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35th Annual Undergraduate RESEARCH Scholarship and Creative Activities Conference

UC DAVIS

April 26-28, 2024

Program and Abstract Book

UCDAVIS
UNDERGRADUATE RESEARCH CENTER

urc.ucdavis.edu/conference

LAND ACKNOWLEDGEMENT

We acknowledge the land on which we are gathered. For thousands of years, this land has been the home of Patwin people. Today, there are three federally recognized Patwin tribes: Cachil DeHe Band of Wintun Indians of the Colusa Indian Community, Kletsel Dehe Wintun Nation, and Yocha Dehe Wintun Nation.

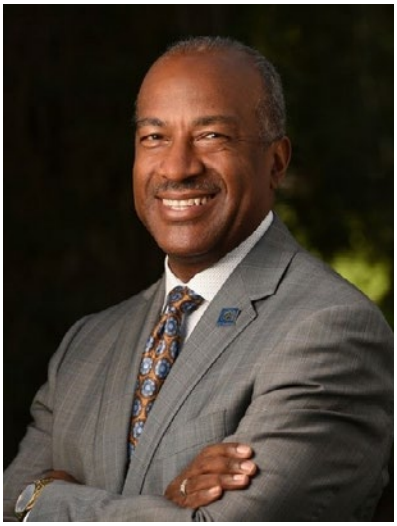
The Patwin people have remained committed to the stewardship of this land over many centuries. It has been cherished and protected, as elders have instructed the young through generations. We are honored and grateful to be here today on their traditional lands.

UCDAVIS

35th Annual Undergraduate Research, Scholarship and Creative Activities Conference

Letter from the Chancellor

April 26, 2024



Dear Students, Colleagues and Guests:

On behalf of the UC Davis community, it's my pleasure to welcome you to the 35th Annual Undergraduate Research, Scholarship and Creative Activities Conference! With more than 880 presenters scheduled for this year's conference, I'm thrilled with the energy our undergraduate students and their mentor faculty bring to our campus.

UC Davis is one of the top research universities in the nation, with globally leading programs in across many disciplines. Our scholarship and research addresses some of society's most critical challenges, including climate change, feeding the world and sustaining the health of all living beings.

Undergraduate research experience is pivotal to developing the researchers who will build a better tomorrow. I know this because it was pivotal to me as an undergraduate. Student researchers are at the heart of the research enterprise.

Through this conference, we prepare our students to move into the future with confidence and creativity. We provide and showcase educational opportunities that prepare students for career, graduate school and research success.

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

Thank you to the Undergraduate Research Center for organizing this important conference and connecting students with important research opportunities, programs and awards. I also thank our faculty members, who serve as mentors and role models for students. They are role models and mentors who guide our students through challenging discussions and center them as leaders in research.

Finally, I extend my gratitude to the many faculty volunteers and staff who serve as moderators for the conference sessions. This is exactly the kind of thoughtfulness and synergy between students and faculty that defines UC Davis.

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

Gary S. May
Chancellor

35th Annual Undergraduate Research, Scholarship and Creative Activities Conference

Letter from the Provost

April 26, 2024

Dear Students, Colleagues and Guests:

As UC Davis provost, I'm delighted to welcome you to the 35th Annual Undergraduate Research, Scholarship and Creative Activities Conference! Each year, this exciting event highlights the intersection of our university's mission of excellence in education, research and public service.

UC Davis is home to top-ranked programs, world-renowned experts, and faculty, staff and students dedicated to solving humanity's most pressing issues.

Undergraduate students at UC Davis work with top-notch faculty and some of the best graduate students in the world while they receive hands-on research experience. Congratulations to our student presenters! Your participation in research, and this conference, provided you the experience to explore your interests, build career skills, defend your work, prepare for graduate school and contribute knowledge. Most importantly, I hope you experienced the joy of discovery and creation through research.

The UC Davis Undergraduate Research Center, which organizes this annual event, hosts this conference each year with the help of many faculty, staff and volunteers. Year round, the center also supports undergraduate research throughout campus by connecting students with faculty-sponsored research, providing a number of research programs and activities as well as hosting research-related awards.

Thank you to our UC Davis faculty who serve as mentors to our student researchers. You make a difference in the lives of our students and in the world.

Whether you attend the poster presentations, the arts and design exhibit or the oral presentations, I hope you are inspired by what you find. Whether you discover new interests or gain new perspectives, you will see how students and faculty work together to solve some of the most urgent challenges of the world.

Mary Croughan
Provost

ACKNOWLEDGMENTS

On behalf of the staff at the Undergraduate Research Center, it is with immense gratitude and great pride that I extend this note of thanks to each one of you who have contributed to the success of the 35th Annual URSCA Conference. The dedication, expertise, and collaborative spirit not only enriches our community but also paves the way for a brighter future in academic and professional excellence.

A special thanks to all our undergraduate research scholars, our faculty mentors, our dedicated program coordinators, and the conference organizing committee. Together, we have created a dynamic event that not only showcases the exceptional talents of our students but also fosters collaboration, innovation, and growth. As we reflect on the accomplishments of this conference, let us also look forward with excitement to the future opportunities that lie ahead.

Thank you all for your invaluable contribution to our community.

Sincerely,

Raynell Hamilton-Starks
Director, Undergraduate
Research Center

Thank you to our sponsors

Student Affairs, Undergraduate Education,
and Undergraduate Research Center

Conference Organizing Committee

Lolita Adkins | *Undergraduate Research Center; NSF CAMP, MMP, MURPPS, IIFH*
Alyssa Arnold | *College of Biological Sciences Dean's Office; Avenue B*
Jacques Bowyer | *Graduate Studies; McNair Scholars Program*
Lili Bynes | *Dean's Office, College of Agricultural & Environmental Sciences*
Connie Champagne | *College of Biological Sciences; EEOP*
Dee Clark | *Undergraduate Research Center*
Ariel Collatz | *Arts Group Advising Center*
Mark Foncannon | *Letters and Science Undergraduate Education and Advising*
Raynell Hamilton-Starks | *Undergraduate Research Center*
Milmon Harrison | *Undergraduate Education*
Meghan McMahon Johnson | *Undergraduate Education*
Jason Masino | Undergraduate Research Center
Kate Stephensen | *University Honors Program*
Victoria "Tori" White | *Success Coaching and Learning Strategies: OEOES*
Sandra Wilson | Undergraduate Research Center

Design and Publications

Marketing and Communications, Office of Enrollment Management

AGENDA

Poster Sessions: Friday, April 26, 2024

1–5 p.m., U Center

1–2 p.m. Poster Session A
U Center

2–3 p.m. Poster Session B
U Center

3–4 p.m. Poster Session C
U Center

4–5 p.m. Poster Session D
U Center

Arts Exhibit: Friday, April 26, 2024

(concurrent with poster session) 1–5 p.m., U Center

1–5 p.m. Arts/Design Exhibit
U Center

Oral and Performing Arts Sessions: Saturday, April 27, 2024

1–4:30 p.m., Wellman Hall

Noon–12:45 p.m. Presenter Check-in
Room 107, Wellman Hall

1–2:30 p.m. Oral Session 1
Wellman Hall Rooms

3–4:30 p.m. Oral Session 2
Wellman Hall Rooms

2 Wellman Hall

1:00 PM — So, Mae Yue - Biochemistry and Molecular Biology
Association of Plasma Neurofilament Light and White Matter Hyperintensity on Memory: Differential Findings across Apolipoprotein E Risk Groups in Normal Aging

1:15 PM — Yi, Shannon - Food Science
Antioxidant Potential of Walnut Skin Tisane

1:30 PM — Wei, Yijun - Neurobiology, Physiology and Behavior
Chemoenzymatic Strategies for Highly Efficient Gram-Scale Synthesis of Human Milk Oligosaccharides (HMOs)

1:45 PM — Osifo-Doe, Cyril A. - Neurobiology, Physiology and Behavior
Ketogenic Functional Overload

2:00 PM — Huang, Katie - Neurobiology, Physiology and Behavior
Studying the Roles of a Quinolinic Acid Biosynthesis Factor BNA1 in NAD^+ Homeostasis Using Saccharomyces cerevisiae

2:15 PM — Vo, Emily - Plant Sciences
Studying Molecular Players involved in Cell Plate Development during Plant Cytokinesis

6 Wellman Hall

1:00 PM — Ramos Gonzalez, Monzerrath - Clinical Nutrition
Policy, Systems, and Environmental Strategies to Increase use of SNAP Benefits at Farmers Markets: A Systematic Review

1:15 PM — Mills, Jackson C. - Community and Regional Development
Analyzing the Effects of COVID-19 on Transit Ridership: A Multi-Year Perspective

1:20 PM — Nair, Nishita - Sociology
TANF Spending Overtime: Why Texas and Arizona Spend Their Block Grant on Child Welfare Instead of Cash Assistance

1:45 PM — Miao, Yang - Managerial Economics
The Impact of the COVID-19 on Consumer Behavior and E-Commerce in the United States

2:00 PM — Serrano, Sophia - Communication
Halting the Asphalt Plant: A Community Effort

2:15 PM — Cho, Audrey C. - Environmental Policy Analysis and Planning
Water, Land, and Power: The Legacy of Asian American Exclusion in the California Water Rights System

106 Wellman Hall

1:00 PM — Shahvali, Tania - Pharmaceutical Chemistry
Stereoselective Synthesis of Carbacycles by C–H Insertion of Donor/Donor Carbenes

1:15 PM — Zhu, Peggy - Electrical Engineering
A Hands-on Sustainable Energy System to Empower Tomorrow's Engineers

1:30 PM — Chabroux, Amy - Pharmaceutical Chemistry
PsychedelCLicKs – Development of Clickable Compounds for Deducing Psychedelic's Mechanisms of Action

1:45 PM — Tsui, Nathan - Materials Science and Engineering
Determining Antiferromagnetic Moment Orientations from Domain Images by Pixel-by-Pixel Analysis

2:00 PM — Diener, Agustina - Biomedical Engineering
Identifying force-dependent protein interactions surrounding actin filaments

119 Wellman Hall

1:00 PM — Basraon, Arjun - Biotechnology
Genetics of Destemming in Pepper

1:15 PM — Tsen, Muyun - Global Disease Biology
Assessing Olive Maturity and Ripening in Orchards Under Different Irrigation Regimes

1:30 PM — Alvaro Ceja, Deysi - Plant Sciences
Enhancing Tomato Nutritional Value: CRISPR Cas9 Approach for Vitamin C Biofortification

1:45 PM — Guel, Bella - Biological Sciences
Investigating Candidatus Liberibacter solanacearum Effectors Responsible for Morphological Changes in Tomato

2:00 PM — Lujan, Ivan A. - Microbiology
Influence of Auxin and Cytokinin on Growth in Dryland Moss Syntrichia caninervis Brid

2:15 PM — Sacoolas, Jadyn S. - Entomology
Within-Plant Distribution of Key Pests of Lettuce (Western Flower Thrips and Aphids) and Interaction With Time

126 Wellman Hall

1:00 PM Wouters, Jalena R. - Biological Sciences
Genomic Diversity Within the Genus Xiphophorus

1:15 PM Bolanos, Chloe - Animal Science
Sound Enrichment Effects on Stabled Horses

1:30 PM Bunting, Jon - Psychology
Happy Plants for Happy Monkeys?: The Effects of Live Plants on the Behaviors and Welfare of Non-Human Primates.

1:45 PM Burke, Aleisha - Animal Biology
The Effects of Visitor Presence and Noise Levels on Northwestern Gray Wolf (Canis lupus occidentalis) Behavior in a Zoo Setting

2:00 PM Tian, Haoying - Animal Biology
Putative Functional Variants of PCDH19 for Equine Juvenile Idiopathic Epilepsy in Arabian Horses

2:15 PM Ganev, Jas - Psychology
Behavioral Consequences of Separation Distress in Prairie Voles (Microtus ochrogaster)

202 Wellman Hall

1:00 PM Triana, Izzy M. - Neurobiology, Physiology and Behavior
Acute DFP Intoxication Causes SRS and Altered Hippocampal Theta Oscillations in Juvenile Rats

1:15 PM Dye, Alicia - Cognitive Science
Calcium Signaling in Cerebellar Parabrachial Nuclei Pathways during Threat and Safety Assessment

1:30 PM Rahbarian, Darlene - Biological Sciences

Studying the Impact of Chd8 Haploinsufficiency on Cerebellar Function at the Transcriptional Level

1:45 PM Louie, Kayla - Biochemistry and Molecular Biology
The role of Kif26 unconventional kinesin family in neurodevelopment and neurological disorders

2:00 PM Narang, Kush - Biological Sciences
Computational Design of $Na_V1.8$ Sodium Channel Inhibitors as Novel Non-Addictive Analgesics

2:15 PM Jain, Nina J. - Global Disease Biology
Expression of the Mechanosensitive ion Channel Protein Piezo1 is Directly Associated With the Development of Experimental Neonatal Sepsis

205 Wellman Hall

1:00 PM Sridhar, Nandhini - Economics
Gender Disparity in Microfinance Loan Recipients

1:15 PM Sabat, Suvam - History
A Half-Union: The Success and Failures of Federalism in India From 1947 to 1964

1:30 PM Mesihovic, Esma - English
British Educational Policies during the Mandate of Palestine: Funding the Police Over Education

1:45 PM Ramakrishna, Ashwin - Economics
The Racialization of Caste in Tamil Nadu

2:00 PM Huston, Jackson S.. - History
Expanding the Feminine Sphere: Women's Labour and Patronage in the 20th Century US South

207 Wellman Hall

1:00 PM Kaadan, Yara - Political Science
NYT MEDIA PROJECT: The Bifurcated Narrative of Lebanese Men in the New York Times in the 1940s

1:15 PM Taha, Nour - Political Science
NYT MEDIA PROJECT: New York Times Depiction of Muslim Men in the 1940s

1:45 PM Misleh, Ali - International Relations
The Representation of Arabs During WWII in the New York Times

2:00 PM Gouvalaris, Max - History

New York Times Media Project: The Representation of Jordan in the 1960s

212 Wellman Hall

1:00 PM Wong, Cecelia - Biomedical Engineering
Identifying Epithelial-specific Cell-cell Fusion Proteins Using Viral Fusogen p14FAST

1:15 PM Sripadanna, Sejal - Biochemistry and Molecular Biology
Identifying Autophagy Pathways Protective Against Neurodegenerative Disease

1:30 PM Gasperini, Francesca Corinna - Biochemistry and Molecular Biology
The Role of R-Loops on Targeting Nucleophagy Pathway Under Replication Stress

1:45 PM Candy, Fenna - Genetics and Genomics
Interaction of Alpha-Synuclein nER Stress and DNA Replication Stress-Induced Nucleophagy

2:00 PM Lim, Trina - Biochemistry and Molecular Biology

Macroautophagy and Selective Autophagy Work in Parallel Pathways to Regulate the Accumulation of Alpha-Synuclein

2:15 PM Tran, Julie - Biological Sciences
Alpha-Synuclein Expression Compromises Energy Metabolism at the Nucleus-Vacuole Junction Under Acute and Gradual Glucose Exhaustion

216 Wellman Hall

1:00 PM Liu, Shih-Na - Evolution, Ecology and Biodiversity
Effects of Diet on Body Shape Evolution in Reef Fishes

1:15 PM Sparks, Madison - Other (Individual Major)
Fishing for Rare Diseases

1:30 PM Sparenberg, Nadia L. - Evolution, Ecology and Biodiversity
Too Hot To Handle: Do Warming Ocean Temperatures Change Ability of Isopods To Control Seagrass Wasting Disease?

1:45 PM Winokur, Moonlily - Anthropology
Historical Ecological and Stable Isotope Research on Faunal Remains from CA-ALA-11

2:00 PM Basu, Anirudh - Computer Science and Engineering
Identifying Copy Number Variants in Anopheles gambiae Conferring Insecticide Resistance

2:15 PM Noroian, Helen - Biological Sciences
Nectar Microbes Are Differentially Affected by Early Arriving Competitors

226 Wellman Hall

1:00 PM Anderson, Eva - Cognitive Science
Navigating Difficult Dialogues: Exploring Antisemitism Conversations Among Jewish Parents and Children

1:15 PM DeNeve, Julianna - Sociology
Shifting Values of Femininity, Family Responsibility, and Collectivism: Gender and Family Representations in Early 2020s Children's Films

1:30 PM O'Sullivan, Alex - Sociology
Secularized Millennials' Values and Culture Within the Workplace

1:45 PM Guerra, Jose - Anthropology
Whose Life Thrives in the Death of Tomorrow? The Material-Temporal Politics of Revitalization in Sacramento's Oak Park

2:00 PM Fogarty, Jane C. - History
Pioneering Progress: Black Women's Activism and Community Building in Early Oakland

2:15 PM Carling, McKenzie G. - Political Science
Beats & Battle: A Political Analysis of the Lyrical Landscape of

Race and Violence in 21st Century Music

230 Wellman Hall

1:00 PM McGhee, Nadia - Communication
From Authenticity to Appropriation: Examining the Impact of AAVE Misappropriation on Professional Spheres

1:15 PM Agarwal, Shyam - Computer Science
Enhancing Formative Assessment Through Automated Short Answer Grading

1:30 PM Adame, Lilianna J. - Communication
Media Representations of Latinos: Effect on Latinos in Academia

1:45 PM Duong, Tina - Global Disease Biology
Intergenerational Trauma Amongst Vietnamese American Undergraduates

2:00 PM Ugwu, Amarachi - Sociology
The Space and Place of Dissent: Exploring the Impact of University Architecture on Student Protests

2:15 PM Chan, Tiffany - Biomedical Engineering
Investigation of Student-Faculty Micro-Interactions on Students' Sense of Belonging Through Organized Student-Faculty Lunches

233 Wellman Hall

1:00 PM Boyce, Kate R. - International Relations
US Foreign Policy: Underlying Causal Mechanisms of Latin American Migration in the Cold War Era (1960-1990)

1:15 PM Stehlin, Natalia - Sociology
Article 26 Backpack: Bridging the Digital Divide in Higher Education for Refugee and Displaced Students

1:30 PM Frazier, Heavenly - English
Article 26 Backpack: Bridging the Digital Divide in Higher Education for Refugee and Displaced Students

1:45 PM Ronne-Mcniel, Fiona - Psychology
Article 26 Backpack: Bridging the Digital Divide in Higher Education for Refugee and Displaced Students

2:00 PM Dusanapudi, Dheera L. - International Relations
Article 26 Backpack: Bridging the Digital Divide in Higher Education for Refugee and Displaced Students

2:15 PM Cegelski, Lauren - International Relations
Article 26 Backpack: Bridging the Digital Divide in Higher Education for Refugee and Displaced Students

2 Wellman Hall

3:00 PM Su, Vanessa - Biotechnology
Advancing Western Blotting Techniques – Exploring pH, Salt Composition, and Transfer Stack Sizes

3:15 PM Samanta, Siona - Neurobiology, Physiology and Behavior
Advancing Western Blotting Techniques – Exploring pH, Salt Composition, and Transfer Stack Sizes

3:30 PM Boquiren, Mazel - Neurobiology, Physiology and Behavior
Advancing Western Blotting Techniques – Exploring pH, Salt Composition, and Transfer Stack Sizes

3:45 PM Miranda, Ana C. - Human Biology
Reducing Nonspecific Binding on Western Blot: Effects of Combination Blocking and Temperature Variation in Blocking Solution

4:00 PM Ali, Omnia - Biochemistry and Molecular Biology
Reducing Nonspecific Binding on Western Blot: Effects of Combination Blocking and Temperature Variation in Blocking Solution

6 Wellman Hall

3:00 PM Yerrabolu, Aditya - Biological Systems Engineering
End Effector and Computer Vision System for an Automated Mushroom Harvester

3:15 PM Dentinger, Tazlina - Biological Systems Engineering
End Effector and Computer Vision System for an Automated Mushroom Harvester

3:30 PM Tas, Rachel S. - Biological Systems Engineering
End Effector and Computer Vision System for an Automated Mushroom Harvester

3:45 PM Chao, Irvin - Biological Systems Engineering
End Effector and Computer Vision System for an Automated Mushroom Harvester

4:00 PM Cui, Yang - Animal Biology
Using Micro-CT Scans and Deep Learning AI to Generate Three-dimensional Models of Aedes aegypti Reproductive Organs for Research and Education

106 Wellman Hall

3:00 PM Tong, Terry - Computer Science and Engineering
Charging Meter: Leveraging Combinational Triggers for Trojan Attacks on Multi-turn Dialogue LLMs

3:15 PM Zhu, Sabrina - Applied Mathematics
Cyclic Sieving Phenomena on Necklace Patterns

3:30 PM Pek, Agnes - Chemistry
Investigating Intermolecular Dynamics of Astrochemically Relevant Five-Membered Nitrogen Heterocycles with Rotational Spectroscopy

3:45 PM Mittal, Aditya - Statistics
Tower Debias: Eliminating the Effect of Sensitive Variables from Black-Box Machine Learning Models

115 Wellman Hall

3:00 PM Sit, Emily - Animal Biology
The Bay Area Food Guide - Coyote Edition: Comparing the Diets of Urban and Non-urban Coyotes via Stable Isotope Analysis

3:15 PM Morey, Brooke - Anthropology
Stable Isotope Analysis of Deer Remains from Alameda County

3:30 PM Su, Ryann - Animal Biology
Aggression of Dark-eyed Juncos (Junco hyemalis) in Post-Wildfire Forests

3:45 PM Sweeney, Joe - Wildlife, Fish and Conservation Biology
Ventilation, Microclimate, and Nest Success in Wood Duck (Aix sponsa) Nestboxes

4:00 PM Meadows, Ryan - Entomology
Effects of Wildfire ash on Ixodes Pacificus Respiration, Cuticle Health, and Survival

119 Wellman Hall

3:00 PM Maxwell, Cohen - Environmental Science and Management
A Comparison of Invertebrate Facilitation Between Pelvetiopsis limitata and Fucus distichus in the Harbor vs. Open Coast

3:15 PM Deigan, Mikayla - Geology
Multiproxy Stalagmite Climate Reconstruction of the 8.2 ka event in the Southern Sierra Nevada, California

3:30 PM Roybal, Evan A. - Biochemistry and Molecular Biology
Artisanal and Small-Scale Gold Mining Causes Changes in Vertebrate Biodiversity in the Peruvian Amazon

3:45 PM Cziko, Jocelyn - Geology
Multiproxy Stalagmite Climate Reconstruction of the 8.2 ka event in the Southern Sierra Nevada, California

4:00 PM Bala, Sindhu - Evolution, Ecology and Biodiversity
Effects of an Endocrine Disrupting Chemical on Sea Urchin Larval Development and Survival

4:15 PM Williams, Caden C. - Geology
Microbially Mediated Weathering in the Basaltic Lava Caves of Lava Beds National Monument, CA

126 Wellman Hall

3:00 PM Tran, Taylor A. - Neurobiology, Physiology and Behavior
Characterizing novel peptide NHIP in relation to oxidative stress and gene expression

3:15 PM Zaynor, Miranda - Animal Science
Dose-dependent Mock Maternal Antibody Protection Against IBV

3:30 PM Desarkar, Aniket - Neurobiology, Physiology and Behavior
Digital Gait Markers from GAITrite for Potential Pre-Diagnosis of Fragile X-Associated Tremor/Ataxia Syndrome

3:45 PM Kawai, Ray - Cell Biology
Intercontinental Insights into Autism Spectrum Disorder: A Synthesis of Prevalence, Environmental Influences, and DNA Methylation

4:00 PM Wong, Melinda - Biochemistry and Molecular Biology
Defining the Estrogen Synthesis Pathway in the Zebrafish Ovary

4:15 PM Thrall, Emily - Biomedical Engineering
Newborn Blood DNA Methylation Correlates With Risk of Autism Spectrum Disorder in the Grandchild and Grandparental Cigarette Smoking and Alcohol Consumption During Pregnancy

202 Wellman Hall

3:00 PM Ma, Yanki - Neurobiology, Physiology and Behavior
Examining the Interaction Between Sensory Proprioceptive Signaling and Muscle Fiber Composition

3:15 PM Caceres, Anelise - Biomedical Engineering
Methods for Analysis of MRI and PET Images for Monkey Model of Social Connectedness

3:30 PM Erices, Carissa - Human Biology
Temporal Progression of Neuroinflammation and Neurodegeneration in a Monkey Model of Alzheimer's Disease

3:45 PM Blumwald, Jake - Neurobiology, Physiology and Behavior
Identifying a Grid-Like Code during Value-Based Decision-Making in the Entorhinal Cortex (EC) & Ventromedial Prefrontal Cortex (vmPFC).

4:00 PM Lopez, Sebastian - Cognitive Science
Learning Algorithms in Basic Neuroscience: Decoding the Contents of Attention.

4:15 PM Novak, Josius - Linguistics
Manipulation of Syllable Perception for Highly Variable Liquid Rime Words via Synthesized Acoustic Beat Stimuli

205 Wellman Hall

3:00 PM Forster, Simona - Political Science--Public Service
Sterilization as a Contraceptive Method: An Empirical Analysis of the Impact of Catholic Hospital Market Share on Estimated Demand of Contraceptives & Sterilization Procedures

3:30 PM Venkatesh, Ember - Psychology
Gender Diversity and Identification with Gendered Experiences of Adults with Intellectual Disability

3:45 PM Perez, Aileen E. - Genetics and Genomics
The Future of Gene Editing: An Analysis of Ethical Concerns and Public Perception

4:00 PM Nguyen, Theresa - Neurobiology, Physiology and Behavior
Communication in Healthcare: The Missing Pieces

207 Wellman Hall

3:00 PM Djadri, Hadil - International Relations
NEW YORK TIMES MEDIA PROJECT: The Representation of Algerians in the 1960s

3:15 PM Yasar, Mahir A. - Political Science
Analysis of the Representation of Iraqis in the 1960s by the New York Times

3:30 PM Jabbari, Eva - Environmental Policy Analysis and Planning
New York Times Media Project: The Representation of Syria in the 1960s

3:45 PM Mohammad, Aaminah - International Relations
The New York Times Representation of Egypt in the 1960s

212 Wellman Hall

3:00 PM Ananda, Keerthana - Biomedical Engineering
Engineering Extracellular Vesicles Using Cell-Free Protein Synthesis

3:15 PM Gutierrez, Timothy - Neurobiology, Physiology and Behavior
Acquired Mutations in Bcor Promote Thrombocyte Counts

3:30 PM Tsonov, Maykal - Animal Science
Effects of Bioactive Fatty Acids on Differentiation and Lipid Metabolism in Bovine Primary Preadipocytes

3:45 PM Al Tekreeti, Taha - Biochemistry and Molecular Biology
Pathogenic Effects of Antimitochondrial Antibodies in Primary Biliary Cholangitis

4:00 PM Tummala, Sweta Reddy. - Neurobiology, Physiology and Behavior
The Microbiome and Cancer Treatments

226 Wellman Hall

3:00 PM Kini, Ravi - Linguistics
Idol Talk: Narratives of Desire in K-pop Fandom

3:15 PM Shenoy, Steven - Japanese
Economy of Sex Work in the Fiction of Ihara Saikaku

3:30 PM Granger, Emily - English
Visiting Chaucer's Kitchens: Analyzing Professional and Domestic Cooks in The Canterbury Tales

3:45 PM Grimes, Sarah - Art History
From Preschool to Picasso: What the Art Museum Can Learn From Children's Museum Exhibit Design

4:00 PM O'Connell, Shane - English
The Sublime and Climate Crisis

4:15 PM Nelson, Isabel R. - Art History
Exhibiting the Erotic: Erotic Japanese Prints from the Edo Period (1700 to 1820) & How and Why Shunga Should Be Displayed

230 Wellman Hall

3:00 PM Ghafoor, Maha - Political Science
Understanding Asylum Acceptance Disparities and Political Shifts: Migration Waves into EU and EEA Member States and Switzerland from Predominantly Muslim Nations and Ukraine

3:15 PM Victa, Olivia - International Relations
Protecting Overseas Filipino Workers: Conditions of Negotiation for Bilateral Labor Agreements

3:30 PM Gonzalez, Jesus - Spanish
Deportation and Reintegration: Migrant Perspectives

3:45 PM Granderson, Pharaoh - Managerial Economics
Financial Constraints and Vulnerable Populations: Unraveling the Correlation Between Limited Access to Bank Credit and the Proliferation of Human Trafficking Networks

234 Wellman Hall

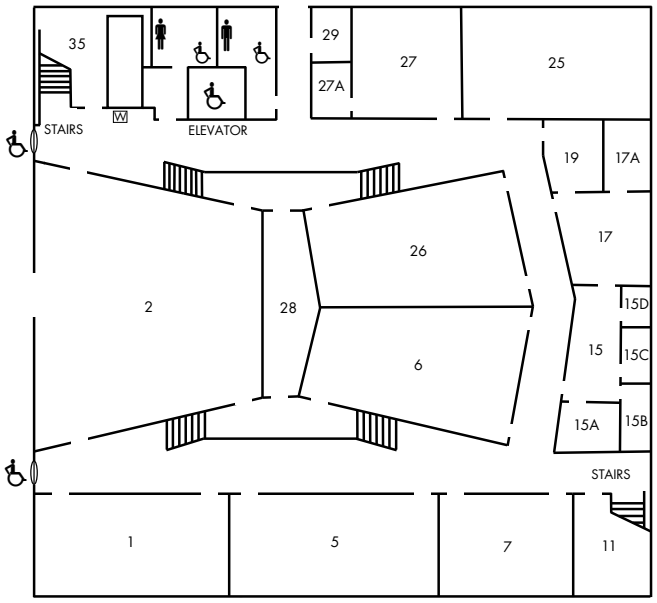
3:00 PM Ng, Ethan H. - Pharmaceutical Chemistry
Integrin Signaling Pathway in Long-Lived Ames Mice

3:15 PM Gardizi, Massie - Neurobiology, Physiology and Behavior
Cytoskeletal Regulation by Rho GTPase Pathway in Long-Lived Aimes Mice

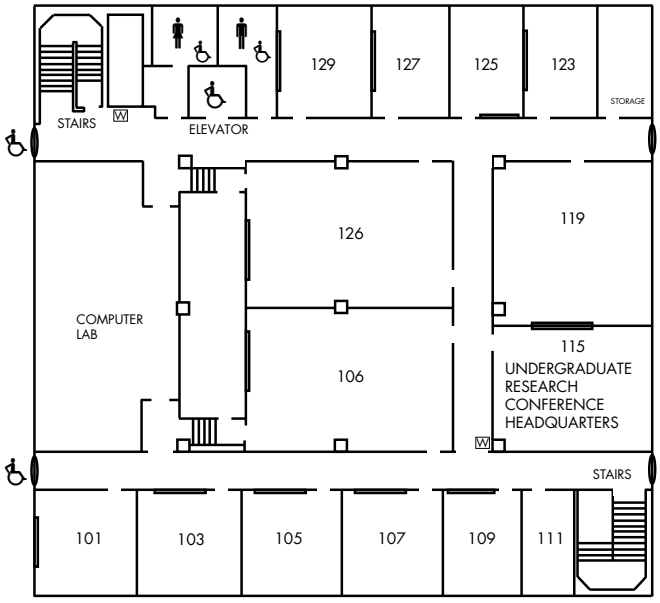
3:30 PM Le, Bao Ngoc - Biochemistry and Molecular Biology
Spontaneous Seizures and Altered Cognitive Outcomes in Adult Rats Following Acute Intoxication with DFP

3:45 PM BANERJEE, ARIANA R. - Neurobiology, Physiology and Behavior
Beta-Hydroxybutyrate Modulates Aging-related Markers in Mouse Microglia

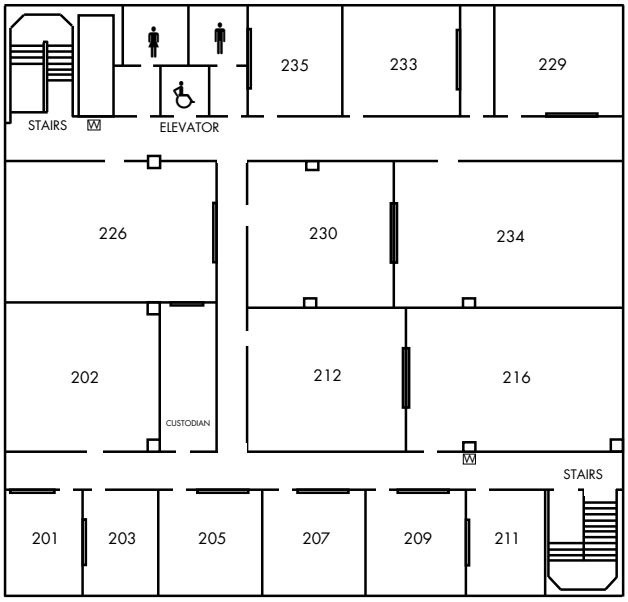
Lower Level



1st Floor



2nd Floor



= Building Entry - Exit = Wheelchair Access W = Water
= Front of Classroom

N
W E
S

DESIGN • CREATE • EXPLORE • DISCOVER • IMPACT

35th Annual Undergraduate RESEARCH Scholarship and Creative Activities Conference

UC DAVIS

Abstracts

The Geographic Burden of Government Fines: The Case of Parking Tickets in 16 U.S. Cities

Huda Abdelnur
Sponsor: Noli Brazil, Ph.D.
Human Ecology

A common way citizens interact with the legal system is through parking tickets. Existing literature on parking tickets suggests that there is a relationship between parking tickets and neighborhood characteristics, particularly those that are characterized as economically vulnerable and historically marginalized. The current research is limited to a select number of cities. We seek to examine if these relationships exist at a larger geographical scale. Specifically, we investigate the spatial distribution of parking tickets across 16 U.S. cities. Employing multivariate regression models, we examine the relationship between neighborhood parking ticket rates and ethnoracial and socioeconomic composition at the block group level. We found that percent Hispanic, percent poor, percent 20–34 year old, and percent renter-occupied units are positively associated with total parking tickets, and parking tickets for violations, days of the week, and times of the day that may be more likely to be issued to neighborhood residents. While percent Black exhibits no association with total parking tickets, it is positively associated with tickets issued by police officers, revealing the complicated relationship between infrastructure, policing, and race.

OppoSits

Madilynn Abe
Sponsor: Jessica Colvin, M.A.
Human Ecology

We often underestimate the power of play and its ability to influence even the most mundane activities. Having recreational seating in a public space can create a whimsical environment, which is exactly what “OppoSits” was created to accomplish. Drawing inspiration from the traditional magnet, “OppoSits” utilizes the color, form, and ability to attract people together like “polar opposites.” Furthermore, the simple shape allows for several arrangements ranging from a simple circle to a larger S-curve. The layout can allow for more people to join or for smaller, more intimate gatherings. If flipped upside down into a U-shape, it can act as a seesaw, turning sitting into an energizing interaction. The capabilities of “OppoSits” are endless due to its dynamic design, but more importantly, it challenges the passerby to exercise their own imagination. “OppoSits” serves as a constantly changing installation piece reminding us of the universal, innate curiosity and child-like playfulness that never quite goes away as an adult.

Evaluating the Relationship Between Adoptive T-reg Transfer and MIA-Induced Gut Tissue Inflammation in Mice Offsprin

Raneen Abu Amara
Sponsor: Paul Ashwood, Ph.D.
MED: Medical Microbiology & Imm

Maternal immune activation (MIA) is characterized by gestational exposure to inflammatory stimuli that can result in autistic-like behaviors and increased inflammation in gastrointestinal tissues of offspring. Regulatory T-cells (T-regs), often lower in MIA offspring, monitor and suppress immune responses. We hypothesize that an adoptive transfer of T-regs can alleviate these inflammatory phenotypes. Pregnant mice were injected with Polyinosinic:polycytidylic acid (Poly I:C) inducing MIA, or saline solution. At 8 weeks old, pups were injected with Phosphate-buffered saline (PBS) or PBS with T-regs. The colon and ileum tissue of n=10 males and females were analyzed via multiplex Luminex assays to quantify Th17 cytokine concentrations. The samples were split into four groups, depending on dam and offspring treatment respectively: saline and saline, saline and T-reg, PolyI:C and saline, and PolyI:C and T-reg. Dam treatment of the male colon samples was found to have a significant effect on the interleukin (IL)-25/1L-17E cytokine concentration. The offspring treatment with T-regs, regardless of dam treatment, was found to have a significant effect on the male ileum IL-4 and IL-13, and colon IL-6. These findings alone do not support the hypothesis that the adoptive T-reg transfer would reverse the gut inflammation.

Media Representations of Latinos: Effect on Latinos in Academia

Lilianna Adame
Sponsor: Jeanette Ruiz, Ph.D.
Communication

Significant knowledge gaps exist in the effect media representation has on the Latino community, particularly in terms of their presence in academia. The purpose of this research is to explore how the media represents minority groups, particularly the Latino community. In order to fill these gaps, a survey is currently being conducted to assess what the relationship is between the portrayals of Latinos and their decision to be an academic either as a student or by pursuing a career in the academic field. The promissory results will indicate Latino individuals feel underrepresented or falsely represented in the media and negatively affect Latino individuals' decision to be in the academic field. The projected outcomes of this project will help to understand how the media represents Latinos in order to help identify ways to lessen any discovered negative effects on the Latino community's decision to become a part of the academic field.

Exploring the Genetic Basis of Sex Comb Rotation in Drosophila melanogaster

Avery Adelseck
Sponsor: Artyom Kopp, Ph.D.
Ag Evolution & Ecology

Across the tree of life, new traits have repeatedly evolved that lack clear homologs in other species, yet the underlying genetic mechanisms remain unclear. To study this, we used the sex comb - a row of recently modified mechanosensory bristles on the foreleg of *Drosophila melanogaster*. These male-specific modifications involve shifts in bristle morphology and orientation, rotating the bristles 90 degrees. Rotation is thought to be driven by movement of the surrounding epithelial cells between 16h and 24h after puparium formation, but the genetic drivers are unknown. Our lab generated a time-series single-cell RNA-seq dataset of the sex comb-bearing region, identifying multiple gene candidates that may be involved in the sex comb's rotation. We performed fluorescence in situ hybridisation chain reaction aimed at staining each rotation candidate, co-expressing each gene with sexually monomorphic markers of the sex comb bearing region in males and the homologous region in females at both 16h and 20h. We found that a subset of the candidates show dimorphic expression in the epithelial cells adjacent to the sex comb, suggesting their involvement in sex comb rotation. This lays the foundation for experimental work to resolve the specific roles and developmental genetic mechanisms underlying this novel, male-specific trait.

Enhancing Formative Assessment Through Automated Short Answer Grading

Shyam Agarwal
Sponsor: Ali Moghimi, Ph.D.
Biological & Ag Engineering

Effective feedback is crucial for a holistic educational experience but the limited availability of instructor time, large class sizes, and other resource constraints pose significant challenges in providing timely and detailed feedback. Our goal is to automate the automatic grading of short-response texts by evaluating text generated by students. We collected written responses to three related items about biological information flow from over 2,000 undergraduates during two semesters. Students responded to the items shortly after an instructional unit that covered the relevant content, the central dogma of biology. Students' responses to each of the items were graded by three raters as correct, partially correct (incomplete), and incorrect answers with 80% inter-rater agreement. We not only show that with a small number of manually graded samples, fine-tuning on BERT beats the state-of-the-art machine learning models by a huge margin, but also show that we can utilize responses to related questions and achieve even higher accuracies using even smaller amounts of data. This shows the potential of utilizing the proposed AI-based framework, especially as part of formative assessment in large courses. We also offer deeper insights into the problem of short-answer grading and attempt to explain the behavior of the model utilized.

Phonetic Information in Children With Cochlear Implants

Maddison Afradi
Sponsor: David Corina, Ph.D.
Linguistics

This study delves into the neural mechanisms underlying speech processing in children with Cochlear Implants (CI) compared to their Normal Hearing (NH) peers, emphasizing the interplay between auditory and visual cues. Utilizing EEG data from 24 CI and 24 NH children, we employ two distinct predictive models to analyze their cortical responses to speech features amidst visual distractions. Based on 38 IPA phonemes represented by indicator vectors, the Phoneme Model allows us to investigate categorical phoneme perception by identifying moments when specific phonemes are identified in the speech stream. Conversely, the Phonetic Feature Model, incorporating articulatory and acoustic features such as voiceness, place and manner of articulation through binary vectors, enables a granular analysis of time course of perception of phonemic features as well as quality of such percepts across the groups. By applying machine learning techniques, we aim to quantify cortical tracking of these speech attributes and understand the time course of phonetic discrimination in the face of auditory deprivation and imperfect auditory input. We expect to see delayed phoneme discrimination and overall lower precision of phoneme discrimination in CI group compared to hearing group.

Whole Orchard Recycling: Impacts on Soil Health and the Soil Food Web

Yarely Aguilar
Sponsor: Amanda Hodson, Ph.D.
Entomology/Nematology

While almond trees have been burned or processed through cogeneration plants at the end of their lifespan, this is becoming less popular. Concerns of air quality and effects of climate change, such as increasing temperatures and levels of carbon dioxide have minimized these practices. Alternatively, biomass recycling, such as whole orchard recycling, proves to be not only a sustainable alternative, but an effective practice in improving soil health. Soils drive critical ecosystem processes, such as carbon sequestration and nutrient cycling. Performing sustainable practices to fortify soil resilience, then, may mitigate effects of climate change while improving crop efficiency. In this experiment, woodchipped orchards were mixed with soil in barrels planted with young almond trees. Data collection began in 2000. Statistical analysis indicated that orchard recycling improved elements of soil health, such as organic carbon and organic matter. Nematode abundance was also assessed as indicators of the soil food web. Results indicated a higher percentage of plant-parasitic nematodes in the non-woodchipped treatment compared to the woodchipped treatment. By investigating the effectiveness of whole orchard recycling using soil analysis and bioindicators, we aim to promote whole orchard recycling as a sustainable soil management practice in strengthening soil resilience and crop output.

Restoration of Choline Acetyltransferase in Mice via AAV9-mediated Gene Therapy

Anahid Aivazian
Sponsor: Ricardo Maselli, M.D.
MED: Neurology

Congenital myasthenic syndromes (CMS) are disorders characterized by muscleweakness and fatigability. One CMS variant results from deficiency of the enzymecholine acetyltransferase (ChAT), which catalyzes the synthesis of acetylcholine at cholinergic synapses and at the neuromuscular junction. We used a conditional knock out model consisting of LoxP sites flanking Chat exons 4 and 5, and Cre-recombination activated by the estrogen agonist Tamoxifen (Tx). Mutant mice injected with Tx at P11 developed progressive weakness and with rare exceptions all died. We hypothesized that injecting an adeno-associated virus type 9 (AAV9) carrying human CHAT (AAV9-CHAT) at P28 would rescue this lethal phenotype. This was experimentally confirmed as 5 out of 5 mice injected with AAV9-CHAT survived while 13 out of 14 mice not injected mice died. Immunohistochemistry showed severe reduction of Chat expression in spinal motor neurons of mutants but almost complete restoration of expression in AAV9-injected mice. RT-qPCR demonstrated only mild reduction of Chat RNA in mutant mice, consistent with the interpretation that the impaired protein expression resulted primarily from an early termination codon induced by the LoxP recombination. Histopathological analysis showed no adverse effects. Thus, AAV9-mediated gene therapy may beeffective and safe for treating humans affected with ChAT-CMS.

Pathogenic Effects of Antimitochondrial Antibodies in Primary Biliary Cholangitis

Taha Al Tekreeti
Sponsor: Weici Zhang, Ph.D.
MED: Int Med Rheumatology

Primary biliary cholangitis (PBC) is an autoimmune liver disease characterized by the immune-mediated inflammatory destruction of small bile ducts. However, the mechanisms of PBC remain unknown. Since the presence of anti-mitochondrial antibodies (AMAs) is one of the biomarkers of PBC, we aim to investigate whether AMAs exerts a pathogenic role in PBC. To do so, we took advantage of an ARE-Del murine model to study the effects of injecting mice with the recombinant hPDC-E2 protein in order to activate an immune response. In doing so, we induced the mice to develop AMAs and harvested serum samples at week 0 (pre-immunization), 2 (two weeks post-immunization), and 4 (two weeks post-secondary immunization). We measured the relative auto-antibody titer of each set of serum samples by running ELISA experiments on heart and liver lysates. Furthermore, we harvested and stained the liver to visualize the extent of immune cell infiltrations as a proxy for AMA induced damage. Our results showed that there was a significant increase in auto-antibodies against the heart and liver lysates as well as increased liver infiltration of immune cells compared to the controls. Based on these findings, we can now further investigate the pathogenesis of AMAs in relation to PBC.

Mutagenesis of PSD-95 To Identify Residues Important for Regulating Synaptic Plasticity

Marco Alarcon
Sponsor: Karen Zito, Ph.D.
Neuro Physio & Behavior

Dendritic spines are dynamic neuronal structures that play an integral role in the synaptic plasticity vital for learning and memory. Previous experiments demonstrate that the expression level of PSD-95, a synaptic scaffolding protein present in dendritic spines, regulates their ability to undergo long-term changes in size that are associated with learning. However, which domains of PSD-95 play important roles in this effect remains unknown. In order to identify the domains that are vital for this function of PSD-95 in synaptic plasticity, I am cloning mutant forms of PSD-95 which contain mutations in the PDZ binding domains of the protein, thus inhibiting the ability of PSD-95 to bind to other proteins in dendritic spines. Initial attempts at mutagenesis have focused on the PDZ1-2 domains of PSD-95, which inhibit binding to transmembrane receptors, such as glutamate receptors, in dendritic spines. These mutations have strong potential to shed light on the mechanisms of spaced learning, a learning strategy which has been shown to improve learning in animal models that display learning deficiencies, such as fragile X and down syndrome models.

Morphology of Lower and Middle Cambrian Oncoids from the Carrara Formation at Emigrant Pass

Eduardo Alatorre Acevedo
Sponsor: Dawn Sumner, Ph.D.
OR: Feminist Research Institute

Oncoids provide a lens through which we can observe the dynamic interplay between microbes, their ecosystem, sediments, and ocean chemistry. They are 0.5 mm to 4 cm diameter grains composed of laminae that grew around a nucleus in response to both microbial and sedimentary processes. Oncoid morphology is influenced by factors such as the type of nucleus, depositional environment, sediment influx rate, ocean chemistry, and amount of bioturbation. Here, I present eight distinct oncoid morphologies collected from six oncolite beds within the Lower and Middle Cambrian Carrara Formation at Emigrant Pass, Tecopa, California. I grouped the oncoids by lamina growth textures and the type of nucleus. Examples of lamina growth texture are continuous vs discontinuous and examples of nucleus are hyolith fragments vs trilobite fragments. I selected oncoids with the best representation of each morphology type and are analyzing thin and serial sections to classify growth textures and observe possible burrowing and grazing of oncoids. Based on features within the oncoids and their context, I interpret four different depositional environments: Shoal, Lagoon, Tidal Channel, and Microbial Reef. By interpreting different oncoid morphologies, we can uncover more information about the paleoenvironment and paleoecology of a formation.

Reducing Nonspecific Binding on Western Blot: Effects of Combination Blocking and Temperature Variation in Blocking Solution

Omnia Ali
Sponsor: Aldrin Gomes, Ph.D.
MED: Physiology & Membrane Biol

Western blotting is a critical technique for the identification and analysis of individual proteins. As part of the western blot, we utilize blocking solutions to promote specific binding. This step allows the blocking reagent to bind to unbound regions on the membrane. In order to enhance the western blot, we conducted experiments to induce greater blocking efficiency. First, we compared if increasing the temperature of the blocking solution using 3% nonfat milk blocking solution would decrease the time needed to incubate the membrane for effective blocking. Second, we experimented with using a combination of blockers and observed how the solutions compared to the use of individual blockers. For this, we compared combinations of BSA, nonfat milk, and casein at three percent total concentrations. Overall, through increasing the efficiency of blocking, we aim to significantly reduce background and nonspecific binding signals on the membrane. Additionally, we seek to reduce the time taken for blocking so that the western blot experiment can be conducted at a faster rate. These would in turn allow for a more efficient and accurate analysis of the protein determination by western blotting.

Neuronal Primary Cilia Gene Expression Across Different Social Experiences in the Monogamous Prairie Vole *(Microtus ochrogaster)*

Albatool AlKhazal
Sponsor: Karen Bales, Ph.D.
Psychology

Primary cilia are non-motile organelles that project from most vertebrate cells. The cilium extends into the extracellular space which makes it an ideal location for cell communication. New evidence shows that primary cilia are related to more complex social behaviors including parental behaviors and pair bonding. When comparing brain regions that are related to pair bonding in distantly related species (seahorses and prairie voles), a rank-rank hypergeometric overlap analysis found regulational differences in cilia-related genes. Yet, the relationship between primary cilia and pair bonding has never been investigated. In this project, we will investigate the changes in cilia-related genes as a result of pair bonding in prairie voles (*Microtus ochrogaster*). Prairie voles are a translational model used in foundational studies of the neurobiology of pair bonding. In this study, we will use HiPlex fluorescent *in situ* hybridization to observe changes in cilia-related genes in targeted areas of the brain with a particular focus on the nucleus accumbens. We will compare gene expression in two groups (same-sex siblings and intact breeders). Investigating the relationship between primary cilia and pair bonding can help us understand the roles the primary cilia play in the plasticity associated with social bond formation.

Evaluation of Combined Ketogenic Diet and Treadmill Running on Molecular Signaling and Adaptation in Mouse Muscle

Anas Almullahassani
Sponsor: Keith Baar, Ph.D.
Neuro Physio & Behavior

The ketogenic diet is a high-fat low carbohydrate diet that shifts the body's energy reliance from glucose to ketone bodies. This shift also leads to muscle adaptations similar to those induced by exercise, such as mitochondrial biogenesis and an increase in mitochondrial enzymes. It is unclear, however, if the adaptive effects of the ketogenic diet and exercise are additive or redundant. We put forty 5-week-old male mice on either a control or ketogenic diet for 9 weeks. After one week of diet acclimation, mice were split into four groups (n=10 each): control diet sedentary (CON-SED), ketogenic diet sedentary (KETO-SED), control diet and treadmill running (CON-TREAD), and ketogenic diet and treadmill running (KETO-TREAD). Treadmill exercise consisted of 30-minute runs (12m/min) 3-4 times per week. After 8 weeks of treadmill running gastrocneminus muscles were collected, frozen in isopentane, and analyzed via western blot. We hypothesize that there will be an additive effect of the ketogenic diet and treadmill exercise on mitochondrial enzyme upregulation and molecular signaling that promotes endurance-type adaptations. We will evaluate this by comparing levels of electron transport chain complexes, and the molecular signals peroxisome proliferator-activated receptor gamma coactivator 1-alpha, and phosphorylated adenine-monophosphate kinase.

Evaluating the Effects of Load and Stimulation on Anabolic Signaling in Muscle

Barah Almullahassani
Sponsor: Keith Baar, Ph.D.
Neuro Physio & Behavior

Load is an important regulator of muscle anabolism. However, how various types of loads alter anabolicsignaling differently remains to be determined. For this pilot experiment, rats were split into three groups of two. The first group (Indirect) had indirect stimulation of extensor digitorum longus (EDL) and plantaris (PLN)muscles via electrode depolarization of the sciatic nerve, resulting in loaded eccentric contractions of the EDL and minimally loaded concentric contractions of the PLN. The second group (Direct) had direct electrode stimulation in the posterior compartment of the lower limb resulting in loaded eccentric contractions of the EDL and minimally loaded concentric contractions of the PLN. The third group (Direct-Resistance) was stimulated identically to the second, but resistance was applied to the foot preventing plantarflexion, resulting in loaded isometric contractions of the EDL and PLN. Muscles were collected, powdered, and processed via western blotting. We hypothesize that load will modulate anabolic signaling such that the muscles that experience the greatest load (relative to their contractile strength) will show the largest response in signals such as phosphorylation of ribosomal protein S6 and S6 kinase, eukaryotic initiation factor binding protein 4E, and eukaryotic initiation and elongation factors.

Investigating the Tumor Microenvironment of Pancreatic Ductal Adenocarcinoma with *BRCA2* Mutation

Fatimah Al-Musawi
Sponsor: Changil Hwang, D.V.M.,Ph.D.
Microbiology & Molec Genetics

Pancreatic ductal adenocarcinoma (PDAC), an aggressive cancer with a 13% 5-year survival rate, often exhibits mutations in DNA damage repair (DDR) genes like *BRCA2*. Additionally, PDAC has an extensive network of extracellular matrix components surrounding the tumor in the stroma, such as cancer-associated fibroblasts (CAFs), which promote cancer cell growth. I hypothesize that *BRCA* deficiency affects recruitment of certain immune cell types and CAFs. To address this hypothesis, I computationally estimated the infiltration of immune and stromal cell types into the tumor using publicly available RNA-seq dataset of PDAC patients from The Cancer Genome Atlas. I found there was a significant increase in the migration of common lymphoid progenitor (CLP) cells into PDAC with DDR gene mutations. CLP are precursors to T-cells, B-cells, and NK cells, suggesting that DDR mutations could cause a more immunogenic environment. There was also a decrease in the infiltration of stromal elements, mainly fibroblasts, into PDAC with DDR gene mutations. Future studies should focus on validation of the infiltration of immune cells and CAFs in *Brca2* deficient PDAC in vitro and in vivo. Mainly, identifying tumor microenvironment and stroma vulnerabilities could guide targeted therapies for PDAC with DDR mutations.

Assessing 24-48 Month Old Visual Short Term Memory Using A Touch Screen Change-Localization Task

Gabrielle Alperin
Sponsor: Lisa Oakes, Ph.D.
Psychology

Visual short-term memory (VSTM) is the component of working memory that temporarily stores visual information. VSTM is necessary for cognitive processes such as learning. In children, VSTM is typically measured through *change detection* or *change localization* tasks in which an array of different objects (e.g., colored shapes) is briefly presented and after a brief delay the array reappears with at least one randomly selected object changed. In previous studies, infants' and childrens' VSTM has been measured through their looking behavior. In an adaptation of a task used by Simmering (2012), the present study utilizes a *change localization* task on a touchscreen tablet. We presented 71 children between the ages of 24- and 48-months with trials including the following sequence: an array of three colored circles, then a 300-ms blank *delay*, and finally a *test array* in which one randomly selected circle has changed color. The child's task is to select which item has changed by touching it. Our analyses will compare children's responses to change (0.33 because there are three items in the array) and across age. These results will help us understand how VSTM develops in young children.

An Ecological Framework Identifying the Factors that Impact the Risk of Developing Hypertensive Disorders of Pregnancy in Indian Birthing People

Anumita Alur
Sponsor: Leigh ann Simmons, Ph.D.
School of Nursing

Like other countries worldwide, the prevalence of hypertensive disorders of pregnancy (HDPs) in India remains high. Identifying the social and cultural factors associated with HDPs among Indian birthing people can help to identify possible interventions that may uniquely improve health in this population. This study aims to understand the multilevel socioecological factors that impact Indian birthing people's risk of developing HDPs. Using Bronfenbrenner's Ecological framework, we conducted a rapid review of the literature to understand how factors at the individual, interpersonal, community, and policy levels interact to influence the risk of developing HDPs in Indians. At the individual level, family history, diet, exercise, tobacco/alcohol use, education, and medical adherence can greatly impact risk. These risk factors are influenced by local cultural/social norms at the microsystem (e.g., family, neighborhood) and broader political, cultural, and economic factors at the macrosystem. Community characteristics (e.g., hospital availability, the built environment) and policies (e.g., preventive care guidelines, detection efficacy, cost) also impact risk for HDPs. These findings can serve as a foundation for developing culturally competent interventions for Indian birthing people with HDPs, ultimately contributing to the advancement of the UN's Sustainable Development Goal 3.4, reducing non-communicable disease rates, by 2030.

Variation in Infant-Directed Speech Across Infant Development

Sheba Queen Alvarado
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Infant-directed speech (IDS) is a speech style that caregivers often use to communicate with infants. It has prosodic features such as higher pitch, wider pitch range, and shorter utterances compared to adult-directed speech (ADS). Previous research points to a positive correlation between IDS and enhanced language skills in early childhood. The goal of this research is to understand the way parents structure and change their interactions with their children in various contexts and across infant development. In this study, we recorded dyadic interactions between parents and their infants, ranging from 9-20 months of age, during book reading and free play tasks. We predict that parents will exaggerate the prosodic features of IDS less with older infants as they are able to recognize more words than younger infants. Moreover, we predict that IDS is more exaggerated during the free play task because of the increased social exchanges and vocal responses observed among dyads compared to the book reading task. The current study will expand the literature on the role of parent speech in facilitating their children's language development. By studying a wide range of ages, the findings of this study explore contexts that foster early learning.

Parenting Styles and Depression Within Immigrant Families Before and During the COVID-19 Pandemic

Evelyn Alvarado-Coronel
Sponsor: Yuuko Tonkovich, Ph.D.
Education

This study investigates (1) immigrant parents' parenting styles and self-reported levels of depression before and during the COVID-19 pandemic, and (2) the associations among bilingual children's heritage language, parenting styles, and depression levels before and during the pandemic. Due to school closures, parents were challenged to help children with their homework. Parent-child interactions became more crucial as they spent more time together. This affected the home dynamics and parent-child interactions. A total of 109 parent-child dyads participated in this study. The participants were low-income, Mexican American and Chinese American immigrant families living in Northern California. This longitudinal study focused on children ages 3-5 prior to the COVID-19 pandemic (2018-2019) and ages 5-7 during the pandemic (2020-2021). T-tests revealed no significant differences between parents' depression levels before the pandemic and during the pandemic. However, significant differences were found in parenting styles. On average, parents reported being more authoritative and less authoritarian during the pandemic. Correlations revealed negative relationships between parents' depression levels and authoritative styles, and parents' depression levels and children's heritage language. The pandemic brought many uncertainties to families. Yet, our preliminary results suggest that parents adjusted their parenting styles and became more empathic and understanding with their children.

Enhancing Tomato Nutritional Value: CRISPR Cas9 Approach for Vitamin C Biofortification

Deysi Alvaro Ceja
Sponsor: Barbara Blanco-Ulate, Ph.D.
Plant Sciences

Tomatoes hold immense economic and agricultural significance in California. The state supplies a substantial portion of the nation's fresh and processed tomatoes, making them a vital component of the agriculture industry. Modern tomato lines have optimized fruit firmness, yield, and processing efficiency from selective breeding but lack some nutritional traits. One nutritional component of particular interest is vitamin C (i.e., ascorbic acid). Vitamin C plays a crucial role in supporting the immune system and promoting overall human health, but its levels remain low in some important tomato varieties. This project targets the plant vitamin C-degrading enzymes APX1, APX2, and APXc9 to enhance vitamin C levels in tomatoes without compromising quality traits, drawing inspiration from peppers that possess high vitamin C levels and lack some APX genes. By leveraging CRISPR Cas9-induced knockouts, we analyze their impact on vitamin C content in the processing tomato line 'M82.' We measured vitamin C levels alongside fruit firmness and sugar-to-acid ratios to assess the efficacy and specific effects of knocking out these APX genes. A successful outcome could extend this approach to enhancing nutritional values in other crops.

Feasible EEG-Based BCI for Hand Gesture Control

Safa Amer
Sponsor: Lee Miller, Ph.D.
MED: Otolaryngology

The development of single-trial EEG decoding algorithms is necessary for the deployment of real-time non-invasive brain-computer interfaces (BCI) to the masses. One case of particular importance is the use of EEG decoding for limb control. This can be applied in translational settings for robotic prosthetic control and commercially in so much that it allows for the incorporation of naturalistic gestures in virtual/augmented reality environments without the need for computer vision. Of all limb movements, hand gestures provide an ecologically valid way of looking at and assessing how to develop these types of classifiers. In this study, we used EEG data to decode 10 different gestures on a single trial level that yields fourfold above-chance decoding. Additionally, we decoded neural feedback signals for correct and incorrect gesture production, to assess the feasibility of using neural feedback for algorithm updating. We did this both with the raw voltages and with frequency band power that is theoretically related to the signals of interests. We find that using phase-locked voltages in classification of EEG data yields stronger results than using specific EEG frequency bands related to motor control and feedback. We demonstrate that classifiers utilizing raw voltages result in stable high-accuracy EEG decoding.

Engineering Extracellular Vesicles Using Cell-Free Protein Synthesis

Keerthana Ananda
Sponsor: Cheemeng Tan, Ph.D.
Biomedical Engineering

Extracellular vesicles (EVs) are membrane-bound particles secreted by cells for cell-to-cell signaling. Due to their unique protein structure and function, EVs have high efficacy in repairing cellular injury and delivering therapeutics, while being non-immunogenic. To exploit EVs for disease therapy, current research modifies EVs by conjugating desired proteins onto their membranes using click-chemistry techniques. However, current methods have low protein conjugation yields and difficulty scaling up. Here, I overcome the challenge by modifying native EVs using cell-free protein synthesis (CFPS). CFPS generates synthetic proteins that co-insert into EV membranes. I validate the production and insertion of desired membrane proteins, specifically CD9, Gal1, and Vamp7, into native EVs. Western blot results confirm the production of CD9 in the EV-CFPS system. Single EV-flow cytometry and ELISA also validate the insertion of synthetic proteins. Furthermore, I use super-resolution microscopy to quantify the number of inserted synthetic proteins per vesicle. My work establishes a flexible and scalable cell-free method to modify EVs. The research has a broad impact on translating EVs for the treatment of different diseases, ranging from neurological repair to anticancer therapy.

Computational Modeling of Cooperative Gating of the L-TypeCalcium Channels and its Role in Cardiac Arrhythmias

Lithika Anbarasan
Sponsor: Daisuke Sato, Ph.D.
MED: Pharmacology

The L-type calcium channels (LTCCs) are crucial for regulating calcium influx into cardiac cells during the action potential, which plays a pivotal role in excitation-contraction coupling. The behavior of LTCCs is not solely determined by intrinsic properties of individual channels but it is influenced by the collective behavior of neighboring channels, a phenomenon known as cooperative gating. Cooperative gating of LTCCs can have a significant impact on cardiac function. For example, increased cooperative gating may lead to enhanced calcium influx during the action potential, resulting in prolonged depolarization and altered contractility of the heart muscle. The coupling strength and cluster size of LTCCs can vary due external factors, such as physiological conditions and drug administrations. In this study, we developed a computational model of LTCCs that incorporates cooperative gating and investigated the effects of coupling strength and cluster size under various conditions. Our findings shed light on mechanisms underlying cardiac arrhythmias.

Navigating Difficult Dialogues: Exploring Antisemitism Conversations Among Jewish Parents and Children

Eva Anderson
Sponsor: Leah Hibel, Ph.D.
Human Ecology

This research delves into the experiences of Jewish parents in addressing antisemitism with their children, employing a survey developed by my faculty sponsor. We are curious to know how parents start these difficult conversations with their kids. I will be sorting through their responses, analyzing patterns, language, themes, nuances, and narratives through qualitative data analysis. The study seeks to gain a comprehensive understanding of the challenges and strategies employed by parents in broaching this sensitive subject. The emphasis lies not only in combating antisemitism but also on acquiring insights into the diverse spectrum of Jewish experiences. Ultimately, the findings aim to inform strategies for fostering resilience, dialogue, and education in combating antisemitism while acknowledging and celebrating the diversity within the Jewish community. By understanding the impacts of these dialogues on both Jewish children and their parents, the findings may inform strategies to empower families in navigating and mitigating the effects of antisemitism.

Perception and Attitudes Towards Research Findings in Social Media Versus General News

Angelique Ancheta
Sponsor: Alison Ledgerwood, Ph.D.
Psychology

Social media has increasingly been used to communicate scientific findings to a wider audience. Existing research suggests a higher percentage of viewership of news through social media, however there is a need for empirical research on the viewers' attitudes towards them. Our study aims to assess perceptions of scientific findings when they are viewed in a social media format versus a general news article. Participants will be asked to take a series of questionnaires through Qualtrics, assessing their trust and interest in scientific findings. Trust will be defined by the article's perceived credibility and a participant's likelihood of sharing the news, measured using Likert-type scales. Interest will be assessed by a participant's time spent on a post or article, how well they understood the research, and their likelihood of doing further research. Utilizing graphic design elements to feign the presentation of social media and news articles, this study aims to measure trust and interest in scientific research when it is communicated over different platforms. We hypothesize that research findings presented on news platforms will gain more trust while those presented on social media will gain more interest. Our results may provide insight into more effective scientific communication.

Modifications of Protein Expression and its effects on ReSIN

Madhulika Appajodu
Sponsor: Kenneth Kaplan, Ph.D.
Ag Molecular & Cellular Bio

The Kaplan lab has characterized ReSIN (**Re**plication **S**tress **I**nduced **N**ucleophagy), a nucleophagy pathway that is induced by replication stress and functions in anaphase to maintain nuclear phase-distinct domains. However, the full extent of cellular stressors that can trigger nucleophagy is not well understood. To begin to identify other stressors, we are taking a genetic approach to identify genes that when overexpressed can trigger nucleophagy. Our hypothesis predicts that overexpression of proteins that form phase-distinct domains in the nucleus will trigger the ReSIN pathway. As a proof of principle experiment, we will use a cargo marker of ReSIN (Fob1-GFP - a nucleolar protein), and we will introduce plasmids into cells in order to overexpress nuclear pore components (Nup60, Nup170), and RNA export factors (Yra1, Hca4). We predict that overexpression of these proteins that are associated with nuclear phase-distinct domains will trigger nucleophagy, resulting in trafficking of Fob1 (and possibly other cargo) to the vacuole for degradation. We will also test how overexpression of proteins normally located in nuclear phase-distinct domains affects the ability of cells to respond to replication stress. We predict these combined stressors will have a negative genetic interaction.

South Sacramento: Examining Events of Historical Environmental Injustice and Air Quality Monitoring

Giselle Aragón García
Sponsor: Clare Cannon, Ph.D.
Human Ecology

Research has found that poor levels of air quality have significant effects on environmental and public health (Manisalidis et al., 2020). To protect the environment and the health of people, hazardous air pollutants need to be monitored and limited. Low-income communities of color typically make up the affected populations in these communities (Patnaik et al., 2020). California Assembly Bill 617 enacted in 2017 seeks to address this issue by requiring local air districts to reduce air pollution specifically in impacted communities. This study will monitor air quality in the South Sacramento region, with a history of environmental injustice , increased exposure to commercial diesel truck emissions, and an executive airport that may be leading sources of air pollution. The history of environmental injustice that will be examined is a direct effect of redlining which pushed communities to outer regions of Sacramento, where processing plants and industries were established. Leveraging a community engagement approach, we will deploy a novel, low-cost, real time monitor (Toxic-metal Aerosol Real Time Analysis, TARTA) to identify and quantify metallic compounds, one kind of air pollutant. The findings of this research will aid in implementing potential policy changes to mitigate toxic emissions.

Testing Counter-selectable Markers in *Giardia*

Satvik Arani
Sponsor: Scott Dawson, Ph.D.
Microbiology & Molec Genetics

Giardia lamblia, an intestinal diplomonad parasite infecting millions annually, and serves as a unique model for the biology of unicellular eukaryotic parasites. *Giardia*'s two unique diploid nuclei poses a considerable challenges for genetic manipulation, however. In recent years, our lab has developed plasmid-based CRISPR/Cas9 techniques to create knockdowns and quadruple allele knockouts. Yet we still have issues of plasmid retention to varying degrees among strains. Thus efficient plasmid removal is essential for selectable marker recycling and for minimizing Cas9 off-target effects. To address this, I am developing a counterselectable marker using the herpes simplex virus thymidine kinase gene (HSV-TK). Cells expressing HSV-TK are selectively eliminated upon exposure to ganciclovir (GCV), selecting for plasmid-free strains. Testing various plasmids and backbones, I aim to establish baseline plasmid loss rates without selection pressure and compare this to similar plasmids expresing the HSV-TK and addition of GCV. Preliminary results suggest HSV-TK-based counterselection effectively promotes plasmid loss, which will enhance our ability to genetically manipulate *Giardia*. Overall, this method promises streamlined selection of plasmid-free strains, advancing our research on *Giardia* and related microbial eukaryotes.

Effects of Social Stress on Corticotropin Releasing Hormone Activity in Female *Peromyscus californicus*

Sinéad Archdeacon
Sponsor: Brian Trainor, Ph.D.
Psychology

Anxiety disorders are a major public health concern, and developing more effective treatments requires a better understanding of the biological basis of stress responses. One major hormone involved in this response is corticotropin releasing hormone (CRH), which controls cortisol release via the hypothalamic-pituitary-adrenal (HPA) axis. Previous studies in *Peromyscus californicus* mice found that HPA activation after social stress is more pronounced in females than males. CRH has important effects on anxiety-related behavior by acting in the brain, but little is known about how stress alters the molecular biology of CRH-producing cells. To determine how stress affects transcription in CRH neurons, female *Peromyscus californicus* mice were randomly assigned to control or social stress conditions. Nuclei from four control and four stressed mice were sequenced using the 10x Genomics platform and CRH neurons were identified. After controlling for the false discovery rate, 51 transcripts were found to be upregulated by stress while 53 transcripts were downregulated. The functions of these transcripts will be analyzed by comparing sequences to a reference genome. Because transcripts were isolated from individual nuclei, the data should provide insight into how CRH activity varies across different cell types.

OppoSits

Faith Arnett
Sponsor: Jessica Colvin, M.A.
Human Ecology

We often underestimate the power of play and its ability to influence even the most mundane activities. Having recreational seating in a public space can create a whimsical environment, which is exactly what “OppoSits” was created to accomplish. Drawing inspiration from the traditional magnet, “OppoSits” utilizes the color, form, and ability to attract people together like “polar opposites.” Furthermore, the simple shape allows for several arrangements ranging from a simple circle to a larger S-curve. The layout can allow for more people to join or for smaller, more intimate gatherings. If flipped upside down into a U-shape, it can act as a seesaw, turning sitting into an energizing interaction. The capabilities of “OppoSits” are endless due to its dynamic design, but more importantly, it challenges the passerby to exercise their own imagination. “OppoSits” serves as a constantly changing installation piece reminding us of the universal, innate curiosity and child-like playfulness that never quite goes away as an adult.

The Domain Functions of BRCA2 in Homologous Recombination

Andrew Arriola
Sponsor: Wolf Heyer, Ph.D.
Microbiology & Molec Genetics

Individuals with mutated BRCA2 are at higher risk of developing breast and ovarian cancers. BRCA2 is a major cancer suppressor that facilitates RAD51 in the homologous recombination (HR) pathway, which repairs Double-Stranded Breaks (DSBs) and interstrand crosslinks. Biostatistical analysis shows that a high concentration of known pathogenic and likely pathogenic missense mutations exists within the helical domain of BRCA2, which may significantly interfere with this process. We hypothesize that the helical domain of BRCA2 is essential for its role in HR-dependent DNA repair. To study this, we will create and isolate a series of mutant BRCA2 proteins with altered helical domains using a mammalian cell system. We will compare the biochemical functions and molecular structures of these mutant proteins with the wild-type version. In the future, we aim to investigate the other regions of BRCA2 that have a high incidence of cancer-related mutations to gain a better understanding of the underlying mechanisms.

Pregnancy After Bariatric Surgery: Persistent Obesity at Conception Influences Peripartum Outcomes

Charuthi Arul
Sponsor: Victoria Lyo, M.D.
MED: Surgery

One third of patients who undergo bariatric surgery (BS) are women of reproductive age. Pregnancy has inherent risks such as gestational diabetes, eclampsia, and the literature on risks of pregnancy in patients who have undergone BS are limited. It is unknown if continued obesity in post-BS patients contributes to pregnancy and peripartum complications. Therefore, we examined pregnancy-related risks using a retrospective chart review study of singleton, live births in post-BS patients from 2009-2023. Data including mother's weight, coexisting conditions in pregnancy, and peripartum results were collected. Obesity was defined via standard criteria. Differences were calculated via chi-square and t-testing. 127 pregnancies in 106 women were analyzed. Mean BMI at BS and conception were 46.9±9.5 kg/m2 and 34.1±8.1 kg/m2 respectively. Compared to those with a BMI>30 kg/m2, Patients with pre-pregnancy BMI < 30 kg/m2 had significantly lower rates of peripartum hypertension (p = .02), diabetes (ShapeShapep = .005), and cesarean section (Shapep < .0001). Persistent post-BS obesity is associated with increased pregnancy and peripartum complications. Patients looking to conceive after bariatric surgery may require additional weight loss support to reduce peripartum complications. ?

Examining Effect of Extracellular Vesicle (EV) Counting Method on Detected Functional Differences Between Healthy Epithelial and Cancer Cell EVs

Vishalakshi Arun
Sponsor: Randy Carney, Ph.D.
Biomedical Engineering

Nano-sized Extracellular vesicles (EVs) are secreted by all cells to deliver functional biomolecular cargo to distant tissues throughout the body. EVs from diseased cells traffic different cargo that can contribute to disease pathogenesis. A limitation of studying EVs from diseased vs healthy cells is accounting for their heterogeneity. EVs have a mode size of 50 nm but range from ~30nm to >1µm, which may significantly vary across EVs from different cells. Nanoparticle tracking analysis (NTA) is the most commonly used technique to determine EV size and concentration, but its lower limit of detection is ~100nm. Resistive pulse sensing (RPS), a competing technique, has a lower limit of detection of 65nm, thus capturing more EVs in its analysis. This study compares the techniques to determine if the current common method of counting EVs (i.e., NTA) is biasing downstream functional studies of EVs by miscounting them. EVs were collected and analyzed from both human breast cancer cells lines (MCF10CA1 and MCF10DCIS) and control healthy epithelial mammary gland cells (MCF10A), and their different size/concentration profiles were confirmed. This study demonstrates that to understand the basic functional differences of EVs in health and disease, their heterogeneity in size and concentration must be accounted for.

Manufacturing Cyborg Cells for Safe and Large-Scale Therapeutic Applications

Veena Arunkumar
Sponsor: Cheemeng Tan, Ph.D.
Biomedical Engineering

Cyborg Cells are non-dividing, metabolically active bacteria with potential applications in anticancer and antibacterial treatment. They are engineered by infusing hydrogel inside them, resulting in hybrid material-cell entities with superior functionalities to their constituents. However, engineering a completely pure Cyborg Cell population after intracellular hydrogelation is still not achievable. There is a need to purify Cyborg Cells for potential applications. Here, we explore the use of density gradient centrifugation to sort Cyborg Cells. The sorting protocol is applied to Cyborg Cells with varying density gradient media to separate the Cyborg Cell population. Additionally, we assess the long-term storage conditions of sorted Cyborg Cells, focusing on storage temperature (room temperature, -20°C, 4°C) and media (PBS, M9 minimal growth media, 2x YTP media). To compare the efficiency and purity of the sorting and storage conditions, we measure Cyborg Cells' metabolic activity and non-proliferative state through daily viability assays and cell counts. The benchmark is no detectable colonies of the sorted Cyborg Cells with high metabolic activity profile throughout the course of storage assessment. My work is the first to enable large-scale manufacturing of Cyborg Cells, opening the doors to the broad deployment of the new Cyborg-Cell therapeutics to the entire U.S. population.

The Protective Effects of Pregnancy and Caregiving on Alcohol Preference in a Mouse Model

Emily Avetisyan
Sponsor: Danielle Stolzenberg, Ph.D.
Psychology

Substance use declines from early pregnancy through the postpartum period. Sociocultural factors are likely involved, however, women reduce alcohol use before they know they are pregnant, suggesting that physiology may also impact drinking. In support of this idea, reproduction-related alcohol resilience has been reported in rodents although the mechanisms remain unknown. C57BL/6J mice, known to prefer alcohol and care for pups as virgins, are an ideal model to address this question. Using a 2x2 design, we independently manipulated pregnancy and caregiving experience. Virgin mice were exposed to pups (or not) and pregnant mice were deprived of pups (or not) in the postpartum period. We used a two-bottle choice paradigm (water vs. ethanol) to measure ethanol preference. Two weeks after initial ethanol exposure, a stud male was added to half the cages and females were checked daily for sperm plugs. After delivery, pups were removed from half of the postpartum mice and distributed to half of the virgin mice. Ethanol consumption was measured daily for two weeks before pregnancy, throughout pregnancy and for 5 days postpartum. We expect to find that the combination of pregnancy and postpartum pup experience significantly reduce alcohol consumption relative to all other groups.

Evaluating the Relative Differentiation of Skeletal Muscle Satellite Cells as Seen in D2 Muscular Dystrophy Models

Avalon Babros
Sponsor: Lucas Smith, Ph.D.
MED: Physical Medicine & Rehab

Skeletal muscle satellite cells (MuSCs) are crucial for the regeneration of damaged muscle, by undergoing a process of differentiation and fusion to form myofibers. However, in the genetic disease, Duchenne Muscular Dystrophy (DMD), the absence of dystrophin expression causes easily atrophied muscles that do not regenerate properly, partly by the disfunction of MuSC differentiation. This project aims to investigate the differentiation of Muscular Dystrophy X-linked (MDX) mouse cells compared to wild-type (WT) models by tracking the expression of transcription factors and muscle contractile proteins - such as myosin - that indicate various stages of differentiation into myofibers. In this study, we utilize D2 MDX mice, a strain with more severe fibrosis compared to typical C57 models, to be more applicable to the severity seen in DMD. Thus far, D2 MDX MuSCs have shown less differentiation than expected, with 2-4% differentiation compared to the 82% seen in WT MuSCs. From these findings, future trials can be done to determine whether MDX models have impairments in transcription factor expression that could be disrupting differentiation. Analysis of future trials hopes to provide insight into the process of MuSC differentiation in DMD and promote investigation of how similar MuSCs in other DMD models differentiate.

Assessing the Effects of ATR Inhibition on Male Meiosis

Kavin Bagal
Sponsor: Satoshi Namekawa, Ph.D.
Microbiology & Molec Genetics

Male germ line proliferation is key to sustaining our species. In somatic cells, the checkpoint kinase ATR has been shown to regulate transition from the S to G2 phase of the cell cycle, and its inhibition has been documented as speeding up mitosis. However, this process has not been fully documented in the germ line and meiosis. Here we hypothesize the inhibition of such ATR kinase with the inhibitor AZ20 will lead to an acceleration of the prolonged process of meiotic prophase I. We establish a method for study in-vivo, treating both adult and juvenile mice with either AZ20 inhibitor serum or control DMSO solution, before harvesting the testes for analysis. Quantification is done using paraffin emboldening of testes and sectioning, combined with immunostaining for markers to indicate progress through meiotic prophase. The preliminary results imply an acceleration of prophase in the adult germ line, but a deceleration in juveniles, indicative of a checkpoint halting the inhibitor group from progress. Future analysis looks to confirm the timeline of checkpoint activation and solidify results from staining, using the same staining technique with modified treatment times to attempt to bypass this checkpoint.

ROS go Boom: Absence of a Negative Regulator Creates Resistance Against Tomato Pathogens

Suji Baik
Sponsor: Gitta Coaker, Ph.D.
Plant Pathology

Tomatoes, Solanum lycopersicum, are a staple crop produced globally that amount to billions in economic value. Due to widespread cultivation of tomatoes, there are diverse disease-causing pathogens that cause millions of losses in revenue for tomatoes each year. Plants evolved immune responses such as the production of Reactive Oxygen Species (ROS) as a defense mechanism with the potential to deter pathogenic infection. One enzyme important for ROS production in tomatoes is RBOHB. The protein PIRE regulates the accumulation of RBOHB through ubiquitination and degradation. Using gene editing, PIRE was knocked out in the M82 tomato variety. The pire mutant exhibited increased ROS production compared to the wild type M82 tomato variety. To further test the hypothesis that tomatoes overproducing ROS have enhanced pathogen resistance, we inoculated our genome edited tomatoes with bacterial pathogens Pseudomonas syringae pv. tomato DC3000 and Xanthomonas campestris pv. vesicatoria. The bacterial infection assays showed significantly increased resistance in the mutant tomatoes. Further assays were conducted using a fungal pathogen Fusarium oxyspororum f. Sp. Lycopersici which will also be presented here. This research provides evidence of increased disease resistance in tomato in the absence of PIRE, which has promise for developing genetic approaches for pathogen control.

Re-imagining the U.S. Demographic Table: Revealing Complex Racial and Ethnic Identities Obscured by Categorical Box-Checking and the 'Other' Label Problem

Amrit Bains
Sponsor: Alice Popejoy, Ph.D.
MED: Public Health Sciences

Undergraduate researchers enrolled in the Quarter at Aggie Square conducted primary research and investigated concepts of race and ethnicity through the lens of advancing health equity. Demographic data (N=4,300 individuals) collected by Community Health Workers in LA county were analyzed to understand how respondents answered the question: 'How would you describe your racial/ethnic background? (Please select all that apply.)' given six options for racial and ethnic categories, plus: 'Prefer not to answer' and 'Other please specify'. Many people do not see themselves fitting into broad racial and ethnic categories, which are often included on official documents and surveys (e.g., U.S. Census) – and which are ubiquitous on clinical intake forms. As an increasing number of people select 'Other' in these circumstances, often providing additional free-text entries, researchers are grappling with the problem of how to effectively analyze and report this information. Here we provide a proof-of-concept for methods to meaningfully represent how people in this sample choose to self-identify, when given the option to fill in a blank text box. By demonstrating how computational approaches can be used to make sense of unstructured demographic data, we hope to facilitate a shift in how demographic information is collected and reported.

Hexamethylene Amiloride-Mediated Induction of Lysosomal Membrane Permeabilization

Rhea Bains
Sponsor: Kermit Carraway, Ph.D.
MED: Biochem & Molecular Med

Hexamethylene amiloride (HMA) is a cationic amphiphilic drug that has been linked to selectively targeting tumor cells and inducing cancer cell death. A gap exists in the use of current cancer therapies (including chemotherapy, radiation, and immunotherapy), which each have a plethora of side effects and demonstrate ineffectiveness in individual cases for tumors that have developed immunity. In conjunction with the common cancer therapeutics currently in use, HMA has the capacity to become a novel therapy with minimal side effects. This project intends to uncover the mechanism by which HMA induces cell necrosis and whether this mechanism could be the induction of membrane permeabilization. Through extensive cell fluorescence microscopy on HMA-treated breast cancer cell lines, it can be determined whether HMA-induced necrosis occurs via lysosome, mitochondria, or plasma membrane lipid peroxidation. Quantification of lipid peroxidation pre and post-treatment as well as cross-correlation with the mentioned organelles in the cells treated allow for conclusions to be drawn about how HMA truly works. Further analysis of HMA and its cytotoxic effects have the potential for optimized drug development, so that it may be used as a cancer therapeutic and aid in the fight against drug-resistant tumors.

Genetic Analysis of Nitrogen Fixation Efficiency in Recombinant Inbred Populations of *C.reticulatum* X *C. arietinum*.

Jaskaran Bajwa
Sponsor: Douglas Cook, Ph.D.
Plant Pathology

Chickpea (*Cicer arietinum*) forms a nitrogen-fixing symbiosis with rhizobium bacteria. The symbiosis occurs within a specialized root "nodule" organ, development of which is triggered by bacterial signals that confer specificity to the interaction. During symbiosis, bacteria convert atmospheric dinitrogen toammonia, which is assimilated to organic forms by plant enzymes. We have limited understanding of the genetic factors that promote efficient nitrogen fixation in crop species. Understanding genetic control would facilitate breeding for improved nitrogen fixation, thereby reducing fertilizer use. We have previously demonstrated that crop wild progenitors have more efficient symbiosis than cultivatedgenotypes. Our project investigated symbiotic efficiency in segregating biparental populations of wild *C. reticulatum* crossed with domesticated *C. arietinum*. Thirty-five Recombinant Inbred Lines (RIL's) were phenotyped for shoot, root, and nodule parameters. Eleven RIL's exhibited highly efficient symbiosis, demonstrating that the wild efficiency trait is heritable. This data is being used for QTL analysis to findgenetic regions that associate with nitrogen fixation efficiency. This work expands our access to genetic diversity and could help introduce useful novel traits back into domesticated cultivars of *C. arietinum*. Further research efforts will include testing the best genotypes under field conditions and improving the precision of genetic analysis.

Impact of Periodic Alternation of Electrical Stimulus Location on Cardiac Alternans

Tymoteusz Bak
Sponsor: Daisuke Sato, Ph.D.
MED: Pharmacology

Cardiac alternans is a physiological phenomenon that occurs when the action potentials change between beats. This phenomenon is linked to a number of arrhythmias including bidirectional ventricular tachycardia (BVT). BVT was linked by a paper by Cerrone et al with alternatingly stimulating the tissue through the left and right bundle branches. Such variation in stimulation sites directly causes fluctuations in the amount of time cells spend in diastolic intervals, and by extension their next action potential durations (APDs). This presentation elaborates on the results from last year (URC 2023) by providing a more detailed description of the relationship between source alternation and cardiac alternans. This relationship was modeled in a single-cell simulation where the stimulation pacing cycle length (PCL) was changed directly. The subsequent results were compared against tissue-level simulations that exhibited periodic source alternation. Furthermore, cell-specific effective PCLs were computed to estimate travel time variations and upon being normalized with the experimental PCL, they revealed a strong correlation with the difference in distance each cell had to the centers of the two sources.

Effects of an Endocrine Disrupting Chemical on Sea Urchin Larval Development and Survival

Sindhu Bala
Sponsor: Rachael Bay, Ph.D.
Evolution & Ecology

Endocrine disrupting chemicals (EDCs) are substances that mimic hormones, generally thyroid or steroid hormones. They are found in a variety of household and industrial products, including pesticides, herbicides, pharmaceuticals, and plastics. EDCs can have several deleterious effects: in marine invertebrate larvae, they've been associated with decreased reproductive output, developmental abnormalities, and altered gene expression patterns. Alkylphenols are a highly water soluble group of EDCs commonly associated with coastal urban areas. They've been found in significant concentrations in the Indian Ocean, off the coast of Germany and Poland, and across the West Coast of North America. In this study, we used Pacific purple sea urchins (*Strongylocentrotus purpuratus*) as a model system, as they are commonly used in ecotoxicology studies and are easily spawned and maintained in the lab. We exposed *S. purpuratus* larvae to three ecologically relevant concentrations of Nonylphenol, the most prevalent alkylphenol, and looked at three distinct early developmental stages to see how Nonylphenol affected urchin development through the pluteus stage. So far we have found that at a dosage of 1000 ppm, Nonylphenol increased larvae size, most likely because of increased development speed.

Case Study of Language Variation in School-Ages Autistic Children: Uncovering Diversity Through Transcripts

Bayleigh Baldwin
Sponsor: Nicole Sparapani, Ph.D.
Education

Children on the autism spectrum possess diverse language abilities. However, this variability is often undercharacterized by studies that evaluate autistic language abilities solely on test scores without examining children's data-rich language initiations. This case study will examine the language of three autistic school-aged children who were recruited for a four-year exploratory study examining inclusion of autistic children within general education settings. The study will examine a language sample produced during the Early Social Communication Scales standardized structured-play assessment (ESCS) using the Computerized Language Analysis (CLAN) program. The language will be qualitatively examined to find expressive language patterns and quantitatively analyzed to check for correlations. Mean length of utterance (MLU), frequency of lexical items (FREQ), ESCS Initiating Joint Attention (IJA) and Responding to Joint Attention (RJA) scores, and scores from the Peabody Picture Vocabulary Test (PPVT) will be compared to gain a wider understanding of the sample's language skills. The author expects to find variations in students' expressive language abilities in their speech samples that do not correlate with their receptive language scores. This study hopes to add more dimension to the presumed spectrum of autistic language and frame autistic language abilities as diverse across students.

Investigating the Effects of Insulin-like Peptide 6 on Temperature Rhythms Induced Longevity

Eva Balogh
Sponsor: Fumika Hamada, Ph.D.
Neuro Physio & Behavior

Human body temperatures fluctuate throughout the day, playing a role in overall homeostatic regulation. This body temperature rhythm (BTR) is controlled by circadian clocks. We previously demonstrated that Drosophila (fruit flies) show similar BTR and regulatory mechanisms to mammals. The purpose of our research is to determine how BTR impacts longevity and which genes are involved in its regulation. We conducted a lifespan assay under several different temperature cycles and found that the wild-type flies housed in the incubator mimicking BTR (increase during the day and decrease during the night) lived longer than those in incubators with an inverse BTR (decrease during the day and increase during the night) or at a constant 25°C. Next, we performed lifespan experiments on insulin-like peptide 6 (*ilp6*) mutants and circadian clock mutants (*tim01*) to assess the importance of these genes on the lifespan of Drosophila. We discovered that *tim01* mutants showed similar life spans to the wild-type flies while all of the *ilp6* mutants lost their BTR-dependent longevity. These results suggest that BTR has an important role in longevity and that insulin signals help regulate BTR-dependent longevity, while circadian clocks may not.

Sequence, Expression & Evolutionary Analysis of ADP-glucose Pyrophosphorylase (AGPase) in Horticultural Crops

Mitchell Bancks
Sponsor: Diane Beckles, Ph.D.
Plant Sciences

ADP-glucose pyrophosphorylase (AGPase) is the important rate-limiting enzyme for starch biosynthesis in plants. Starch provides 50-60% of the calories consumed by humans, and besides its nutritional value, determines postharvest quality of horticultural crops as a primary metabolite. Cereals and tubers accumulate up to 90% of their weight as starch, while in unripenfruits and vegetables, such as tomatoes, apples, bananas, and mangoes, starch accumulates (40-60%) and is broken down to sugars contributing to quality. Therefore, fundamental knowledge of AGPase is pivotal for crop production. Early work identified functionally critical residues of potato AGPase, followed by in-vitro site-directed mutagenesis studies, createdan enzyme with reduced sensitivity to feedback inhibition and enhanced heat-stability in E.coli expression systems. This knowledge serves as a foundation of subsequent crop improvement using biotechnological approaches like CRISPR-Cas9 base editing. However, the knowledge of the enzyme'sstructure-function relationship, the isoforms and their differential expression, or key residues that are conserved or diverged across species are still limited in horticultural crops. Here, we will perform a comprehensive bioinformatic analysisof AGPase in starch-storing horticultural crops as a starting point for modifying the enzyme's key residues.

Do People Mirror Emotion Differently with a Human or Text-to-Speech Voice? Comparing the Performance of Human Judgment and Transformer Models.

Grisha Bandodkar
Sponsor: Georgia Zellou, Ph.D.
Linguistics

In social interactions, individuals often adopt each other's mannerisms, such as facial expressions and linguistic patterns, a process known as "mirroring." As speakers engage more with technology, previous studies have shown that they also mirror the linguistic patterns of technological interlocutors, adopting their vocabulary, syntax, and pronunciation patterns. The current study uses two experiments to assess California English speakers mirror emotionally expressive and neutral words produced by a human and a text-to-speech (TTS) voice. Experiment 1 uses human listener judgments to evaluate mirroring. Experiment 2 evaluates mirroring with wav2vec 2.0, using embeddings to quantify linguistic similarity using distance in latent space. Overall, we find that both human listener and wav2vec 2.0 approaches captured mirroring toward emotional prosody for both human and TTS voices, but the latter could not clearly distinguish between a human and generated voice. We discuss these findings in terms of theories of computer personification and emotional mirroring, as well as their contributions toward methodological advancements in phonetic entrainment.

Beta-Hydroxybutyrate Modulates Aging-related Markers in Mouse Microglia

ARIANA BANERJEE
Sponsor: Gino Cortopassi, Ph.D.
VM: Molecular Bio Sciences

Microglia are the resident immune cells of the central nervous system (CNS). They have many responsibilities ranging from regulating synaptic development, density, and connectivity, to responding to local injury and infection. Neuroinflammation is common in many neurodegenerative diseases (NDs), increases with age, and elicits microglial immune response. Microglia can be protective or detrimental in their overall response. The M0 microglia phenotype are in a resting state. Whereas the activated M1 phenotype is pro-inflammatory and potentially neurotoxic in response to injury. M2 microglia have anti-inflammatory and neuroprotective characteristics. With aging, microglia typically present with an M1 pro-inflammatory phenotype with concomitant morphological changes. To model neuroinflammation associated with NDs and aging, mouse microglia were dosed with lipopolysaccharide (LPS) to induce inflammation. β-hydroxybutyrate (β-HB), a ketone body produced from ketogenesis, exerts anti-inflammatory effects. In this study, inflamed mouse microglia were treated with β-HB t and we measured expression of M1 markers TREM2, Cx3cr1, P2yr12, TMEM119, TNF-a, and IL-1B using qt-PCR. Protein levels of TNF-a and IL-1B were also quantified. Additionally, microglial morphological changes in ramification were imaged and assessed. This study probes if β-HB supplementation can prevent aging-associated microglial phenotypes in mice.

Data Sonification

Haotian Bao
Sponsor: Naoki Saito, Ph.D.
Mathematics

The presentation will briefly discuss the essence of Data Sonification, an innovative approach not only democratizes data accessibility, allowing individuals with visual impairments to engage with data, but also unveils patterns and trends not immediately apparent through traditional visual representations exploring its principles, applications, and benefits. Central to our methodology is the application of the Synchrosqueezing Transform (ST), a cutting-edge signal processing technique that refines the temporal and frequency resolution of signals. By employing the ST, we enhance the clarity and interpretability of sonified data, enabling more nuanced and detailed auditory analysis. I will also present the mechanisms and basic idea of the ST and discuss why we choose this transform in our project and its advantages over other common types of transforms such as the short-time Fourier transform (STFT) and the fast Fourier transform (FFT). Aside from these, I will also demonstrate the power of the Julia Programming Language: a high-performance programming language we used for our project which is designed for technical computing which combines the simplicity of Python with the speed of C, making it ideal for tasks in data science.

Functional Validation of Genes Implicated in Skin Pigmentation Variation of South African Ancestry Using Zebrafish

Aidan Baraban
Sponsor: Megan Dennis, Ph.D.
MED: Biochem & Molecular Med

Human skin pigmentation is a polygenic trait that is entirely based on an individual's genetic inheritance. Prior to the last seven years, studies have been focused on European and Asian populations, leaving our knowledge of genetic architecture incomplete and lacking global representation. Previous genome-wide association study (GWAS) results generated a gene set and interrogated 50 novel loci significantly associated with pigmentation. More recently, we performed a new GWAS of ~900 individuals, replicating a previous association of *SNX13*, a gene involved in intracellular trafficking not functionally implicated with pigmentation, thus requiring validation. We propose performing CRISPR mutagenesis coupled with a high-throughput imaging of pigmentation in zebrafish to characterize candidate genes. To begin, we used multiple guide RNAs to generate mosaic mutants of *snx13*, as well as a positive control gene, *tyr*. Though our results show clear loss of pigmentation of *tyr* mutant larvae, we did not observe a significant pigment phenotype in zebrafish *snx13* mutant larvae (up to 5 days post fertilization) compared with scrambled guide RNA injection controls. Experiments are ongoing to characterize pigment alterations in adolescent and adult *snx13* mutants. Moving forward, we will apply this approach to characterize the functions of additional genes identified from GWAS screens.

The Price of Crime: The Effect of the Misery Index on Crime Rates in the United States 2008-2022

Gabrianna Barcelo
Sponsor: Katherine Eriksson, Ph.D.
Economics

In this paper, I seek to investigate the effect of the misery index, which is the sum of annual inflation rates and seasonally adjusted unemployment rates, on crime (property and violent) levels in the United States. The time period that this study focuses on is 2008-2022, and thus encompasses most of the Global Financial Recession and the entirety of the COVID-19 pandemic recession. Specifically, this paper seeks to know if states with a higher misery index also experience higher crime rates and to identify these states. This relationship is estimated via a state and time fixed-effects regression model, in addition to including an interaction and a control variable to account for likely endogeneity. This study is unique in that it uses state-level data for all of its variables and is the first of its kind to create a statewide dataset for the misery index and inflation rate. Preliminary results suggest that there is a positive relationship between the variables of interest (higher misery index increases crime).

Tissue-Specific Changes in the Cell Wall of Pistachio Hull Lead to its Breakdown During Maturation

Annamarie Basco
Sponsor: Georgia Drakakaki, Ph.D.
Plant Sciences

Pistachio is a rapidly expanding crop in California. Pistachio nuts are covered in a fleshy hull, made up of the exocarp and mesocarp, where it protects the kernel and the shell from pests and pathogens during maturation. Once the pistachio reaches maturity, the shell, or the endocarp, splits, and the hull separates from the shell. However, it has been observed that the hull of the pistachio can also split during maturation, exposing the hull to pests and pathogens, and there is limited research on why it splits. In this study, we used microscopy-based approaches to investigate the hull's anatomy in hulls with different breakdown phenotypes. We found that hulls with varying phenotypes of breakdown show tissue and cell type-specific differences, leading to our hypothesis that hull degradation is due to changes in the cell wall in the hypodermal parenchyma and filler parenchyma cells, which are located in the fruit hull.

Portable, sustainable, and efficient 3D-Printing Systems for Emergency and Disaster Relief in Rural Communities

Kholoud Bashayan
Sponsor: Barbara Linke, Ph.D.
Mechanical & Aerospace Engr

Natural disasters and emergencies cause hardships in the lives of those affected because they often destroy the infrastructure of impacted cities and towns, resulting in a shortage of crucial resources such as mechanical parts and medical equipment that are necessary for providing a good quality of life in those communities. To avoid manufacturing and shipping wait times for important parts and devices in time-sensitive cases during emergencies, 3D-printing can be used to rapidly and locally produce critical medical and mechanical repair components, as previously observed during the COVID-19 pandemic where ventilator parts were 3D-printed when traditional manufacturing was heavily impacted due to high demand. Given the isolated nature of rural areas and the consequent limited access to resources and power especially during disasters, this research focuses on designing a portable, energy-efficient, operator-friendly, and sustainable setup of 3D-printing systems to use in manufacturing the needed parts in rural regions. We aim to research commercially available systems and examine their energy consumption, emissions, and material recyclability to determine their suitability and to define printing parameters under different conditions and situations that can occur in rural areas during emergencies. Our goal is to also define a database of relevant printable parts and their STL files.

Re-imagining the U.S. Demographic Table: Revealing Complex Racial and Ethnic Identities Obscured by Categorical Box-Checking and the Other Label Problem

Dinisha Basnet
Sponsor: Alice Popejoy, Ph.D.
MED: Public Health Sciences

Undergraduate researchers enrolled in the Quarter at Aggie Square conducted primary research and investigated concepts of race and ethnicity through the lens of advancing health equity. Demographic data (N=4,300 individuals) collected by Community Health Workers in LA county were analyzed to understand how respondents answered the question: 'How would you describe your racial/ethnic background? (Please select all that apply.)' given six options for racial and ethnic categories, plus: 'Prefer not to answer' and 'Other-please specify'. Many people do not see themselves fitting into broad racial and ethnic categories, which are often included on official documents and surveys (e.g., U.S. Census) – and which are ubiquitous on clinical intake forms. As an increasing number of people select 'Other' in these circumstances, often providing additional free-text entries, researchers are grappling with the problem of how to effectively analyze and report this information. Here we provide a proof-of-concept for methods to meaningfully represent how people in this sample choose to self-identify, when given the option to fill in a blank text box. By demonstrating how computational approaches can be used to make sense of unstructured demographic data, we hope to facilitate a shift in how demographic information is collected and reported.

Genetics of Destemming in Pepper

Arjun Basraon
Sponsor: Theresa Hill, Ph.D.
Plant Sciences

Most peppers (*Capsicum sp.*) in the US for processing are handpicked, with harvest labor accounting for 20–50% of production costs. Fruits with detached pedicels are ideal for the processing industry. Easy removal of the pedicel has been shown to improve mechanical harvest of peppers. A *Capsicum annuum* land race, UCD-14, was found to have the easy destemming trait. A modified torque gauge was used to measure the force at which fruit is detached. Lines derived from the cross between UCD-14 and the 'Maor' cultivar were developed by single seed decent and selected for low destemming force and improved mechanical harvest. Crosses were performed between UCD-14 and five non-destemming cultivars. QTL analysis identified several genomic regions affecting destemming including a major QTL found in all populations at 140 to 190 Mb on Chromosome 10. The deposition of lignin at the fruit pedicel junction suggests early activation of abscission is responsible for easy destemming. Genes affecting organ abscission have been found in *Arabidopsis*. Pepper homologs encoding four of these proteins were identified within destemming QTL intervals. However, none were found within Chromosome 10 QTL. Further studies are in progress to narrow the chromosome 10 QTL and underlying gene candidates.

The Effect of Modernization on Previously Published Proxy CO_2 Levels via Paleosol Carbonates

Audra Bastress
Sponsor: Jon Richey, Ph.D.
Institute of the Environment

Paleosol carbonates have long been used to predict levels of paleo-CO2 via isotopic analysis. Recently, however, there has been an effort to standardize and modernize proxy-based CO2 estimates and better characterize them statistically. To further this goal, we turn to previously published CO2 studies from the Cretaceous (Canada, Petrified National Forest) and Triassic (Big Bend National Park) from Nordt et al. 2002, 2003, and 2015. Using updated analysis techniques and the Paleosol Barometer Uncertainty Quantifier (PBUQ), we generated new isotopic data and fully quantified error in the input parameters. Previous studies of the isotopes from these samples collected isotopic data from the whole rock sample with no error quantification. We analyzed isotopes from one specific nodule rather than the whole sample and tested for different isotopic values of δ13C and δ18O through stable isotope analysis with improved methods in order to obtain increased accuracy CO2 levels. Furthermore, we make a stepwise comparison of the effect of improved input parameters on calculated CO2 levels via PBUQ. Preliminary results indicate better-constrained CO2 estimates with realistic errors through the modernization of paleosol analysis methods and quantification of error via PBUQ.

Identifying Copy Number Variants in *Anopheles gambiae* Conferring Insecticide Resistance

Anirudh Basu
Sponsor: Gregory Lanzaro, Ph.D.
VM: Pathology, Micro, & Immun

Anopheles gambiae mosquitoes, vectors of the deadly malaria-causing parasite *Plasmodium falciparum*, are known to be resistant to certain insecticides. An important yet understudied genetic basis for insecticide resistance in *An. gambiae* mosquitoes are variations in the copy number of certain genes. It is of interest to understand the types of copy number variants (CNVs) contributing to insecticide resistance and the frequency of CNVs in *An. gambiae* populations. We aim to present the copy number state of gene loci previously associated with insecticide resistance in *An. gambiae* mosquitoes as a means to estimate insecticide resistance in *An. gambiae* mosquitoes from São Tomé and Príncipe Islands. The lab previously sequenced 286 *An. gambiae* mosquitoes from São Tomé and Príncipe in Sub-Saharan Africa. Using a suite of bioinformatics tools, this raw sequence data was filtered for quality and analyzed for CNVs using a hidden Markov model. Five gene clusters, previously identified as conferring insecticide resistance, were examined for CNVs. Preliminary results show potentially elevated copy number states in gene clusters associated with insecticide resistance.

Investigating ANKLE2 Protein-Protein Interactions During Zika Virus Infection to Reveal Molecular Mechanisms of Microcephaly

Sydney Becker
Sponsor: Priya Shah, Ph.D.
Microbiology & Molec Genetics

Zika virus (ZIKV) is a mosquito-borne orthoflavivirus that causes adverse congenital birth defects *in utero*, such as microcephaly. The mechanisms behind these birth defects are not well understood. To explore this, we previously identified a protein-protein interaction between ZIKV NS4A and host ANKLE2, a scaffolding protein involved in cell division. In fruit flies, NS4A induces a microcephaly-like phenotype in an ANKLE2-dependent manner, suggesting that ZIKV induces this phenotype by inhibiting ANKLE2. During infection, ANKLE2 colocalizes with sites of ZIKV protein and dsRNA. Knockout of ANKLE2 reduces ZIKV replication in several cell types, suggesting ANKLE2 promotes virus replication. We hypothesize that ANKLE2 mediates protein-protein interactions are beneficial for ZIKV, while interactions promoting cell division are minimized during infection. To study these protein interactions, we performed proteomics on ANKLE2 with and without ZIKV infection and identified hundreds of candidate interactors. We sought to validate the top protein candidates using confocal microscopy to determine colocalization between the proteins and affinity-purification and western blot to confirm physical interactions. Exploring ANKLE2 host protein-protein interactions and how they change during infection will shed light on how ANKLE2 promotes ZIKV replication and the onset of microcephaly.

Vowel Coarticulation and Expansion Across Styles: Comparing Adults Varying in Age

Nishchala Beeram
Sponsor: Georgia Zellou, Ph.D.
Linguistics

This study investigates how adults of different age groups adapt their speech in response to varying communicative contexts. Previous research indicates that speakers modify their speech to enhance intelligibility, employing strategies such as reducing coarticulation (or segmental overlap of speech sounds) and expanding vowel space (making their vowels more distinct). 129 participants, ranging from 18 to 60 years, engaged in an experiment online. Stimuli consisted of 18 target words, produced in the frame "I say [target word] again". They produced target sentences in three style conditions with two repetitions each: clear (produced for individuals with hearing challenges), casual (produced for close friends/family), and fast (produced as if an auctioneer). The sentences were transcribed in Praat, the vowels were segmented with the Montreal Forced Aligner then hand-corrected. Next, we took vowel measurements with FastTrack and Praat scripts. We predict there will be age-related variation in the patterns of vowel expansion and coarticulation across different communicative styles. This research contributes to our understanding of the dynamic interplay between age, communication styles, and speech production strategies.

Changes of the Left Ventricular Internal Diameter Associated with Age in Thoroughbred Racehorses

Jessica Behar
Sponsor: Jessica Morgan, D.V.M.,Ph.D.
VM: Medicine & Epidemiology

The heart undergoes physiological changes in response to aerobic training, resulting in an enlargement of its chambers. The size of the heart is also influenced by the individual's age. The aim of this study was to investigate how age affects the size of the diameter of the left ventricle in diastole in Thoroughbred racehorses. To explore the relationship between age and cardiac size, a study was conducted on a group of 100 Thoroughbreds in race training. The horses were divided categorically by age. Point of care ultrasounds were performed before exercise using a handheld device Butterfly IQ+. To further determine the left ventricular internal diameter during diastole, Image J. was used to measure the length of the septal endocardial border to free wall endocardial border. An ANOVA was used to compare the left ventricular diameter across ages. Preliminary analysis of 25 horses ranging from 3-8 years of age suggests a trend towards increase in left ventricular diameter between 3 and 4 year olds. Analysis of the complete data set will have sufficient statistical power to more accurately assess this effect.

Aberrant Mitochondrial Morphology in Age-Related Macular Degeneration

Amruta Belambe
Sponsor: Cecilia Giulivi, Ph.D.
VM: Molecular Bio Sciences

Age-Related Macular Degeneration (AMD) is a retinal disease that leads to central vision loss. The disease manifests as an accumulation of lipid and proteins plaque in the form of extracellular lipid deposition known as drusen or intracellular lipid accumulation presenting as punctate lesions, culminating in macular degeneration. Primates are the only mammals to possess maculae essential for sharp central vision, making them crucial models for AMD research. The macula, rich in mitochondria, is susceptible to environmental influences (such as sunlight exposure and dietary habits) and genetic factors that may contribute to mitochondrial damage, influencing the onset and progression of degeneration. To investigate, we analyzed mitochondrial morphology in retinal pigment epithelial cells of healthy rhesus macaques versus those with drusen or punctate lesions. Our findings revealed disrupted mitochondrial morphology in AMD samples, particularly those with drusen or punctuated deposits, exhibiting blunted fusion, a more circular shape, and diminished content compared to normal animals. These observations shed light on the potential role of mitochondrial dysfunction in AMD. Understanding this mechanism could guide the development of future treatments and preventive strategies targeting mitochondrial aspects of AMD.

Constructing Genetic Pedigrees in a Highly Endogamous Population

Catrinel Berevoescu
Sponsor: Brenna Henn, Ph.D.
Anthropology

The Himba are an endogamous population of agro-pastoralists from Namibia, who prefer to marry within their group, thus increasing the average relatedness among individuals. Constructing genetic pedigrees is therefore challenging due to multiple reticulations (i.e., inbreeding loops) within individuals' genealogies. I identified Identity By Descent (IBD) segments, shared DNA segments between individuals inherited from a common ancestor, across all pairwise comparisons in a dataset of 681 individuals. I compared three different IBD software programs, PhasedIBD, Germline1.5.3, and Germline2, using two different reference genetic maps, which inform the program of the likelihood of recombination events (chromosomes exchanging segments during meiosis), the standard hg37 reference map and an ancestry-specific map based on the West African Yoruba population. By comparing the average parent-child shared IBD identified by each program to expectations based on total chromosome length, I identified Germline2 with the hg37 reference map to be the most appropriate software to use for further analyses. I then used the PONDEROSA algorithm with the Germline2 IBD data to infer more distant relationships and create a pedigree for the individuals within this dataset. I identify many instances of reticulations in the pedigree leading to high overall IBD sharing in this population.

Examining the Influence of Limb Posture and Visual Feedback Dissociations on Reaching Movements

Sean Berg
Sponsor: Wilsaan Joiner, Ph.D.
MED: Neurology

Short-term motor learning is the process by which the brain adjusts motor output through the comparison of the anticipated and actual sensory consequences of action. Prior work has shown that visual information plays a critical role in goal planning and action selection by influencing the movement acceleration duration, with proprioceptive feedback influencing movement recalibration by adjusting the acceleration magnitude. To further investigate these relationships, we recently examined the effects of alterations to visual and postural sensory estimates on the exerted force patterns—modulated by the position and velocity motion-state variables—during reaching arm movements. Specifically, lateral visual dissociations strongly correlated with an increase in the velocity and acceleration state variables, whereas lateral postural dissociations correlated with an increase in the position and acceleration state variables. However, it remains unclear how radial and angular dissociations impact these relationships. Here, we designed an experiment that systematically examined radial and angular dissociations of visual and proprioceptive information. We predict that the velocity component of the reaching movement will correlate to the perceived distance, scaled by the radial visual perturbations. Further, we hypothesize that the position component will correlate to the actual distance, scaled by the postural perturbation.

Functional Comparison of Biosignals for Upper-Limb Prosthetic Control

Sonia Bhaskaran
Sponsor: Wilsaan Joiner, Ph.D.
MED: Neurology

Although upper-limb prosthetics have gained complexity (e.g., precise digit actuation), effective control methods are needed to increase functional benefits and decrease device abandonment. Surface electromyography (sEMG) is used in many commercial prostheses to translate user intentions into actions, but the electrodes that sense muscle activity have a limited ability to account for proportional movement (e.g., partial closing of the hand) and variations in arm position (e.g., elbow flexed vs. extended). In contrast, in sonomyography (SMG), ultrasound transducers image a cross-section of the forearm, capturing the positional shift of muscles during contraction. This allows for precisely determining individual finger muscle position and detecting the amount of activation. However, sonomyography exists largely as a research tool; translation into prosthetic devices is still under development. To help this translation, a quantitative assessment is needed of SMG's ability to (1) detect user intentions and (2) provide effective functional control within a prosthetic. Therefore, I aim to compare sEMG and SMG using the Southampton Hand Assessment Procedure, which involves manipulating objects and performing everyday tasks (e.g., cutting food) with a prosthetic hand. Through this, I will examine differences in the performance of the two control signals during functional prosthetic hand use.

Identification of Biomarkers and Pathways for Idiopathic Pulmonary Fibrosis

Purva Bhatia
Sponsor: Ching-hsien Chen, Ph.D.
MED: Int Med Nephrology (sac)

Idiopathic pulmonary fibrosis (IPF) is the most lethal type of pulmonary fibrosis - a disease that causes scarring (fibrosis) of the lungs. With its unknown cause, it presents challenges including diagnostic complexity, limited treatment options, and poor prognosis. To identify biomarkers and pathogenic pathways for early diagnosis and potential therapeutic targets, whole blood samples were used for RNAseq analysis, which led to the identification of differentially expressed genes (DEGs) using the DEseq2 R package by comparing the control and IPF samples. Several potential biomarkers were identified for IPF diagnosis, including TLR4, S100A12, NOD2, IL1R2, and CDK1. DAVID pathway enrichment showed pathways upregulated in IPF, Alpha-defensins, Toll-Like Receptor 4 Cascade, Interleukin-1 family signaling, p53 signaling pathway, and NOD-like receptor signaling pathway. These pathways/signaling contribute to lung fibrosis by promoting inflammation, immune cell activation, fibroblast activation, extracellular matrix deposition, as well as cellular responses to injury and inflammation. Furthermore, several pathways for T cell activation were suppressed in IPF samples, including CD4-positive regulation, alpha-beta T cell proliferation, and T cell co-stimulation. In conclusion, these results hold promise for early diagnosis and potential therapeutic interventions, shedding light on the complex interplay of inflammation, immune dysregulation, and tissue remodeling underlying this devastating disease.

Ineffective Policies: Examining the Lack of Impact of State Minimum Wage Changes on Poverty

Mahek Bhora
Sponsor: Colin Cameron, Ph.D.
Economics

This paper seeks to investigate the causal effects of changes in state minimum wage on the likelihood of an individual being beneath the poverty threshold. This paper contributes to existing research by exploring the impact of minimum wage at a state level on poverty through a narrower scope. By comparing the outcomes of all industries with industries that have the largest ratios of minimum wage workers, we are able to see the impact in both a broad and targeted context. Our investigation into the relationship between the probability of being below the poverty threshold and key regressors — real state minimum wage, state fixed effects, year fixed effects, and industry fixed effects — employs causal methods, specifically a fixed effects regression model and logistic model. We leveraged data from the American Community Survey and Federal Reserve Economic Data from 2012 through 2019, and through our analysis, the results indicate that real minimum wage does not have a large nor significant impact on the probability of an individual being below the poverty threshold across the industries included in the dataset. The findings indicate that the minimum wage is ineffective as the only policy tool to combat poverty.

Transformative Dialogues: Exploring Contemplative Science Discussions in the Saron Lab

Arie Bialostozky
Sponsor: Clifford Saron, Ph.D.
Center For Mind & Brain

Contemplative science is a multifaceted and interdisciplinary field that requires a holistic research approach, which combines a deep understanding of ancient contemplative traditions with modern scientific methodologies. As Research Assistants in the Saron Lab, we immerse ourselves in contemplative research through experimental lab discussions that foster a free-flowing dialogue among participants. These discussions seamlessly integrate personal, spiritual, academic, and scientific research methodologies into a cohesive fabric of philosophical exploration. The discussions enhance our comprehension and efficacy as investigators and enrich our paths of self-discovery and growth, empowering us as contemplative researchers. Conversational insights from these discussions suggest that they may play a role in reducing cognitive dissonance and achieving internal congruence in beliefs, resulting in peace of mind. Our research aims to investigate the subjective experiences of individuals regarding their perceived feelings of peace of mind before and after participating in lab discussions. To gather this data, we will employ a Subjective Experience Assessment that includes pre and post-discussion surveys using questionnaires to assess participants' perceived emotional state. The results of this study may have implications for the use of conversational discussions as a powerful component in achieving greater peace of mind and could inform future research in this area.

Using Behavior Modification and Cooperative Care Techniques to Improve Adult Shelter Cat Welfare During Nail Trims

Matthew Bibiano
Sponsor: Carly Moody, Ph.D.
Animal Science

Nail trims are an important routine health procedure in shelter cats. However, this procedure can be stressful for cats given exposure to many stressors such as restraint, new people, and an unfamiliar environment. Thus, this study aims to establish a nail trim protocol for shelter cats using desensitization and counter-conditioning (D and CC) methods, along with cooperative care techniques, to reduce negative cat responses during nail trims. We used 40 shelter cats from the Sacramento SPCA, assigning them to either the D and CC (n=20) or handling-only (n=20) group. First, cats underwent an initial habituation phase with exposure to the researcher. During this phase, latency to approach the researcher and time the cat spends on the mat (consenting to interaction with theresearcher) will be scored using video recordings. After the habituation phase, cats underwent training sessions incorporating D&CC or handling-only, followed by a nail trim test. We predict that cats in the D &CC group, as well as those showing a shorter latency to approach and more time spent on the mat during the habituation phase, will have an increased likelihood of a successful nail trim (all nails on front paws trimmed) during the nail trim test.

Identifying a Grid-Like Code during Value-Based Decision-Making in the Entorhinal Cortex (EC) & Ventromedial Prefrontal Cortex (vmPFC).

Jake Blumwald
Sponsor: Erie Boorman, Ph.D.
Psychology

Grid cells are specialized neurons in the entorhinal cortex (EC) and ventromedial prefrontal cortex (vmPFC) that encode an individual's trajectory and location in physical space. Grid cells have a distinct hexadirectional firing pattern that has recently been shown in humans during the navigation of abstract spaces – non-physical 2D spaces. We utilize novel experimental tasks to understand the neural mechanisms of value-based decision-making and test if a grid code – an abstract representation of the non-physical space of value and probability – is utilized during the decision-making process. Previous work involving non-human primates has shown 2-dimensional representation in a 'value space' (with value and probability axes) and has demonstrated via neuroimaging analysis that a grid code is utilized in representing this space. We use regression modeling of both participant choices and response time seeking to identify if participants were utilizing both value and probability dimensions during the decision-making process. We conducted fMRI imaging of participants during the task and identified a hexadirectional BOLD (blood-oxygen-level-dependent) signal correlated with a grid-like code in EC & vmPFC. We further identified a subjective 'value space', in which participants uniquely assigned values and probabilities during the task according to their individualized risk preferences and probability weighting.

Observing Budbreak in *Juglans regia* (Walnut) to Genetically Map and Identify Loci Suited to Withstand Climate Change

Isabelle Bodner
Sponsor: Patrick james Brown, Ph.D.
Plant Sciences

Climate change urges breeders to identify cultivars and associated genes that allow a lower chilling period (dormancy) for temperate tree crops to ensure consistent future production. Previous research from the Walnut Improvement Program at UC Davis identified the locus, *Leafing date1* (*Lfda1),* that has a large effect on timing of bud break. To test a new method of phenotyping bud break and possibly identify additional loci involved, we will be collecting sticks from a mapping population segregating for *Lfda1* during winter, premature to natural bud break in the spring. The sticks will be kept in growth chambers to encourage bud break, and we will record bud break timing for each genotype. This alternative phenotyping strategy allows us to monitor the progression of bud break before it occurs in the field. Our growth chamber data will be compared to previous field collected bud break data to determine if there is significant correlation between the two methods. We will then perform genetic mapping to identify loci responsible for bud break with our new dataset. This could be a step towards finding genotypes that are more resilient to climate change and potentially allow more flexibility in phenotyping woody perennial plants.

Sound Enrichment Effects on Stabled Horses

Chloe Bolanos
Sponsor: Amy Mclean, Ph.D.
Animal Science

Stabled horses spend most of their day standing with little to no enrichment, leading to frustration. Studies suggest environmental enrichment may reduce frustration behavior and increase foraging. Sound as environmental enrichment has been associated with reduced frustration. This study aimed to investigate the impact of sound enrichment on horse behavior compared to no sound (control), and which sound was an optimal environmental enrichment. Stabled warmblood horses (n=6) were observed for two weeks, one hour, twice/day (12:00-13:00, 16:00-17:00) with and without sound. Foraging, frustration, social interactions, and stereotypic behaviors were measured when horses listened to Jazz, Country, Nature Sounds, Lullaby or Classical. Statistical analysis used a mixed-effects logistic regression model in Stata to measure differences. Frustration behavior significantly increased ($p<0.05$) when jazz music was played compared to Control pre-enrichment but significantly decreased when nature sounds were played. Frustration significantly decreased ($p<0.05$) pre- to post-enrichment, showing sound may improve welfare. Foraging behavior significantly increased when nature sounds were played compared to pre-enrichment, but jazz music caused a significant decrease in foraging. Results suggest sound enrichment may decrease the expression of frustration behavior. Nature sounds may be the optimal form of sound enrichment to reduce frustration and promote natural behavior.

A Comparison of How Spanish-English Bilingual Mothers Talk to Infants in Northern California and Miami

Clariss Bolanos
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

In infant-directed speech (IDS), caregivers deliver slow and simplified utterances when speaking to their infants to support their language development. In this research, we will examine the different types of utterances used by Spanish-English bilingual caregivers from different regions of the U.S.: Cuban-American mothers from Miami and Mexican-American mothers from Northern California. Mothers and their infants played in either a laboratory or home setting and these sessions have been transcribed. We will categorize each utterance as a directive (e.g., “look at the cat!”), question, description (e.g., “the duck is yellow”), label, play vocalization (e.g., “moo”), imitation (e.g., “ba-ba”), or acknowledgment (e.g., “yes, the cat meows”). These categories are used to play with the infant, guide attention, and inhibit or encourage specific actions. We will consider how demographic factors of the participants such as generational status, cultural identity, and language exposure spoken in their city of residence affect utterance use of IDS. I predict that Mexican-American mothers' directive use will be high based on prior research. There is no evidence of Cuban-American mothers’ directive use, and this project aims to seek more knowledge regarding this topic.

How Prevalent are Psc1-Identifiable Type III Effectors in the Ralstonia Solanacearum Species Complex?

Nicolas Bonagura
Sponsor: Tiffany Lowe-Power, Ph.D.
Plant Pathology

Ralstonia solanacearum is a bacterial plant pathogen that causes wilt disease in a broad range of hosts. One mechanism of infection is the Type III secretion, which R. *solanacearum* uses to inject Type III Effector proteins into the host cells. These effectors have a variety of functions, some of which can suppress immune responses or influence metabolic pathways to hijack the plant cell. Psc1 is a plant gene which has recently been discovered to confer resistance to several plant pathogenic bacteria, including *R. solanacearum*. While the mechanism of this gene is unknown, it enables host plants to resist pathogenic bacteria by recognizing various Type III Effectors. Examples of Type III Effectors in *R. solanacearum* that can be identified by Psc1 are RipBN, RipTAL, RipE1, RipE2, and RipBH. This project uses computational tools to assess the prevalence of these effectors in the Ralstonia Solanacearum Species Complex (RSSC). The widespread occurrence of these effectors across the RSSC suggests that it would be worth the investment to modify plants with Psc1 in regions impacted by *R. solanacearum*. Further investigation is being done about the variation of each of these effectors.

Advancing Western Blotting Techniques – Exploring pH, Salt Composition, and Transfer Stack Sizes

Mazel Boquiren
Sponsor: Aldrin Gomes, Ph.D.
MED: Physiology & Membrane Biol

Over the last 40 years, Western blotting – used to detect and quantify sample proteins – has become an increasingly prevalent lab technique. Due to the current method’s susceptibility to variation and error, this proposal explores three adjustments to traditional protocol: (1) comparing sodium chloride (NaCl) and potassium chloride (KCl) in Tris-buffer, (2) adjusting the pH of Tris-buffered saline with Tween 20 (TBST), and (3) varying the filter-paper stacks during protein transfer. As the buffer’s salt-composition influences protein binding to the membrane and other proteins, comparing Tris-buffers composed of NaCl and KCl allows us to deduce which salt more effectively enhances Western blot performance. Similarly, pH affects the efficiency of protein binding and antibody interactions; varying TBST’s pH allows us to determine the optimal pH to maximize protein retention on the membrane while minimizing non-specific binding. Lastly, adjusting the size and distribution of filter-paper layers used during protein transfer helps us identify the ideal combination that reduces incomplete transfer or uneven protein distribution. In order to analyze these factors independently, individual experiments are being conducted for each alteration, ensuring precise observations of the effects of the targeted changes. Overall, this project seeks to refine standardized conditions that promote consistent, reliable Western blots.

Evaluating the Role of Heart Biomarkers in Sleep Apnea Pathology and Treatments

Hayat Botan
Sponsor: Shelley Blozis, Ph.D.
Psychology

Obstructive sleep apnea (OSA) is a sleep-related breathing disorder, characterized by intermittent cessations in breathing rhythms. These episodes, although brief, can recur nightly, leading to headaches, depression, and a heightened risk for cardiovascular disease, if left untreated. In essence, individuals with OSA experience pharyngeal narrowing and possible collapse during inspiration, promoting oxidative stress on the nervous system. Furthermore, sleep apnea disrupts cardiac autonomic regulation, manifesting as unexplained heart rate variability. Theoretical explanations linking OSA with cardiovascular disease suggest that OSA induces a persistent inflammatory condition, resulting in enhanced atherosclerotic alterations within the patient's blood vessels. Recent advances in clinical diagnostics have leveraged heart biomarkers to unveil correlations with symptoms, guiding personalized treatment strategies. This study aims to elucidate sleep apnea's prevalence and severity, employing heart biomarkers across diverse demographics. The dataset of which this analysis will be based on utilizes computational methods for polysomnography recordings, a key diagnostic tool in OSA. This study also investigates the comparative efficacy of supplemental nocturnal oxygen or Positive Airway Pressure (PAP) therapy against standard medical prevention in individuals with cardiovascular diseases, utilizing advanced statistical analyses to further explore demographic disparities. These therapies are identified as highly effective and well-tolerated by patients.

Habitat Selection and Nesting Success in Vineyard Songbirds

Maggie Bourda
Sponsor: Daniel Karp, Ph.D.
Wildlife & Fisheries Biology

Suitable habitat is a critical factor in the survival and success of nestling songbirds. In California's Napa Valley, a significant portion of the natural landscape has been converted into vineyards. Artificial nesting sites within vineyards have been thought to mitigate the effects of habitat conversion, but it is unclear how successfully birds are able to reproduce in these nestboxes. To understand how vineyards can support nesting birds, we collected data across 10 vineyards in Napa Valley from nestboxes occupied by two focal species: Western Bluebirds (*Sialia mexicana*) and Tree Swallows (*Tachycineta bicolor*). Throughout the summer of 2023, we collected data on clutch size and nestling survival, as well as over 5,000 locations from GPS trackers placed on parents associated with each nest, to determine (1) how habitat selection of adult birds could differ depending on clutch size and (2) how habitat selection by the parents affects nestling success. Different habitats may have tradeoffs depending on the size of the clutch for which the parent is providing food. Knowing which habitats are preferred for larger clutches could help managers understand which habitats are most beneficial to these birds, and help them understand how the birds are using the agricultural landscapes.

US Foreign Policy: Underlying Causal Mechanisms of Latin American Migration in the Cold War Era (1960-1990)

Kate Boyce
Sponsor: Jeannette Money, Ph.D.
Political Science

In recent years, Latin American migration has been a hot-button issue for United States policymakers. However, it is pertinent to observe the evolution of this phenomenon; this study begins with the Cold War Era. How did economic and foreign aid affect migration to the United States between 1960 and 1990? Through a quantitative analysis, examining migratory flows through Statistical Yearbooks of the Immigration and Naturalization Service, and 5 confounding variables for migration: migration networks, transportation and communication costs, distances to the United States from home countries, rates of inequality, and U.S. immigration policy, economic and foreign aid significance will be assessed through statistical regression. Qualitatively, this study will also look at two countries, one of which experienced government destabilization from 1960 to 1990, Chile, the other which did not experience destabilization, Venezuela. In observing a causal graph for these countries, the study will look at the indirect relationship between economic and foreign aid and outmigration. Should the hypothesis hold true, that Cold War economic and foreign aid contribute to outmigration, a statistical significance will be observed in the independent variable, economic and foreign aid, for Chile.

Characterizing the Efficiency of MoS_2 and Other Molybdenum Chalcogenides in a Membrane Electrode Assembly for the Conversion of CO_2 to Value-Added Products

Nicholas Braga
Sponsor: Jesus Velazquez Mojica, Ph.D.
Chemistry

Metal chalcogenides have been previously investigated for carbon dioxide (CO_2) reduction (CO_2R) due to their ability to break scaling relations through tuning of the electronic structure and composition. Although their electrocatalytic properties have been adequately studied via static CO_2 reduction, metal chalcogenides have not been explored as electrolyzer catalysts. Membrane electrode assemblies (MEA) have shown promise in improving the reduction of carbon dioxide (CO_2) to value-added chemicals due to the improvements in mass transfer and the reduction of ohmic losses. The focus of this project was to determine the efficiency and selectivity of nano-Molybdenum disulfide (MoS_2) for CO_2R in an aqueous MEA setup. To test the catalytic performance of MoS_2, an ink was formulated utilizing an ionomer binder and the catalyst powder and subsequently spray-deposited on gas diffusion electrodes (GDE). IrO_2 acted as the anode and 0.5 M potassium hydroxide was the electrolyte used. Current was then applied using a potentiostat to drive CO_2R and minimize unwanted side reactions like the hydrogen evolution reaction (HER). The gas and liquid products were analyzed using gas chromatography (GC) and nuclear magnetic resonance (NMR) techniques. Materials were characterized through scanning electron microscope and x-ray diffraction.

The Squeezing of Trapdoor Spider Populations on the California Coast

Hanna Briggs
Sponsor: Jason Bond, Ph.D.
Entomology/Nematology

The trapdoor spider *Aptostichus stephencolberti* is endemic to the fragile and shifting coastal dune ecosystems where they construct silken burrows into dune faces. These isolated and threatened coastal populations will likely experience intensifying coastal squeeze with predicted sea level rise and encroaching development. To understand their population dynamics and ecological role, *population* surveys were completed at two state beaches along the Central California coast during the 2022 and 2023 summer field seasons. Our main objective was to estimate population size and population density of *A. stephencolberti.* Our second objective was to determine if a relationship exists between spider density and native plant density. We took photographs of each sample plot and identified the plant species present and the percent plant cover. We then tested whether trapdoor spider burrow density was correlated with the presence of native versus non-native plants and plant density. These relationships could potentially inform future conservation strategies.

Enemy Anemones: The Aggressive Behaviors and Competitive Interactions Between a Native and Newly Introduced Anemone

Zoe Brumbaugh
Sponsor: Eric Sanford, Ph.D.
Evolution & Ecology

Marine invasions have become increasingly common as human activities link regions previously separated by natural barriers. These invasions pose substantial threats to biodiversity as nonindigenous species can impact native species through predation, disease, or competition. The sea anemone *Anthopleura hermaphroditica* is native to Chile, New Zealand, and Australia and was recently identified for the first known time in the Northern Hemisphere in Tomales Bay, California. It has spread prolifically in this estuary, reaching high abundances and densities, but it is unknown how its introduction affects the co-occurring native anemone *Anthopleura elegantissima*. We ran a lab experiment where we staged one-on-one encounters between the two species and quantified aggressive interactions and competitive outcomes during one-hour trials held at two different temperatures: 12°C and 18°C. We found that *A. hermaphroditica* was a weaker competitor, with *A. elegantissima* winning more encounters, especially when temperatures were warm. Additionally, *A. elegantissima* exhibited dominance in several other aggressive behaviors including inflating more acrorhagi (club-shaped tentacles), inflating acrorhagi faster, and initiating more acrorhagial contacts. Although these findings suggest that *A. hermaphroditica* may not pose a direct threat to the native anemone, its potential for rapid proliferation and spread may be a concern for estuarine communities in California.

New Approach to Monitoring Body Temperature

Gregory Bui
Sponsor: Fumika Hamada, Ph.D.
Neuro Physio & Behavior

Quality sleep is essential for maintaining health, as sleep deficiency heightens risks of injury and mortality, and decreases productivity. Our research aims to improve overall sleep quality by understanding how body temperature affects sleep. We use the common fruit fly, Drosophila, as a model system for human body temperature rhythm (BTR), as circadian rhythm is conserved across flies and humans. Specifically, both fly and human temperatures increase during wakefulness and decrease during sleep. To understand how BTR and sleep interact, we developed a method to monitor BTR and sleep which combines day-night video recording and open-source motion tracking to measure the frequency, length, and preferred temperature of sleep. Using past research that defines fly sleep as five minutes of inactivity, we selected flies with mutated clock genes (per01) and compared their sleep behavior to wild-type flies (w1118 and Canton-S) across a temperature gradient of 18-32°C. Results show that longer sleep is achieved early in the night before shorter sleep in conjunction with the anticipation period. Flies exhibit longer sleep bouts coinciding with lower body temperature and shorter sleep bouts with higher body temperature. This pattern correlates with the sleep-body temperature relationship in humans.

Validating Computational Models of Crustacean Swimming Mechanics with a Biomimetic Shrimp

Kenneth Bui
Sponsor: Daisuke Sato, M.D.,Ph.D.
MED: Pharmacology

Recent mathematical and computational analysis by Zhang *et al*. has shown how the neural circuits underlying the coordination of crustacean swimmerets generate an efficient and robust stroke pattern. Our study aims to validate these findings in a physical environment using a biomimetic shrimp model. In this study, we created a biomimetic shrimp with four 3D-printed swimmerets driven by electronically controlled motors. These motorized appendages emulate the limb movements, with a 0.25 phase difference, that is observed in crustacean propulsion. This pattern has been shown to be the most mechanically optimal swimming method across a range of biological Reynolds numbers in crustacean swimming. The Arduino-based control system allows us to precisely manipulate the motors to replicate various stroke patterns shown in the computer simulations and experiments. By directly comparing our physical model with computer simulations, we can bridge the knowledge gap between theoretical understanding and real-world biomechanical performance. This comparison will contribute to our understanding of how neural circuitry design translates to efficient, real-world motion. This approach contributes significantly to biomechanics by validating theoretical models with empirical data, thereby increasing our comprehension of neural circuit architecture and moving closer to solving nervous system disorders in humans.

Happy Plants for Happy Monkeys?: The Effects of Live Plants on the Behaviors and Welfare of Non-Human Primates.

Jon Bunting
Sponsor: Karen Bales, Ph.D.
Psychology

Indoor plants have profound and well-documented effects on human behavior, including positive associations between novel exposure to plants and greater productivity, health, cooperation, and positive affective states. A possible evolutionary explanation for this phenomenon is EO Wilson's biophilia theory, which states that humans have an innate tendency to enjoy the presence of greenery due to vegetative-rich areas serving as adaptive environments during our evolutionary history. Because this perspective suggests that preferential proximity to plants arose early in our evolutionary history, it is possible that other primates may show a similar response to the presence of plants. There is a long tradition of habitat naturalization for non-human primates in zoo science, but direct experimental inventions on indoor-housed primates, with plants isolated as a variable, represent a gap in the literature. In this study, twenty-eight titi monkeys (*Plecturocebus cupreus)* housed indoors were exposed to foliage outside of their home cages for 6 hour intervals over multi-day periods. Behavioral patterns once the monkeys were introduced to plants were recorded and compared to control and baseline conditions. We expect to find increased prosocial behaviors in response to the plants, and a reduction in behaviors associated with stress and anxiety.

The Effects of Visitor Presence and Noise Levels on Northwestern Gray Wolf (*Canis lupus occidentalis*) Behavior in a Zoo Setting

Aleisha Burke
Sponsor: Kristina Horback, Ph.D.
Animal Science

Previous research of the effect human visitors have on zoo-housed animals have been documented. By understanding visitor effects, zoos can increase habitat enrichment and conservation efforts for many human-impacted species. In this study, we investigated how noise l levels and visitor presence altered the behavior of six wolves (3 M, 3 F) at Oakland Zoo in California. Each wolf was observed in 15-minute focal periods for three rounds each day (between 0800-1230), three days a week, resulting in 73 observation hours over five weeks. Temperature, the number of visitors present, and decibel level were taken at the beginning of each focal observation. We found that as decibel levels increased, the frequency of standing ($P<0.001$), locomotion ($P<0.05$), and proximity to another wolf ($P<0.05$) significantly decreased. In the presence of visitors, standing and locomotion decreased while the frequency of sleeping increased. Interestingly, there was only a significant difference in decibel levels after more than 10 visitors were present. These results concur with the literature that captive wolves are impacted by noise levels and visitor presence. Understanding that wolves tend to move less when visitors are present provides insight into their potential behavioral shifts in the wild in response to high anthropogenic activity.

Effect of Cattle Grazing on Ground Squirrel Abundance and Behavior

Madison Burnam
Sponsor: Fraser Shilling, Ph.D.
Inst Of Transportation Studies

The California Ground Squirrel (Otospermophilus beecheyi) [CGS] is a keystone species which shares its home with cattle on rangelands throughout California. We are interested in tracking how the presence of cattle affects the CGS because their population fluctuations affect other wildlife species (e.g. coyotes, birds of prey, and other burrowing species), and a preliminary relationship has been shown through linear analysis of camera trap data. We have chosen parcels of public land in Point Reyes and private land in Contra Costa Water District that have both cattle and CGS, and a separate plot containing only CGS. Squirrel data will be collected using faux ground squirrel calls, walking quadrats, and counting warrens alongside camera trapping data which would be used for population density and behaviour reporting. Cow presence will be cross-referenced with rangeland records and physical sightings. We hypothesize the presence of cattle will have a predominantly negative effect on the population of CGS, because of behavioural changes, den trample, and predator avoidance. The results of this study are not meant to say rangelands and cattle have a harmful relationship, but to help find a compromise between using land for grazing and still keep it habitable for wildlife.

Fish Bones from an Ancestral Ohlone Site in Fremont, CA

Cera Burns
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

In preparation for a new housing development, archaeological excavations were conducted at a site in Fremont, California. A series of radiocarbon dates show that the site was occupied for a short period of time between 1350 and 1200 years ago. At that time, the site sat on the banks of a channel of Alameda Creek, and was about four to five kilometers from the bayshore. In collaboration with the local Ohlone group, further analyses of fish bones were conducted in the Archaeometry Lab at UC Davis to learn about paleo-ecology and how people occupying the site used local wetlands and/or bay resources. Species identified include Sacramento sucker, longjaw mudsucker, sculpin, silversides, herring, surfperch, and salmon. These results show that site occupants accessed species that inhabited both local freshwater creeks as well as San Francisco Bay. Measurements of bones allow us to estimate original fish lengths. Results of the measurements show that people harvested mainly small-bodied fishes during site occupation. A sample of bones are currently being prepared for future stable isotope analyses to examine paleo-ecological adaptations of particular species to local environmental conditions just before the onset of the Medieval Climatic Anomaly (ca. 1200 BP).

CHD4 is Essential for the Formation of the Ovarian Reserve in Mice

Adam Bynder
Sponsor: Satoshi Namekawa, Ph.D.
Microbiology & Molec Genetics

Ovarian reserve determines female reproductive lifespan and is defined by the quantity and viability of dormant oocytes. Several events are essential for the maintenance of the oocyte reserve, such as the nuclear localization of FOXO3. Before follicle activation, oocytes will stay dormant in the primordial follicle stage. However, it is unclear how the chromatin state of the oocyte is regulated for that long term dormancy. We hypothesize that the repressive chromatin remodeler CHD4 establishes a chromatin state that is essential for maintaining ovarian reserve. To validate this hypothesis, Chd4 cKO mice were generated using germ cell-specific Vasa-Cre mice and Chd4 flox mice. We used immunostaining followed by oocyte counting to confirm this knockout. Our immunostaining data showed that the CHD4 protein is absent from P1 ovaries in Chd4-KO mice. In addition, there was a significant decrease in both the number of oocytes and the number of oocytes with nuclear localization of FOXO3 in these Chd4-KO ovaries. Further research could focus on this phenomenon in order to discover more about dormancy in oocytes. We conclude that CHD4 is essential for the ovarian reserve formation, including the nuclear localization of FOXO3.

Improvment of Muscle Structure Imaging Identification

Mauricio Caldera-Madera
Sponsor: Lucas Smith, Ph.D.
MED: Physical Medicine & Rehab

Muscular dystrophies are a class of progressive disorders characterized by weakness of muscles. This weakness of muscle is caused by cumulative damage and progressive accumulation of extracellular matrix proteins (ECM) in the wounded area, leading to fibrosis. Fibrosis has been shown to significantly affect muscle function leading to impaired mobility. Characterizing the differences between fibrotic muscle ECM and healthy muscle ECM would allow for the development of a clear relationship between muscle structure and function. Despite the potential of current second harmonic generation (SHG) imaging, the imaging process pipeline remains poorly optimized for the purposes of ECM structure identification and dynamical imaging. In this study, we aim to improve the structure identification through Matlab code alterations and imaging of distinct muscles, such as the soleus and extensor digitorum longus (EDL) from mice. Code alterations include filter function adjustments or replacement, and computational solutions. A streamlined imaging process will provide a clear downstream analysis pipeline for the visual for identification and analysis of the relationship between muscle structure and function.

Methods for Analysis of MRI and PET Images for Monkey Model of Social Connectedness

Anelise Caceres
Sponsor: Abhijit Chaudhari, Ph.D.
MED: Radiology

Titi monkeys, a socially monogamous new world non-human primate (NHP), are a robust model for social connectedness in humans. Kappa opioid receptor alterations, which have been implied in pair bonding behavior, can be assessed non-invasively with brain imaging. A titi monkey brain image analysis pipeline was developed to evaluate MRI and PET scans. Adult Titi monkeys (N = 20) underwent 110-minute dynamic PET brain scans using the radiotracer [11C]GR103545, that binds to the KOR, at baseline and upon experience of a stressor in the presence (social buffering) and absence (stress) of their partner. PET scans were then reconstructed (after correction for attenuation), quality controlled and motion corrected. MRI scans were acquired to capture brain anatomy and were bias corrected, skull-stripped, mapped onto to a titi monkey reference space, and segmented by warping to an atlas. The PET and MRI scans were then rigidly co-registered to obtain region-wise nondisplaceable binding potential. Our analysis found different levels of binding in the different brain regions, indicating variation in kappa receptor activity. The aforementioned pipeline illustrated drastic improvements in comparison to previous attempts with manual segmentation thereby demonstrating its scope for robust analysis of NHP brain data.

Streamlining Silencing, a Novel Stacked VIGS Approach in Eggplant

Jonathan Calzada
Sponsor: Gitta Coaker, Ph.D.
Plant Pathology

Viral induced gene silencing (VIGS) is a tool commonly used in plant science research to identify gene function. Here, I will report our novel stacked VIGS method on eggplant, a non-model organism. Stacked VIGS silences multiple genes at once, rather than a single gene. This approach allows us to streamline large scientific screens. We designed constructs with about two to five genes each and were able to screen 71 genes in 13 constructs. Using traditional VIGS approaches, this screen would have required 71 constructs to silence each gene individually. Studies using VIGS frequently use *Nicotiana benthamiana,* a model organism for plant research. We have optimized VIGS protocols in eggplant. To our knowledge, our work presents the first time stacked VIGS has been performed in any organism other than *N. benthamiana*. This poster will include elaboration on our optimized VIGS protocol that accounts for the differences between the model plant, *N. benthamiana*, and our non-model eggplants. This method has the potential to be an effective protocol for screening many genes at a time in non-model plants.

Uncovering the Health Stressors Latinx and Indigenous Students encounter within Academia: How Latinx and Indigenous students find empowerment and resilience at UC Davis and Santa Rosa Junior College

Cindy Camacho
Sponsor: Monica Torreiro-Casal, Ph.D.
Chicano Studies

This research is intended to uncover the mental health stressors that stem from academic institutions for Latinx and and Indigenous students. Aiming to highlight the places of strength in which students find within their community and culturally inclusive spaces at their institutions. Focusing on the academic and personal value of taking culturally responsive courses for Latinx and Indigenous identifying students and how these classes affirm their positive self identity and aid in their academic success.Capturing the communal and familial support that students receive within and outside of their institutions that support their academic success and the advantage of taking culturally responsive courses. Honing in on mental health stressors that accompany educational restraints which students encounter while navigating academic spaces and uncovering the learning engagement and confidence promotion within culturally relevant courses. Surveys will be distributed at both institutions to better understand the resources they attribute to their academic success that offset feelings of not belonging and the mental health disparities that coincide with it.The questions are geared to better understand the outlets students engage with to combat confidence reduction,alienation and hostility that are rooted in the educational oppression of Latinx and Indigenous students within academic spaces.

Segregated Anatomical Connectivity Could Contribute to Diversity in the Role of the Cerebellum in Fear Extinction

Sara Camarero
Sponsor: Diasynou Fioravante, Ph.D.
Neuro Physio & Behavior

The cerebellum is understood to modulate motor function and cognitive and affective processing, including learned fear. Connections between the cerebellar output nuclei (DCN) and limbic structures including the periaqueductal gray (PAG) and parafascicular thalamic nucleus (PF) regulate extinction of learned fear, but in opposite ways: inhibition of the DCN-PAG pathway impairs extinction whereas inhibition of the DCN-PF pathway facilitates extinction. Moreover, inhibiting DCN connections to the centromedial (CM) thalamus, which belongs to the same group of intralaminar nuclei as PF, does not affect extinction. This functional divergence lacks understanding; we hypothesize that anatomical segregation of pathways within DCN could contribute to this divergence. Retrogradely-traveling viruses expressing different-color fluorophores were stereotactically injected into PAG, PF and/or CM of mice and allowed time to express. Mice were then perfused intracardially, and brains were extracted, sliced, and imaged. Following registration of brain slices to the Paxinos brain atlas and confirmation of injection sites, the location and number of retrogradely-labeled fluorescent neurons in DCN will be quantified using ImageJ. Anticipated results will be discussed in the context of anatomical divergence of these pathways in the DCN and could offer insights into the complexity of the cerebellum's role in fear processing.

The Squeezing of Trapdoor Spider Populations on the California Coast

Julianna Campos
Sponsor: Jason Bond, Ph.D.
Entomology/Nematology

The trapdoor spider Aptostichus stephencolberti is endemic to the fragile and shifting coastal dune ecosystems where they construct silken burrows into dune faces. These isolated and threatened coastal populations will likely experience intensifying coastal squeeze with predicted sea level rise and encroaching development. To understand their population dynamics and ecological role, populationsurveys were completed at two state beaches along the Central California coast during the 2022 and 2023 summer field seasons. Our main objective was to estimate population size and population density of A. stephencolberti. Our second objective was to determine if a relationship exists between spider density and native plant density. We took photographs of each sample plot and identified the plant species present and the percent plant cover. We then tested whether trapdoor spider burrow density was correlated with the presence of native versus non-native plants and plant density. These relationships could potentially inform future conservation strategies.

Interaction of Alpha-Synuclein nER Stress and DNA Replication Stress-Induced Nucleophagy

Fenna Candy
Sponsor: Kenneth Kaplan, Ph.D.
Ag Molecular & Cellular Bio

Proteotoxic stress, resulting from the aggregation of proteins in the neuron, is associated with many forms of neurodegenerative disease (ND). However, the role of proteotoxic stress in the progression of ND is poorly understood. Many studies link proteotoxic stress to changes in nuclear homeostasis, including the disruption of genome stability. The Kaplan Lab has found that alpha-synuclein, a protein that forms aggregates in the neurons of Parkinson's patients, is associated with a class of nuclear-ER associated autophagy receptors in budding yeast. The lab has also shown that these receptors are involved in the cellular response to DNA replication stress, which is required to maintain nuclear homeostasis. We hypothesize that alpha-synuclein aggregation with nuclear-ER autophagy receptors will disrupt the cell's ability to respond to replication stress. We will express alpha-synuclein in budding yeast and then expose them to replication stress, in order to measure the cell's ability to transport cargo from the nucleus to the vacuole. Our prediction is that alpha-synuclein expression will inhibit the trafficking of nuclear proteins to the vacuole after replication stress is induced, and result in increased cell toxicity.

Visual Sampling of Target and Non-Target Context Information during Difficult Search Tasks

Hanxiao Cao
Sponsor: Joy Geng, Ph.D.
Psychology

When searching for a target, we often hold an idea in mind of what that target looks like – a target template. However, when targets are difficult to find we may rely on other context features to help guide our search. In this study, participants were trained to associate target faces with distinct scene backgrounds. We tracked their eyes as they were tested on these scene/face associations, and quantified the degree to which viewers used either target template information or scene context information to help them complete the task. Here, we report unique gaze patterns that reflect attention to relevant vs. irrelevant target and scene information. We further test whether more attention to context over target information leads to faster target recognition. Together, these results suggest that searchers rely on background scene context information early on in difficult search tasks. These results provide further evidence as to how searchers use both guidance and target information as templates in difficult tasks.

Effect of Cattle Grazing on Ground Squirrel Abundance and Behavior Abstract

Selena Cao
Sponsor: Fraser Shilling, Ph.D.
Inst Of Transportation Studies

The California Ground Squirrel (Otospermophilus beecheyi) [CGS] is a keystone species which shares its home with cattle on rangelands throughout California. We are interested in tracking how the presence of cattle affects the CGS because their population fluctuations affect other wildlife species (e.g. coyotes, birds of prey, and other burrowing species), and a preliminary relationship has been shown through linear analysis of camera trap data. We have chosen parcels of public land in Point Reyes and private land in Contra Costa Water District that have both cattle and CGS, and a separate plot containing only CGS. Squirrel data will be collected using faux ground squirrel calls, walking quadrats, and counting warrens alongside camera trapping data which would be used for population density and behaviour reporting. Cow presence will be cross-referenced with rangeland records and physical sightings. We hypothesize the presence of cattle will have a predominantly negative effect on the population of CGS, because of behavioural changes, den trample, and predator avoidance. The results of this study are not meant to say rangelands and cattle have a harmful relationship, but to help find a compromise between using land for grazing and still keep it habitable for wildlife.

Beats & Battle: A Political Analysis of the Lyrical Landscape of

Race and Violence in 21st Century Music

McKenzie Carling
Sponsor: Amber Boydstun, Ph.D.
Political Science

There is an undeniable relationship between music creation, the struggles faced by minority Americans, and the impact of resulting lyrics on listeners' opinions, which this paper intends to address. By using lyrical coding techniques and analyzing the Billboard Top 100 from 2000 to 2022, this research aims to determine the extent to which historically disproportionate violence against minority groups, particularly Black Americans, leads to a higher level of violence in music created by contemporary minority musicians compared to their White counterparts. While previous studies have shown a correlation between themes of violence and rap music, this research fills a critical gap in political science by exploring how race and violence in modern music interact and the effect on American audiences' perceptions of politics, policies, and policing. The statistically significant and compelling results of this study reveal that nearly 78% of violent songs are created by Black musicians, which is further interrogated by questioning whether rap's association with Black music history makes it the primary source of violent lyrics. The research concludes with a discussion of how exaggerated violent music could both promote collective action and harm Americans' perspectives on policies related to racial tensions and the state of the nation.

Exploring Language Input Dynamics: Joint Attention and Non-Joint Attention Episodes During Naturalistic Puzzle Play

Annalia Castrejon
Sponsor: Lisa Oakes, Ph.D.
Psychology

Naturalistic play provides contexts for infants to reason and learn about the world. Infants' joint attention with parents is associated with longer visual attention (Deák et al., 2014). Moreover, when parents touch and talk about objects during joint attention, infants engage in even more sustained attention (Suarez-Rivera et al., 2019). However, it is unknown whether parents talk more during joint attention episodes than at other times. Particularly, we hypothesize that parents provide more language input during joint attention than when only the infant is looking at an object. To test this hypothesis, we will analyze a dataset including 53 parents and their 9-to-11-month-old infants playing with an age-appropriate puzzle while their eye-gaze was recorded with head-mounted eye-trackers. Parents were instructed to play as they would at home. We transcribed the parents' speech and coded where each play partner was looking. Joint attention episodes were identified as periods when both parent and infant were focused on any part of the puzzle. We identified episodes when only the infant was looking at the puzzle or when neither parent nor infant were looking at the puzzle. We anticipate that, on average, parents will say more words during joint attention episodes than other episodes.

Article 26 Backpack: Bridging the Digital Divide in Higher Education for Refugee and Displaced Students

Lauren Cegelski
Sponsor: Keith Watenpaugh, Ph.D.
Religious Studies

Article 26 Backpack aims to make the promise of the 26th article of the Universal Declaration of Human Rights achievable: quality higher education, accessible to everyone. Backpack, which currently supports over 4500 displaced students, was developed to meet the needs of displaced Syrian students pursuing higher education in neighboring countries, not only provides crucial document storage to students who may have limited safe places to store personal information, but also a wealth of scholarship and employment opportunities, free academic credentialing, and test vouchers. As a result of our experience working directly with refugee communities and alongside college counselors with lived experience of displacement, Article 26 Backpack has had the opportunity to gain deeper knowledge of the tangible obstacles to pursuing higher education. Our presentation will address Backpack's key findings over its seven years of work, examining programming models and survey results from Rwanda to Afghanistan to identify key points of difficulty that hamstring refugee students on their pursuit of higher education, among them the severe financial strain of application prerequisites and limited digital literacy and wifi access.

PsychedelCLicKs – Development of Clickable Compounds for Deducing Psychedelic's Mechanisms of Action

Amy Chabroux
Sponsor: David Olson, Ph.D.
MED: Biochem & Molecular Med

Recently there has been an increase in studies focusing on psychedelics due to their potential use as treatments for mental health disorders. However, their underlying biological mechanism is not fully understood. Psychedelics target numerous receptors and signaling pathways, making it difficult to elucidate what causes their effects, both hallucinogenic and psychoplastogenic. To address this, we synthesized clickable psychedelics (psychedelCLicKs). These compounds contain an alkyne handle, which combined with the powers of click chemistry will allow us to identify and isolate protein targets and visualize binding in cells utilizing fluorescent probes. Our initial library of compounds was based on LSD, 5-MeO-DMT, and serotonin. To evaluate how structural modifications affect binding, an alkyne was introduced to one of three distinct positions per scaffold, resulting in a total of 9 analogs. Then, using a 5-HT_{2A}-based biosensor we confirmed that our psychedelCLicKs bind and activate the serotonin 2A receptor with similar potency and efficacy as their parent compounds. In future studies we will use these probes to identify and visualize protein targets of psychedelics.

Investigation of Student-Faculty Micro-Interactions on Students' Sense of Belonging Through Organized Student-Faculty Lunches

Tiffany Chan
Sponsor: Xianglong Wang, Ph.D.
Biomedical Engineering

We introduced organized student-faculty lunches to twenty-three (23) non-graduating BME undergraduate students during 2023 to address the scarcity of research in best practices about informal student-faculty interactions on students' sense of belonging. Participants, matched with faculty with shared interests, were tracked over three anonymous surveys, a pre-survey, a post-survey, and a one-month post-survey, through 8 identical Likert-scale questions assessing sense of belonging in BME at UC Davis. Additional questions including goals for attending the lunches and feedback regarding the lunches were sought in the surveys. We received 20 and 14 valid responses (87.0% and 60.9% response rate) for the immediate and one-month post-surveys, revealing significant improvement in multiple items including participation and satisfaction of events, sense of belonging, clarity of career goals, and knowledge of DEI. In general, the improvements in the one-month post-survey and the immediate post-survey were similar with minimal regressions. Our highly translatable and cost-effective approach suggests a positive and lasting correlation between students' sense of belonging and informal student-faculty micro-interactions through the organized lunches.

Computational Modeling to Investigate Cardiovascular Responses During Spacecraft Aerodynamic Re-Entry

Shreya Chandra
Sponsor: Rich Whittle, Ph.D.
Mechanical & Aerospace Engr

Re-entry from Low-Earth Orbit presents a unique set of hypergravity conditions that act as stressors on the cardiovascular system. There is a risk that this orthostatic challenge may cause issues in injured/ill crewmembers. This research aims to simulate cardiovascular responses during the re-entry of the UC Davis Space Ambulance concept, based on a X-37B to incorporate a pressurized crew volume, selected for its flight heritage and entry, descent, and landing capabilities. Using an optimized re-entry trajectory based on lifted-body aerodynamics, the resultant force is derived on supine subjects over re-entry. Subsequently, the gravitational profile is applied to a model of the cardiovascular system in simulated subjects to determine the effect of re-entry on cardiovascular function. Results will inform the ergonomics and performance of the vehicle that could be used to extract injured/ill crewmembers. These results act as a baseline against which to compare the response in injured/ill crewmembers in order to determine critical medical constraints. Currently, no spacecraft cater to medical evacuation from the International Space Station or elsewhere. With the broadening demographic and risk profile of commercial spaceflight, there will be a requirement to evacuate patients from space in a more deliberate fashion than existing capabilities.

Modeling Transposable Element Evolution during Maize Domestication

Vibha Chandrasekar
Sponsor: Jeffrey Ross Ibarra, Ph.D.
Ag Evolution & Ecology

Zea mays subsp. mays, commonly known as maize or corn, was domesticated from the wild grass teosinte 9000 years ago. Over 80% of the maize genome is composed of transposable elements (TEs), which are genetic elements that move within a genome. During domestication, maize experienced significant population bottlenecks that shifted TE dynamics. Using the population genetics software SLiM, I simulated TE dynamics in maize to study their evolution during domestication and determine the effects of population bottlenecks on genetic differences between maize and teosinte. My simulation models TE dynamics in an ancestral population of teosinte through a population bottleneck and subsequent expansion. When designing my simulation, I considered differences in TE activity, biology, and transposition mechanisms. I also incorporated empirical estimates of TE mutation rates, disabling, and effects on fitness. I modeled epigenetic silencing to include realistic genomic responses to increased TE activity. My simulation reached equilibrium where TE diversity stabilized, with most TEs being deleterious. I am currently modifying parameters to best represent realistic TE dynamics. These results can be used to identify the most important characteristics of TE biology in plant genomes. My simulation can also provide insight into the evolutionary history of maize, an agriculturally important crop.

Shared Tomorrows: Designing a Digital Interactive Project to Foster Conversations Between First- and Second-Generation Taiwanese Americans

Ashley Chang
Sponsor: William Mead, M.S.
Department Of Design

Many first- and second-generation Asian American families experience difficulty connecting due to children adapting to the new culture faster than their immigrant parents. However, parents who still hold on to their traditional values and behaviors expect their children to do the same. The division creates intergenerational cultural conflict, leading to diminished mental health in children according to previous research. Taiwanese Americans are not exempt from this occurrence. My project explores how I might prototype a digital interactive project available on the web to enhance the experiences associated with intergenerational communication between Taiwanese American parents and children. I will interview Taiwanese Americans, collecting descriptions of firsthand experiences to inform my design. Designing for a web platform will ensure ubiquity and easier accessibility by all. The project will undergo three phases of design (low, middle, high fidelity), with two phases of user testing in between. The objective of this interactive prototype is to create an environment encouraging conversations among Taiwanese American individuals and their family, aiming to provide better comprehension of common intergenerational cultural conflict and mitigate tension within the community. I propose to demonstrate a prototype of the interactive project and show how individuals might navigate it.

Using Genetic Screenings to Identify Novel Genes Associated with NAD^+ Metabolism and its Regulation in the Model System *Saccharomyces cerevisiae*

Winnie Chang
Sponsor: Su-ju Lin, Ph.D.
Microbiology & Molec Genetics

Nicotinamide adenine dinucleotide (NAD^+) is an essential metabolic cofactor involved in redox reactions and cellular signaling. NAD^+ is synthesized from tryptophan leading to quinolinic acid production (QA) via the *de novo* pathway or by salvaging precursors such as nicotinic acid/nicotinamide (NA/NAM) and nicotinamide riboside (NR) via their respective pathways. Abnormal NAD^+ levels are associated with age-related human disorders, but NAD^+ regulation is not completely understood due to its complexity. Using *Saccharomyces cerevisiae* and NAD^+ intermediate specific cell-based assay, we identified ~350 genes that may impact NAD^+ intermediate homeostasis. We validated ~100 clones, including known NAD^+ metabolic and novel genes such as transcription factors, signaling pathway components, and autophagy trafficking components. We will be focusing on several targets that show strong phenotypes including QDR2, AFT1, NPY1, and FPY1. These studies will help elucidate the interconnections within NAD^+ metabolism and its regulation as well as aid in developing therapeutic strategies for metabolic disorders related to abnormal NAD^+ levels.

Low-Cost Microfluidic Device for Single-Cell Isolation and Cloning

Julian Chang
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

The Microfluidics Research Team in the BioInnovation Group is developing a low-cost microfluidic chip, known as a single-cell capture (SCC) device, to study heterogeneous cellular populations. We expect this device and methodology to enable the capture, cloning, and analysis of single cells from heterogeneous populations without the use of cell surface markers. Monoclonal cell lines cultured *on-chip* can then be extracted and studied in applications such as tissue regeneration. We based our initial device design on examples from literature that used photolithography to create masks for PDMS casting. However, the cost of photolithography limits access to these tools. We propose that common and affordable 3D printing technologies can be used as an alternative to photolithography to create SCC devices that will perform nearly as effectively. Our current device achieves a SCC rate of 35%, comparable to devices created using photolithography (60% capture rate) at 1% of the upfront cost. Our current focus is optimizing cell culturing and proliferation of various mammalian cell types to perform functional assays *on-chip*. Here we report the development of surface treatment techniques to promote growth and the design and testing of a 3D printed container for environmental control.

End Effector and Computer Vision System for an Automated Mushroom Harvester

Irvin Chao
Sponsor: Ali Moghimi, Ph.D.
Biological & Ag Engineering

With consumer diets becoming more healthy, the demand for mushrooms has increased due to the excellent health benefits mushrooms provide. Despite mushrooms being a multi billion dollar industry, mushroom farmers struggle to find workers amidst the declining agriculture workforce. To combat this, robotics are being implemented across all areas of agriculture, including harvesting, but automated harvesting of mushrooms is under-explored, with current solutions often resulting in a lower quality product. Our research investigated the integration of mushroom-specific end effector and fine-tuned a computer vision model to the FarmBot, an open-source CNC (Computer Numerical Control) farming robot. After evaluating different end effectors for FarmBot integration, a pneumatic suction cup proved optimal. A vacuum system was found to minimize mushroom bruising during picking. The fine-tuning of our computer vision model involves a two-stage process which significantly improves processing time and accuracy: first, applying image segmentation technique using deep learning model, YOLOv8, to locate mushrooms in real time, followed by classification using MobileNet to determine mushroom ripeness. In conclusion, our research evaluated a cost effective robotic mushroom harvesting system that can ease the labor shortage while maintaining a similar quality of product to manual harvesting.

Beyond the Swipes! Social Media Usage and Student Mental Wellbeings

Pei-Yu Chao
Sponsor: Azra Jahanitabesh, Ph.D.
Psychology

In the contemporary landscape, social media has become an integral part of individuals' lives, significantly influencing daily routines. This research project investigates the multifaceted relationship between social media usage patterns and their impact on mental well-being, with a focus on self-esteem, identity, comparison, and depressive symptoms. The study examines variables such as the time spent on social media, types of activities engaged in (e.g., passive scrolling, active posting), and social identity among college students.

Approximately 100 UC Davis undergraduates participated in a 15-minute survey, providing insights into perceived and actual social media usage, self-esteem levels, and depressive symptoms. The research employs linear regressions and mediation analyses to unravel the intricate interplay between social media habits, self-esteem, and depression symptoms. The main hypothesis posits that increased passive social media use will exhibit positive correlations with depressive symptoms and lower self-esteem.

By delving into these variables, the study aims to contribute valuable insights into the nuanced dynamics between social media engagement, social identity, and mental well-being among college students. The findings may inform strategies for promoting healthier social media habits and ultimately enhance the overall mental health of this demographic.

Dietary Factors and Prevalence of Cardiovascular Disease in the Punjabi Sikh Community

Kiran Chauhan
Sponsor: Debbie Fetter, Ph.D.
Nutrition

Cardiovascular disease (CVD) is the leading cause of death worldwide. Factors that increase risk of CVD include diabetes, hypertension, and hypercholesterolemia. Cardiovascular disease is especially prominent within the Punjabi Sikh population. However, there is a dearth in the literature with regards to evaluating health-related factors in this specific population. To investigate the association between dietary factors and CVD risk, a questionnaire was administered at one Sikh Gurdwara Sahib in Sacramento. The survey included demographics, medical history, and self-reported dietary intake. Of the 163 respondents, 101 (62%) reported having at least one CVD risk factor. Cardiovascular disease risk was associated with low fruit intake and high intake of vegetables, starch, grains, whole grains, milk, beans, sugar beverages, and sodium. Individuals with a risk factor also had lower diet quality scores (P<0.05). A penalized logistic regression model was used to further analyze associations between CVD risk and predictor variables. It was found that weight, less than 12th grade education level, and sugar-sweetened beverages raise the odds of CVD risk. Knowledge of specific CVD risk factors in the Punjabi Sikh population is essential to improving health education and preventative care initiatives.

Detection of Calcium Deficiency in the Growing Stage of Lettuce using Computer Vision

Alise Chavanapanit
Sponsor: Md shamim Ahamed, Ph.D.
Biological & Ag Engineering

Calcium deficiency, presenting challenges like trip-burn, poses a significant threat to indoor hydroponic lettuce production. This study addresses an object detection problem, specifically investigating advanced image segmentation and classification techniques to detect calcium deficiency in lettuce at various growth stages. Timely identification of calcium deficiency is crucial for intervention and mitigation, as it profoundly impacts lettuce quality and yield. Our two-stage approach involves employing cutting-edge image segmentation methods (U-Net, MU-Net, Recurrent U-Net, and Mask R-CNN) to isolate lettuce leaves and utilizing deep learning models (ResNet, EfficientNet, Inception, and a novel architecture) for precise calcium deficiency detection. Comprehensive datasets, collected under three different calcium supply conditions, were used for training and validation. Experimental results highlight the strengths and limitations of each technique, with the proposed method demonstrating superior performance and accuracy compared to current CNN models. This study addresses calcium deficiency challenges in hydroponic lettuce production, offering valuable insights into effective strategies for early detection.

Inhibition of *Fusarium oxysporum* Growth in the World's Crop Production

Diego Chavez
Sponsor: Christopher Simmons, Ph.D.
Food Science & Technology

A prevalent plant pathogen today threatening many crops, including bananas, tomatoes, and strawberries, is the fungus *Fusarium oxysporum*. One possible inhibitor of *F. oxysporum* growth is the antifungal lipopeptide, xantholysin, produced by the bacterium *Pseudomonas mosselii*. This study aims to understand the relationship between xantholysin and the growth of *Fusarium oxysporum* formae speciales infecting economically important plants. To test this, various techniques were employed, including inoculation of sterile media, DNA and plasmid purification, and polymerase chain reaction (PCR), to create mutant strains of *P. mosselii* with the inability to produce xantholysin. These mutant bacteria will be used in growth inhibition assays testing *F. oxysporum* growth in the presence of xantholysin-producing and xantholysin-deficient *P. mosselii*. The required plasmids, pGNW6 and pSEVA, have been purified yielding concentrations of 7.80 x 10^3 ng/mL and 8.80 x 10^4 ng/mL, respectively. Three rounds of *P. mosselli* genomic DNA extraction yielded concentrations of 8.86 x 10^4 ng/mL, 8.42 x 10^4 ng/mL, and 8.18 x 10^4 ng/mL. PCR amplification of plasmid pGNW6 yielded a concentration of 1.72 x 10^3 ng/mL. Next steps include mutant strain creation via genome engineering and conducting growth inhibition assays.

Latina/Chicana Women's Reproductive Health Disparities as Rural Farmworkers in California

Jennifer Chavez Valencia
Sponsor: Natalia Deeb Sossa, Ph.D.
Chicano Studies

Through testimonies of Mexican farmworkers in rural communities in Northern California, I will explore how they were taught and talked about sexual and reproductive health, their views on consent, and how this has shaped their sexual lives and that of their children. I have conducted a preliminary literature review focusing on this selected population to explore what Chicana feminist literature has to say about this resilient population that have historically been underserved and underrepresented in the medical health care system in the US. After conducting six testimonies with Mexican farmworkers in Northern California in which they share their sexual and reproductive health lives and experience, my goals are to share their sexual agency in spite of limited reproductive information and the decision to break the cycle as mothers by making sure their children were informed and "did not make the same mistakes." With the data collected from the testimonies, I will also piece together the implications and potential future interventions for health care providers serving this population.

Lactobacillus crispatus Colonization in the Vaginal Microbiome of Mice

Komal Cheema
Sponsor: Renée Tsolis, Ph.D.
MED: Medical Microbiology & Imm

The human vaginal microbiota is composed of unique microorganisms; it is characterized by *Lactobacillus sp.* dominance. *Lactobacillus crispatus* is a H2O2 and lactic acid-producing bacteria commonly attributed to a protective role in the vagina. In our study, we used female Swiss Webster mice to look at the colonization of *L. crispatus*. Mice have an estrous cycle which is homologous to the menstrual cycle in humans. We tried to simulate this via subcutaneous administration of 250 mg progesterone per mouse. This will synchronize all the mice to the diestrus phase which is homologous to the human lutenic phase. After synchronization, we inoculated 1x10^7 CFU of *L. crispatus* per mouse via intravaginal administration. Our goal was vaginal colonization of *L. crispatus* in our mouse model. We observed low levels of bacterial colonization with bacteria not staying in the vaginal tract for longer than 10 days. *L. crispatus* was able to produce H2O2 and lactic acid. This data shows us that *L. crispatus* can produce metabolics even when there are only low levels of colonization.

Proteomic Analysis within the Olfactory Region in COVID-19 Patients

Maggie Chen
Sponsor: Qizhi Gong, Ph.D.
MED: Cell Biology & Human Anat

COVID-19 has been associated with anosmia, or loss of smell, in those infected. While many regain their sense of smell once the infection clears, some individuals face permanent loss or incomplete recovery. The mechanism of COVID-19 associated olfactory loss is still elusive. We hypothesize that olfactory dysfunction is correlated with the olfactory mucosal environment. This study aims to identify and analyze the proteins present in the olfactory region of COVID-19 patients experiencing olfaction loss and compare to that of the non-infected individuals. Swabs were collected from the olfactory cleft region via endoscopy. We extracted proteins from the olfactory swabs, subjected heat inactivation to neutralize viral proteins and used protease inhibitors and RIPA buffer for preservation of protein integrity. Proteins were then quantified and digested with trypsin. The resulting peptides were analyzed by liquid chromatography-mass spectrometry (LC-MS). Our analysis involves comparisons of samples from patients 2 weeks post-infection (acute phase), 6 weeks post-infection (long-term phase), and non-infected individuals as controls. Preliminary results indicate distinct protein profiles found within the samples from COVID-19 patients compared to controls. While data analysis is still ongoing, our research has the potential to identify quantitative and qualitative protein changes associated with COVID-19-induced olfactory loss.

Antibiotic Resistance of Non-typhoidal *Salmonella* spp. in Retail Chicken in California, 2018-2020.

Katelyn Chen
Sponsor: Xunde Li, Ph.D.
VM: Population Hlth & Reprod

The objective of this study was to investigate the prevalence of phenotypic antimicrobial resistance (AMR) of *Salmonella* spp. across different cuts of retail chicken in California from 2018-2020. Antimicrobial susceptibility testing was conducted for the 123 *Salmonella* isolates collected. *Salmonella* across cuts of chicken meat – chicken wings (n=17), breasts (n=39), legs/thighs (n=13), and whole carcass (n=54) – had the highest prevalence of AMR to streptomycin and tetracycline. *Salmonella* from all cuts of chicken meat were susceptible to azithromycin, meropenem, and sulfisoxazole. The prevalence of multidrug-resistant (MDR) *Salmonella* across the different cuts of meat are as follows: 17.65% (chicken wings), 15.38% (chicken legs/thighs), 11.11% (whole chicken carcass), and 2.56% (chicken breasts). Of the MDR *Salmonella* (n=12), 3 serotypes were identified: *S*. Infantis (75.0%), *S*.Kentucky (16.67%), and *S*. Braenderup (8.33%). Overall, *Salmonella* with the highest prevalence of MDR were from chicken wings and legs/thighs, with the majority of MDR isolates serotyped as *S*. Infantis. The results of this study provide insight into the distribution of AMR in *Salmonella* across different cuts of retail chicken, contributing to perspectives in public health and food safety.

Split dCas9 AAV for the Treatment of Neurological Disorders

Yi-An (Ashley) Chen
Sponsor: Kyle Fink, Ph.D.
MED: Neurology

Adeno-Associated Virus (AAV) is a non-integrating virus that can be manipulated to deliver transgenes into cells. AAVs contain a compact, single-stranded DNA genome, and can package up to ~4.8 kilobases (kb). AAVs do not integrate into the genome, and the FDA has approved AAV therapies. The development of CRISPR-dCas9 allows for target modulation of gene expression, which can be used to treat many genetic disorders. However, the Cas protein is too large for AAV. To overcome this, dCas9 was split into 2 lobes and fused inteins. This allows for packaging into a dual AAV system, where the lobes can find each other and recombine to make full-length dCas9. dCas9 can be fused to effector domains for precise control over gene regulation, enabling the activation or inhibition of specific genes without altering their original sequences. Effector domains like KRAB deposit H3K9me3 for downregulation, while VPR can achieve upregulation for transcriptional activation or Tet1 for DNA demethylation. I cloned a novel plasmid to package into AAV and tested it on cells, showing positive transduction through fluorescence and western blot. The successful creation of this novel AAV brings us one step closer to creating treatments for genetic diseases.

Are Ureide Permease Genes Important to Wheat Growth Under Low-Nitrogen?

Steven Chen
Sponsor: Diane Beckles, Ph.D.
Plant Sciences

Wheat accounts for 40% of the global food supply but requires extensive inputs of nitrogen (N) fertilizer which is environmentally damaging. Improving the uptake and utilization of N in wheat would facilitate its sustainable production. Ureide permeases (UPS) are responsible for storing, transporting, and recycling nitrogen in N-rich legumes. Rice overexpressing UPS3 showed enhanced growth in low-N soil but the role of UPS has not been confirmed in wheat. Lines with varying levels of the three UPS gene isoforms in wheat were created to determine if UPS affects tetraploid wheat growth. CRISPR-Cas9 edits in the A- and B-genomes of UPS1, 2, and 3 genes, and, UPS transgenic overexpressing wheat lines, will be grown under normal and low nitrogen soil. Parameters that indicate time to maturity, yield, and productivity, will be compared between the engineered and control plants. I expect lines overexpressing either, UPS1, 2, or 3 to mature faster, have higher photosynthetic capacity and yield than the wild type and the UPS knockout mutants. However, differences may be seen among the UPS isoforms. This study can determine if UPS is critical to wheat growth under low nitrogen and be used to make wheat production more ecologically favorable.

Phenotypic Characterization of Monkey Flower (*Mimulus guttatus*) Root Architecture to Discover New Drought Resistance Mechanisms

Qiudi Cheng
Sponsor: Florian bernard arthur Deligne, Ph.D.
UC Davis Genome Center

Mimulus guttatus is a curious and remarkable plant that can grow in various environments, in the range from the desert areas of Mexico to the snowline of the Altiplano region. Such a diverse habitat environment makes *Mimulus guttatus* a good model for climate adaptive mechanisms. Drought in California is a great problem for seed companies. In 2022, California's rice yields dropped by 50% compared to 2019. To uncover novel mechanisms of drought resistance, we have chosen to study the root adaptation of *Mimulus guttatus*. To achieve that, we utilize seeds from 18 populations of *Mimulus guttatus* which were harvested before and after the California drought spanning from 2013 to 2016. We evaluated their drought response by assessing the root system architecture. Seedlings were cultivated in-vitro on adapted media, incorporating Polyethylene Glycol 8000 (PEG8000) to mimic drought conditions through dehydration. The phenotypic data obtained will be employed in a Genome-Wide Association Study to find new potential candidate genes associated with drought resistance. This study aims to contribute new insight into mechanisms that may have broader applicability to other species.

Microbial Methanogenesis and Methane Metabolism Dynamics Throughout Wet and Dry Seasons in an Amazonian Wetland

Grace Cheng
Sponsor: Jorge Mazza Rodrigues, Ph.D.
Land Air & Water Resources

The Amazon Rainforest contributes ~8% of the global methane (CH_4) budget due to its biological and microbial diversity. As global warming becomes an increasing threat to Earth, determining changes in microbial activity across seasons have become essential for modeling the consequences of increased CH_4 emissions. This study aims to determine how wet and dry seasons affect CH_4 production, the microbial groups responsible for CH_4 cycling (methanogens and methanotrophs), and available metabolites. In 2019, 44 sediment samples were collected in the wet and dry seasons across four sampling sites along the Amazon and Tapajos rivers intersection in the Arapixuna region, State of Pará, Brazil. Microbial communities were characterized through 16S RNA sequencing analysis and metabolomics, and further categorized into generalists, methanogenic and methanotrophic specialists, and rare. We then compared the shared and distinct metabolic composition of the wet and dry samples. Finally, CH_4 flux measurements were correlated with methane-related taxa to determine the most prolific contributors to methane production and consumption across the samples. Ultimately, the anoxic environment during the wet season provided optimal conditions for methanogens, increasing methane production and contributing to global warming. These findings hold significance in developments mitigating climate change and forming sustainable environmental policies.

Prevalence of Viral Hepatitis B and Type II Diabetes Comorbidity: A Retrospective Study of At-Risk Populations within a Free Asian Clinic

Lawrence Cheung
Sponsor: Mary Pauly, M.D.
MED: Int Med - Gastroenterology

Most patients seen at Paul Hom Asian Clinic are born in regions with high prevalence of hepatocellular carcinoma (HCC) and its primary risk factor, hepatitis B (HBV). 36.6% of our patients are anti-HBc seropositive ("core-positive"); such individuals are twice as likely to develop HCC, especially in the absence of serological immunity (anti-HBs). Additionally, type II diabetes mellitus (DM-2) presents significant risk for developing metabolic-dysfunction associated steatotic liver disease (MASLD), which is associated with a three-fold increase in HCC and cirrhosis in core-positive patients. We aim to study the prevalence of DM-2 and pre-diabetes (pre-DM) within groups categorized by hepatitis status and examine the significance of HBV and DM-2 comorbidity through laboratory results. We are retrospectively examining the medical records of approximately 150 adult patients screened for hepatitis at our clinic over the past 10 years. Incidence of DM-2 and pre-DM, laboratory results collected at the time of screening, and subsequent diagnosis of known liver disease comorbidities will be analyzed between groups. We propose that the results of this study can help inform screening for liver disease, including MASLD and fibrosis, and add to existing guidance for the monitoring and treatment of DM-2 in patients with a history of HBV.

Examining the Effect of *MOS4-associated complex 3B* Nuclear Condensate Formation on Plant Circadian Rhythms

Jade Chi
Sponsor: Stacey Harmer, Ph.D.
Ag Plant Biology

The circadian clock is a complex mechanism that regulates an organism's response to environmental cues, promoting adaptability and energy conservation. In plants, biological timing relies on many genes including *MOS4-associated complex 3B*(*MAC3B*)—one of the two homologs of human-derived *PRP19*—an evolutionarily conserved U-box E3 ubiquitin ligase. *MAC3B* is also involved in various other pathways including nuclear condensation, plant immunity, pre-RNA splicing, and DNA damage response. However, the links between these pathways remain unclear. Recent research showed a gain-of-function mutant *MAC3B*(Q77A/D81A) formed nuclear condensates in response to pathogen infection, activating defense gene expression in an immune activation response. In contrast, another mutant *MAC3B*(H31A/D34A) showed no gain-of-function phenotype. These results suggest that formation of nuclear condensates by *MAC3B* ligase affects immunity responses in Arabidopsis. Therefore, by comparing the circadian rhythms in Arabidopsis plants expressing wild-type *MAC3B*, *MAC3B* (Q77A/D81A), and *MAC3B* (H31A/D34A), we aim to determine whether nuclear condensation of *MAC3B* affects circadian rhythm. Understanding the significance of nuclear condensation in regulating circadian clock function will provide insight into the complex pathways that link plant immunity and rhythmicity.

Water Quality, Sanitation, and Waterborne Illnesses in Underserved Rural India

Shivani Chidambaram
Sponsor: Marit Macarthur, Ph.D.
University Writing Program

India continues to struggle with addressing long-standing water pollution, which has fueled over 37.7 million cases of waterborne illnesses and 1.5 million child deaths. Rural communities especially bear the brunt of this crisis due to limited resources. Tackling this multifaceted issue extends beyond mere technical solutions and requires mindfulness of the culture in rural India. This problem, beyond its scientific dimensions, is fundamentally ethical and requires sustainable solutions such as plant xylem-based and biosand water filters. These solutions take into account the circumstances of the vulnerable populations and aim to use materials that can be locally sourced and are inexpensive. By understanding the intricate link between water quality, sanitation, hygiene practices, and waterborne diseases like dysentery in underserved regions, we can develop cost-effective, sustainable interventions to enhance human health in these areas, addressing the immediate crisis and creating a positive impact on the long-term well-being of rural India.

Exposure to Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) and the Progression of Breast Cancer

Sara Chin
Sponsor: Michele La Merrill, Ph.D.
Environmental Toxicology

Per- and polyfluoroalkyl substances (PFAS) are common chemicals that are used as hydrophobic surfactants in common household products such as food packaging, heat resistant cookware, and furniture. Due to how common these chemicals are, they are found in significant quantities that buildup in the environment and can accumulate in humans. The Centers for Disease Control and Prevention (CDC), found that 97% of Americans have traces of PFAS in the blood. The biggest problem is that PFAS are linked to carcinogenicity and endocrine pathway disruptions. This study aims to compare different select PFAS chemicals, with varying carbon chain lengths, and their ability to affect cell proliferation of breast cancer cells *in vitro*. Epithelial breast cancer cell line Hs578T cells were introduced to various PFAS chemicals for 24-48h exposure times. With the CyQuant cell proliferation assay, we fluoresced nucleic acids and counted levels of viable cells. Results demonstrated a positive dose response of cell proliferation and viability. Data is currently being collected. Our results will help us understand how different chain lengths of PFAS will affect breast cancer progression and proliferation.

Segregated Anatomical Connectivity Could Contribute to Diversity in the Role of the Cerebellum in Fear Extinction

Carolyn Chiu
Sponsor: Diasynou Fioravante, Ph.D.
Neuro Physio & Behavior

The cerebellum is understood to modulate motor function and cognitive and affective processing, including learned fear. Connections between the cerebellar output nuclei (DCN) and limbic structures including the periaqueductal gray (PAG) and parafascicular thalamic nucleus (PF) regulate extinction of learned fear, but in opposite ways: inhibition of the DCN-PAG pathway impairs extinction whereas inhibition of the DCN-PF pathway facilitates extinction. Moreover, inhibiting DCN connections to the centromedial (CM) thalamus, which belongs to the same group of intralaminar nuclei as PF, does not affect extinction. This functional divergence lacks understanding; we hypothesize that anatomical segregation of pathways within DCN could contribute to this divergence. Retrogradely-traveling viruses expressing different-color fluorophores were stereotactically injected into PAG, PF and/or CM of mice and allowed time to express. Mice were then perfused intracardially, and brains were extracted, sliced, and imaged. Following registration of brain slices to the Paxinos brain atlas and confirmation of injection sites, the location and number of retrogradely-labeled fluorescent neurons in DCN will be quantified using ImageJ. Anticipated results will be discussed in the context of anatomical divergence of these pathways in the DCN and could offer insights into the complexity of the cerebellum's role in fear processing.

Synaptic Convergence Onto Space-Specific Neurons in the Auditory System

Liebe Cho
Sponsor: William Debello, Ph.D.
Neuro Physio & Behavior

Neurons perform computations on their inputs, but how those computations are shaped by the dendritic addressing of 100s – 1000s of synaptic inputs remains poorly understood. My project approaches this question through reconstruction of space-specific neurons (SSNs) found in the inferior colliculus of barn owls. Integrative studies of auditory processing and adaptive plasticity in this model system may reveal common principles that operate across circuits and species. In collaboration with the National Center for Molecular Imaging Research, our lab produced a 3D image dataset using volume electron microscopy. To visualize the networks and morphologies of SSNs and toric spines – dendritic protrusions hypothesized to act as synaptic integrators – I am using an AI-assisted pipeline. I reconstructed a variety of dendritic objects and mapped their complete patterns of synaptic convergence ("motifs"). To investigate how these motifs shape neuronal computations, I am working with a graduate student to import reconstructions into NEURON for compartmental simulation. In summary, by merging high-resolution morphological data with previously published electrophysiological data, my work will provide a foundation to investigate principles of neural computation at the cellular level.

Water, Land, and Power: The Legacy of Asian American Exclusion in the California Water Rights System

Audrey Cho
Sponsor: Tracy Winsor, J.D.
Environmental Science & Policy

The California water landscape is dauntingly complex, comprising systems of water rights, methods of distribution and management, and challenges concerning availability, quality, and conveyance. Within this landscape exists a fraught history set up to exclude Asian American immigrants, among many other marginalized peoples, from property ownership and water rights by extension. This work utilizes ethnographic research methods to trace anti-Asian sentiment as it relates to land ownership, agriculture, and access to water resources. Specifically, it investigates the longstanding impact of the Alien Land Law of 1913, and the forced removal and incarceration of Japanese Americans under Executive Order 9066. Interviews with multigenerational Japanese American farmers revealed the impact of this legal exclusion on their ability to purchase high-quality agricultural land. Regardless of the type and source of their water rights, farmers generally experienced more challenges bringing land into productivity in comparison to their white counterparts, and interviewees cited water reliability and quality difficulties. This work also utilizes interviews with public officials, relevant nonprofit organizations, and community members to support policy recommendations. Specifically, legislative, administrative, and community-based interventions could help advance equity within California's water governance system.

Assessing the Extent of Myasthenia Gravis (MG) Based on the Difference in the Anti-Mouse versus Anti-Rat MuSK Titer of Lewis Rats

Julia Choi
Sponsor: Vu Trinh, Ph.D.
MED: Neurology

Myasthenia gravis (MG) is an orphan autoimmune disease that results in generalized muscle weakness. In muscle-specific kinase (MuSK) MG, autoantibodies against MuSK disrupt the differentiation and development of the neuromuscular junction. In the majority of MuSK-MG patients, early symptoms are ptosis and diplopia, leading up to bulbar impairment, generalized fatigue, and respiratory crises. Furthermore, in some unusual cases, MuSK-MG can cause muscle atrophy in facial muscles and the tongue. Our lab has developed an animal model for MuSK-MG by immunizing Lewis rats with mouse MuSK protein. Since the mouse and rat MuSK proteins are 96% homologous, antibodies against the mouse MuSK protein cross-react with the endogenous rat MuSK protein as well, causing MG-like symptoms in the Lewis rats. By measuring the anti-MuSK titer existing in the rats' sera, we can estimate how sick the rats are. The aim of this experiment is to figure out the proportion of anti-mouse MuSK antibodies that cross-reacts with endogenous rat MuSK and cause the rats to present MG-like symptoms. By doing so, we hope to find out if there is a marked difference in the anti-mouse vs. anti-rat MuSK titer and whether we can assess the extent of disease based on the anti-MuSK titer.

Preliminary Review of the Hemphillian Herbivore Guild of Turlock Lake, Mehrten Formation, Central California

Aidan Clay
Sponsor: Sandra Carlson, Ph.D.
Earth And Planetary Sciences

The Mehrten Formation crops out around Turlock Lake in Central California, with deposits spanning from 8 to 5 million years ago. These sites contain material representing 46 vertebrates and 25 plants, but there has been limited study of the herbivore guild at the site. Here, we review the relevant literature as well as Mehrten Formation specimens at the Natural History Museum of Los Angeles County, calculating summary statistics of number of identifiable specimens (NISP), minimum number of elements (MNE), and minimum number of individuals (MNI) of herbivore species. Across large-bodied mammals of the herbivore guild, we counted 824 identifiable specimens, at least 1,214 elements, and at least 75 individuals. The best represented species in the Mehrten Formation is the equid *Dinohippus interpolatus*, represented by at least 24 individuals from Late Hemphillian (5 Ma) deposits based on right upper first and second molars. A minimum of 37 equid individuals represent about half of large herbivore MNI. Based on the local flora and the presence of an extinct tortoise, Late Hemphillian Central California had a wet, mild, and low-frost climate relative to modern-day. The presence of numerous equids supports prior inference of a Late Hemphillian paleoenvironment consisting of a grassy oak woodland-savanna.

Field Trial Assessment of Soil Biosolarization Using Cover Crop Amendments for Managing Soil Pests

Natalie Chueh
Sponsor: Christopher Simmons, Ph.D.
Food Science & Technology

Agricultural practices have shifted away from chemical fumigants due to environmental and health concerns. Biosolarization is a fumigant alternative that uses solar heat and soil amendments to decrease pest populations while enriching the soil. The technique consists of spreading an organic soil amendment onto soil, watering, and covering with a plastic tarp. The combination of high temperatures, anaerobic environment, and production of biopesticidal acids is predicted to lower common pest populations like *Fusarium oxysporum.* In this project, the cover crops *B. juncea* and the legume *Vicia villosa* were used as soil amendments in a eight-day biosolarization field trial. *B. juncea* was selected for its endogenous production of biopesticides, while *Vicia villosa* may contribute to additional ecosystem services, such as nitrogen fixation and moisture conservation. Soil samples collected throughout the trial were tested for pH, electrical conductivity, and volatile fatty acid concentrations. Initial results show the cover crop amendment lowered soil pH, suggesting production of biopesticidal acids. Next, the soil samples will be used for fungal colony extractions and plated onto a selective medium to test for inactivation of *Fusarium oxysporum*. These results will indicate whether crop amendments can be used in biosolarization to reduce soil pest populations without chemical fumigants.

Quantification of Neuronal Activation in the Olfactory Region of K18-hACE2 Mice Infected with SARS-CoV-2

Maxwell Collins
Sponsor: Qizhi Gong, Ph.D.
MED: Cell Biology & Human Anat

Anosmia, characterized by total or partial loss of olfaction, is a common clinical manifestation in COVID-19 diagnoses. We hypothesize that loss of olfaction after SARS-CoV-2 (CoV2) infection is caused by decreased function of Olfactory Sensory Neurons (OSNs) within the Olfactory Epithelium (OE). Humanized mouse model, K18-hACE2, is used to test OSN function post-infection. CoV2 is a BioSafety Level 3 (BSL3) reagent, which prevents common physiological approaches to measure neuronal activities. We designed a histological approach to monitor neuronal activation by quantification of ribosome protein S6 phosphorylation (pS6) levels in OSNs. We exposed mice to Acetophenone or a ddH2O control for 1 hour. The mice were then perfused with 4% Paraformaldehyde (PFA). We determined that 24-hour fixation in 10% Formalin post-perfusion yielded the most consistent results. OSN activation was visualized via fluorescent immunohistochemistry. Several primary antibody titers and signal amplification conditions were tested to determine an optimal staining procedure. Sections were viewed using confocal microscopy which showed more robust OSN activity in the OE and Olfactory Bulb (OB) in mice exposed to Acetophenone when compared to the ddH2O control. We plan to use this protocol and inoculate K18-hACE2 mice with CoV2 to determine whether infection inhibits OSN activation, contributing to anosmia.

Pairing Transcriptomics With Neuroanatomy to Investigate the Cellular Role of CHD8 in the Adult Mouse Brain

Melissa Corea
Sponsor: Alexander Nord, Ph.D.
Neuro Physio & Behavior

De novo mutations in the chromatin-remodeling factor CHD8 (Chromodomain-Helicase DNA-binding protein 8) are strongly associated with autism spectrum disorder (ASD) and other neurodevelopmental disorders, resulting in intellectual disability and macrocephaly. Recent single-nuclei RNA-sequencing experiments in the cortex cerebellum of Chd8 haploinsufficient mice have revealed cell-specific dysregulation of transcription across all cell types. Here, I mapped Chd8 and candidate target protein expression in the postnatal, mature brain to validate the previously identified transcriptional dysregulation. I visualized protein expression patterns and subcellular localization via immunohistochemistry followed by high resolution epifluorescence and confocal microscopy. These studies were performed in *Chd8*$^{+/del5bp}$ mice and wild type littermates at postnatal day 12 (PND12) and PND60. Brain tissue from the cortex, hippocampus, amygdala, and cerebellum were analyzed. Preliminary results validate a mostly nuclear Chd8 subcellular localization pattern at PND12 where expression decreases as the brain matures (i.e. PND60). These findings contribute to a better understanding of the role of Chd8 in the mature mouse brain and how specific cell types are impacted by Chd8 haploinsufficiency.

Ancestral Impact on Family History of Breast Cancer and High Penetrance Mutations

Amanda Corpuz
Sponsor: Laura Fejerman, Ph.D.
MED: Public Health Sciences

Family history of breast cancer (FHBC) and carrying a high penetrance mutation are strong predictors of breast cancer risk. Breast cancer associated genes have been characterized and pathogenic variants identified, mostly in patients of European ancestry. The distribution of high penetrance mutations in other ancestry components has not been well described. The Peruvian Genetics and Genomics of Breast Cancer Study (PEGEN-BC) is a case cohort of ~2,000 breast cancer patients from Lima, Peru. Demographic, and clinical information was collected from all participants and genome-wide genotyped data was used for genetic ancestry estimation. We tested the association between FHBC and genetic ancestry using a logistic regression model. The proportion of Indigenous American (IA) and European ancestry for those in the study with FHBC was 69% and 22% respectively, while it was 76% and 17% for those without FHBC. The odds of having a FHBC decreased as the proportion of IA ancestry increased (OR= 0.80 per 10% increase, 95%CI 0.73-0.87, p<0.0001). Inversely, as European ancestry increased, the odds of FHBC increased (OR= 1.29, 95%CI 1.14-1.45, p<0.0001). Pathogenic variants in known genes might be more common in the European compared to the IA genetic background. Further work is underway to test this hypothesis.

Characterizing PARP Inhibitor and Next-Generation Anti-Androgen Responses in Advanced Prostate Cancer

Bryan Correa Gonzalez
Sponsor: Alan Lombard, Ph.D.
MED: Biochem & Molecular Med

Treating metastatic castration-resistant prostate cancer (mCRPC) with poly (ADP-ribose) polymerase inhibitors (PARPi) has been effective in men harboring mutations in DNA repair genes. Success has been seen when combining PARPi's with next-generation anti-androgen therapies (NGAT), another mCRPC treatment. PARP inhibition leads to both cell death and senescence. It is unknown if NGATs act as a senolytic, which induce death of senescent cells. We hypothesize that combining PARPi's with a senolytic enhances PARPi efficacy, driving tumor cells towards apoptosis. In this study, we sought to characterize to determine if the combination would promote synergism and a synthetic lethality effect. To test the hypothesis: cell growth assays and cell morphology were analyzed in cells lines C4-2B, MDVR, and Abi-R. As expected, drug combinations were more efficacious at limiting cell growth than either monotherapy. Although the combinations were found to reduce cell growth, cells appeared more cytostatic than apoptotic. Data suggests that combining PARPi's with NGAT's doesn't promote cell death but a persistent cytostasis which may allow tumor progression and resistance. Future studies are directed at further characterizing combinations with PARPi's and developing novel strategies to enhance their efficacy.

The Impact of Financial Anxiety and Difficulties on Parental Efficacy and Satisfaction in Single-Parent Families During the COVID-19 Pandemic

Ellie Covarrubias
Sponsor: Paul Hastings, Ph.D.
Psychology

Financial disparities disproportionately affect single-parent families in the US. Single-parent families are more likely to be classified into lower socio-economic households relative to double-parent families, and existing financial disparities between single-parent and double-parent households were exacerbated during the COVID-19 pandemic. The Family Stress Model suggests that financial difficulties are associated with greater levels of stress in parents that may negatively impact the family as a system. Parental satisfaction, reflecting how satisfied parents were with their role as parents during the pandemic, in addition to parental efficacy, defined as parents' reports of being equipped with the necessary skills to be a good parent and manage problems, predict family thriving during the pandemic (Partington et al., 2022). Pandemic-related financial disparities may have undermined parents' overall sense of wellbeing, with single parents being most likely to feel lower parental efficacy and satisfaction due to the lack of marital partner support which could buffer financial distress. However, the association between financial difficulties and anxiety and parental satisfaction and efficacy among different family structures remains unclear. This study aims to examine the relations between financial distress and parental efficacy and satisfaction during the pandemic in 38 single-parent and 38 two-parent families, matched for income.

The Role of the *phaR* Gene in Regulating Polyhydroxybutyrate Levels in *Ralstonia* Cells

Tabitha Cowell
Sponsor: Tiffany Lowe-Power, Ph.D.
Plant Pathology

The *Ralstonia solanacearum* species complex (RSSC) is a group of three xylem-colonizing plant pathogen species that survive in soil and water for long periods of time between infections. Many bacterial cells contain polyhydroxybutyrate (PHB) granules, which are protein cages that store the carbon-rich PHB polymer. The PhaR protein is a granule component that acts as a transcriptional regulator for many of the genes that encode granule-associated proteins. Towards testing the hypothesis that the cell's ability to store PHB influences its ability to survive in water, we compared the levels of PHB in the wild-type and Δ*phaR* mutant strains using Nile Red staining and fluorescence measurements. The results show that there is a decrease in PHB levels in the Δ*phaR* mutant compared to the wild-type during the exponential growth phase, but there is not a significant difference between them during the stationary phase. Therefore, the absence of PhaR impacts PHB levels, but does not appear to prevent storage of PHB. PHB granules are present in other microbes, so findings in this context may be useful for the study of other organisms, such as some species of *Bacillus*, which are commonly found in soil, and *Pseudomonas*, which includes a variety of pathogens.

Microcosm Methods for *Zostera m.* Microbiome Studies

Sarah Crystal
Sponsor: John Stachowicz, Ph.D.
Coastal & Marine Science Inst

The goal of this project was to determine which methods of lab cultivation of eelgrass, *Zostera marina*, were most effective and reflective of natural conditions for subsequent microbiome studies. Seeds were numbered and randomly assigned as sterile (seeds with only the interior microbiome intact) or unsterile (seeds with exterior and interior microbiome present) and then assigned either light or dark conditions to germinate. Once seeds germinated, they were randomly transferred into one of three environments: petri dishes, test tubes, and EcoFabs 2.0 (in collaboration with LBNL). For all three environments, seed growth stage, seed color, cotyledon color, number of leaves, disease, algae growth, and death were recorded over the course of the experiment. Results were analyzed with R to determine efficacy and will be used to inform our subsequent experiments looking at the seedling microbiome. We hope the results from this experiment increase germination success of eelgrass in the lab to propel research on this ecologically important and threatened species. Ultimately, the goal is to improve seagrass germination success in natural populations as they face increasing challenges with time.

Flow Visualization With Smoke Tunnel

Orion Csizmadia-Zinnes
Sponsor: Camli Badrya, Ph.D.
Mechanical & Aerospace Engr

The Davis Applied Aerodynamics Lab (DAAL) at UC Davis wants to create educational videos to provide students a visualization of flow characteristics over airfoils. To do this, a smoke tunnel is used to generate thin streamlines of smoke over various airfoils and objects to demonstrate the impact of airfoil geometry on the flow field. A Fujifilm XT2 camera records the airfoil's effect on the surrounding flow field. Demonstrations include flow over an airfoil at varying angles of attack, flow separation over an airfoil at high angles of attack, wingtip vortices, and turbulent flow from a blunt body. We plan to demonstrate the flow field of a rotating cylinder, active flow control, and other high lift configurations. Additionally, we plan to create a video series covering the development and demonstration of early airfoils such as Lilienthal glider airfoils, Wright Flyer airfoils, frequently studied NACA airfoils, and other airfoils from the 1910s to 1940s. Our final educational goal is to visually disprove the commonly-known equal transit time theory of lift.

Pinoy Tayo (We're Filipinos): Exploring the Pivotal Experiences of 1.5 Generation Filipino Immigrants and 2nd Generation Filipino Americans

Rheiana Mirazen Cuevas
Sponsor: William Mead, M.F.A.
Department Of Design

This project will showcase Filipino/Fil-Am cultural experiences through an interactive prototype. Users will explore scenes capturing the distinct upbringings of 1.5 Generation Filipino Immigrants and 2nd Generation Filipino Americans at UC Davis, fostering empathy and understanding. The project follows a human-centered design process, encompassing research through interviews, literature reviews, and participation in Fil-Am organizations in Davis. It involves ideation by synthesizing the research, defining the problem, proposing solutions, and culminating in the design of a Figma prototype, which is developed into an interactive platform. Preliminary research identifies a literature gap regarding immediate connections between the two generations, providing an opportunity for this project to bridge that void. The project hopes to provide a transformative journey, allowing 1.5 Generation Filipino Immigrants to empathize with the perspectives of 2nd Generation Filipino-Americans, and vice versa. Thus, it will hopefully promote a deeper connection and a shared appreciation for each other's narratives and experiences, enriching Filipino narratives.

Using Micro-CT Scans and Deep Learning AI to Generate Three-dimensional Models of *Aedes aegypti* Reproductive Organs for Research and Education

Yang Cui
Sponsor: Geoffrey Attardo, Ph.D.
Entomology/Nematology

Aedes aegypti mosquitoes are essential vectors of viruses that cause disease in humans and animals. This species of mosquitoes invaded California in 2013 and posed a significant public health threat. However, the public's lack of education on mosquitoes and their biology increases the risk of nuisance and disease transmission by these insects. Here, we used a new technology, micro-CT scanning, to visualize and study the reproductive physiology of these mosquitoes to better understand their biology and generate three-dimensional visualizations of whole mosquitoes that can be used in outreach and education activities. This work focuses on building a precise three-dimensional model of the reproductive tract to showcase their organs and reproductive biology in a vivid way. To do this, we utilized the *Dragonfly* software package, which includes an advanced scientific image-processing algorithm aided by artificial intelligence technology. Using micro-CT data of egg-bearing Aedes aegypti mosquitoes, we successfully trained an AI model to recognize different parts of the reproductive tract and generate a three-dimensional virtual representation of these tissues. We will use the resulting representations to study the process of egg development in this mosquito and educate students and the public using these detailed and accessible visual resources.

Retrospective Chart Review: Prevalent Characteristics of Hmong Patients Seen at the Hmong Lifting Underserved Barriers Clinic, a Free Student-Run Clinic in Sacramento, California

Allison Cunningham
Sponsor: Christian Bohringer, M.D.
MED: Anesth & Pain Medicine

The Hmong community in the greater Sacramento area faces significant health disparities, necessitating culturally sensitive healthcare. Hmong Lifting Underserved Barriers (HLUB) Clinic aims to address these challenges by understanding their health needs. Data (n=8) was collected from patients of Hmong descent seen at the HLUB Clinic from 2014 to 2023 for several parameters. Patients' BMI results were 25% normal, 25% overweight, and 50% obese. Hepatitis screenings showed 3 naive, 3 immune from vaccination, 1 dormant, 1 immune from past exposure, and none with active chronic hepatitis B. Patients' initial diabetes results were: 6 normal, 1 pre-diabetic, and 1 diabetic. Other parameters showed only 1 patient actively receiving care at the clinic, an average travel distance of 41.65 miles, 75% insured, and an average age of 33.5 years. Our preliminary data indicates a prevalence of high BMI patients, patients naive to hepatitis with no record of vaccination, and others who are positive for the core antibody. The enrollment in insurance and access to a clinic closer to home could explain a decrease in active Hmong patients. We suggest the clinic consider expansion of outreach, screening, and education efforts.

Multiproxy Stalagmite Climate Reconstruction of the 8.2 ka event in the Southern Sierra Nevada, California

Jocelyn Cziko
Sponsor: Isabel Montanez, Ph.D.
Earth And Planetary Sciences

Models project increased "whiplash climate," alternating periods of wet and dry conditions, for 21st-century California. Climate archives indicate that California has experienced similar whiplash climate phenomena during the last 11,700 years. Rainfall patterns in California under different climate states are not fully understood, prompting further research. Stalagmites are multiproxy climate archives that precipitate from cave drip water, preserving the chemical signature of the water, and allowing for geochemical analysis of trace elements and stable isotopes for climate reconstructions. We present a high-resolution multiproxy time series from a stalagmite in the southern Sierra Nevada that grew during the 8.2ka event. This significant climate change event occurred ~8,000 years ago and altered global temperature and precipitation patterns. The geochemical data supports "whiplash climate" conditions during the 8.2ka event. Previous studies have utilized a coastal California stalagmite to emphasize highly variable hydroclimate, vegetation, and wildfire conditions during and after the 8.2ka event. By comparing alpine and coastal cave records, we found that California experienced "whiplash climate", the coastal cave suggests an above-average amount of precipitation while the alpine cave shows a concurrent rise in drought conditions demonstrating the complexity and variability of regional climate response during the event.

Studying the Correlation Between Oxygen Extraction Fraction (OEF) in White Matter Hyperintensities (WMHs) in Elderly Participants

Poorvi Daga
Sponsor: Audrey Fan, Ph.D.
Biomedical Engineering

Alzheimer's disease (AD) is a progressive neurodegenerative disorder which causes memory loss and cognitive decline. Studies have shown that cerebral oxygen extraction fraction (OEF), a physiological parameter of the brain's metabolism measured using quantitative blood oxygen level dependent (qBOLD) magnetic resonance imaging (MRI), can be a useful biomarker to detect neurodegeneration before dementia and cognitive impairment. In this study we aim to analyze the correlation between OEF in white matter hyperintensities (WMHs), brain lesions reflective of structural connectivity damage, across age in 72 elderly participants (64-91 years old) of the Alzheimer's Disease Research Center. OEF is calculated from gradient echo slice excitation profile imaging (GESEPI) technique with an asymmetric spin echo (ASE) pulse sequence and percent WMH is calculated from a fluid-attenuated inversion recovery (FLAIR) MRI scan. We hypothesize that brain regions with higher WMHs density will have elevated OEF, due to compensatory metabolic changes in damaged tissue. Currently, we have calculated OEF and percent WMH for each participant and are analyzing their distributions across participants in preparation for linear regression. In the future, we aim to quantify the correlation between OEF and WMH at specific regions of the brain.

Avian Airfoils: A Case for Biologically Informed Airplane Design

Lucas Dahlke
Sponsor: Christina Harvey, Ph.D.
Mechanical & Aerospace Engr

Humans have found success in emulating bird flight through airplane design at the start of the 20th century. Modern advances in computing and manufacturing in the 21st century have made more sophisticated airplane designs possible, and birds have continued to give us a framework to drive these innovations. Namely, the drive to develop more maneuverable uncrewed aerial vehicles (UAVs) has led to the study of how birds change their wing shape in flight, i.e., morphing. To model the bird wings, we have extracted a new database of avian airfoils from wing scans. The exploration of the natural selective pressures behind their geometries can offer us insight, prompting us to explore two attributes: the effects of flight style and span location on aerodynamic performance. We previously were limited to 9 bird species, so in this next effort, we aim to study a larger sample size of 1000 species for a comprehensive study of their characteristics. We expect that the airfoils of gliding birds will have a higher aerodynamic efficiency and airfoils towards the interior will produce a higher lift. The study of avian airfoils can ultimately provide us with a template for new airfoil design and better-informed morphing wing models.

Functional Characterization of BRCA2 DNA Binding Domains

Ellianna Damozonio
Sponsor: Wolf Heyer, Ph.D.
Microbiology & Molec Genetics

BRCA2, an essential protein during high-fidelity DNA repair by the homologous recombination pathway, binds damaged DNA to recruit the homology search and DNA strand exchange protein RAD51. BRCA2 also supports DNA repair *via* gap suppression, replication fork protection, and the inhibition of an alternative end-joining repair pathway. Three separate regions with DNA binding activity have been localized to the N-terminal, C-terminal, and extreme C-terminal region of the BRCA2, but only the structure of the C-terminal region has been determined by X-ray crystallography. Furthermore, potential interactions between the disparate DNA binding regions remain to be established. We hypothesize that the multiple DNA binding domains of BRCA2 interact when the protein is properly folded and cooperate for its various functions. To test this hypothesis, we will generate BRCA2 mutant variants of the various DNA binding domains, assay their DNA binding activities, and compare activities to the purified wildtype domains. We also will determine whether the large middle domain encoded by exon 11 and containing 8 critical RAD51 binding sites can directly bind DNA. Results from this study will provide new insights into how BRCA2 mutations affect homologous recombination and DNA repair capability.

Unfolding: Human-Centered & Adaptable Clothing for Neurologic Disorders and Diseases

Julia Dang
Sponsor: Gozde Goncu Berk, D.V.M.,Ph.D.
Department Of Design

Neurologic Diseases and disorders such as Parkinson's Disease, spinal cord injuries, stroke, cerebral palsy, and muscle dystrophy affect millions of people causing difficulty putting on clothing due to reach, mobility, and fine motor skill problems. Buttons, zippers, and even some ties all require dexterity efficiency, and fine motor skills in the hands and arms. It can be hard for a person to don a dress shirt, and caregivers are usually present to don these garments for those who are impaired.

There have been a few methods that improve this everyday activity without the aid of another person. The opportunity is to design clothing that a disabled individual can manipulate with ease that will be both functional and fashionable.

Using techniques found in fabric manipulation, this project aims to design clothing prototypes that are accessible and human-centered for those who have challenges with clothing due to dexterity issues that emerge from neurologic disorders and diseases. The overarching goal is to improve lifestyles while being fashionable, functional, and sustainable through the exploration of low-waste design and fastening systems.

Using a Phylogenetic Approach To Understand the Structure and Assembly of Target of Rapamycin (TOR) Signaling Complexes

Tracy Dao
Sponsor: Ted Powers, Ph.D.
Molecular & Cellular Bio

Target of Rapamycin (TOR) is a kinase that plays a role in regulating and controlling cellular processes involving cell growth and autophagy. TOR localizes to two complexes, TOR complex 1 (mTORC1) and TOR complex 2 (mTORC2). Comparative analysis examining TOR across the eukaryotic kingdom suggests that mTORC1 is present in all eukaryotes while mTORC2 is not. To begin understanding how these complexes assemble and function in different organisms, we aim to determine whether LST8, a common protein present in mTORC1 and mTORC2, of different organisms are functionally similar to LST8 in budding yeast, *Saccharomyces cerevisae*. We will perform a sequence alignment of LST8 from different organisms across the expanded eukaryotic kingdom including yeast, mammals, and algae. We will perform a complementation assay by expressing LST8 from different organisms in yeast that lack endogenous LST8 to determine whether they can functionally replace the yeast protein. In addition, a western blot will be done to verify the expression and stability of the protein from different organisms in the yeast. These findings will provide insight into the structure and function of TOR within the expanded eukaryotic kingdoms.

Comparative Molecular Modeling of Beta-Adrenergic Receptor–Drug Interactions

Nancy Daoud
Sponsor: Igor Vorobyov, Ph.D.
MED: Pharmacology

Computational studies play a crucial role in drug design where they provide tools to predict the binding affinities of drug candidates to target proteins, understand their molecular interactions, and screen chemical databases for the identification of novel therapeutics. This study presents a comprehensive comparative analysis of SILCS (Site Identification by Ligand Competitive Saturation) and OpenEYE docking software packages. We assessed the accuracy of these two programs in predicting binding affinities compared to experimental values for ~50 ligands of b_1 and b_2 adrenergic receptors (bARs), key molecular players in the sympathetic nervous system (SNS) stimulation of physiological functions, the so called "fight-or-flight" response. We used popular bAR agonists and antagonists (so called beta-blockers), as well as cryo-EM structures of active and inactive receptor conformational states to understand receptor subtype- and state-specific interactions of the ligands. We identified differences in binding affinity between R and S stereoisomers as well as strong b_1AR or b_2AR preferences for some ligands. Comparison with experimental affinity values indicated that SILCS was better than OpenEYE docking at predicting relativity affinities of some ligands for b_1AR vs. b_2AR. These receptor subtype and conformation-specific affinity predictions can be used to design more efficacious and selective drug candidates for bARs.

The Relationship Between Perspective Taking and Peer Diversity: Moderated by Racial/Ethnic Identity

Anne Daruwala
Sponsor: Adrienne Nishina, Ph.D.
Human Ecology

Perspective taking is the ability to understand situations from others' points of view and is related to higher conflict management, academic success, and relationship satisfaction, making it an important skill to understand. Additionally, more cross-ethnic friendships are associated with less prejudicial attitudes, possibly due to interactions that promote perspective taking. We hypothesized that a) more friend group diversity would be related to higher perspective taking, b) this relationship would be stronger for White students than students of Color and c) White students would have lower perspective taking than students of Color. We used a multiple regression to test the association between friend group diversity and perspective taking, moderated by student ethnicity, in a sample of 10th grade students from California and Oregon (50% male, 50% female; 30% White, 70% students of Color). We found that friend diversity did not predict perspective taking ($\beta = .09$, $SE = .02$, $p = .06$) and student ethnicity did not moderate the relationship between friend diversity and perspective taking ($\beta = .07$, $SE = .04$, $p = .14$). Identifying as White was related to lower perspective taking than identifying as a student of Color ($\beta = -.13$, $SE = .06$, $p = .002$).

Impact of Memory for Audiovisual Objects on Search Behavior in Virtual Reality

Rishit Das
Sponsor: Joy Geng, Ph.D.
Psychology

Previous research on search behavior in Virtual Reality (VR) found that familiarity with an environment, like a regularly visited grocery store, shortens search times as layout knowledge increases. This study specifically investigates whether audiovisual objects impact search times by serving as landmarks in memory that are useful for later visual search. Participants (N=70) explored a virtual IKEA-style store, EyeKEA, containing audiovisual (AV) objects before searching for 10 furniture items sequentially. Eye movements and spatial positions were tracked, and environment memory was assessed post-search. We hypothesized that focusing on AV objects prior to search would forge better spatial and object memory, speeding up the later searches for target furniture items. Preliminary findings indicate a slight correlation between fixation duration on AV objects and search efficiency, suggesting that more time spent fixating AV objects prior to search was related to more efficient search. Further analyses will consider how the amount of exploration roaming behavior and AV object memory affect search strategies and target room arrival times. We propose that thorough engagement with AV objects before searching forms mental landmarks, enhancing search efficiency and revealing the impact of AV attention on navigation and memory in VR settings.

Iron Modulation as a Treatment for Type II Diabetes

Christian Davalos-Gutierrez
Sponsor: Marie anne Heffern, Ph.D.
Chemistry

Iron misregulation is a risk factor for developing type II diabetes, but the molecular mechanisms linking the two remain unknown. Iron dyshomeostasis is observed in diabetic conditions, even in cases where iron intake is normal. We hypothesize an approach that uses an iron-modulating compound capable of transporting iron across the cell membrane to restore iron regulation thereby alleviating diabetic complications. We utilized a diet-based model comparing male C57Bl/6J mice fed low- and high-fat diet diets containing either normal or high iron levels. After 6 weeks, mice received intraperitoneal injections of an iron modulator (10 mg/kg) for 7 days. Iron and metabolic markers were measured to determine diabetes progression with and without treatment. Mice fed high-fat diets exhibited increased weight gain and glucose intolerance, which is characteristic of diabetes onset. The high-iron chow resulted in higher fat content in the liver compared to the normal iron counterparts. Mice treated with the iron modulator displayed weight loss in both normal and high iron conditions. Western blot analysis indicates that the iron modulating agent simultaneously shifts iron regulatory markers and decreases fat production, suggesting an association between the two.

Investigating the Relationship between Environmental Exposures and Maternal Health Outcomes

Anisha De
Sponsor: Leigh ann Simmons, Ph.D.
School of Nursing

Current research on the impact of climate change on maternal health outcomes remains limited. Environmental exposures pose some risk for poorer health outcomes, however, most literature reveal conflicting trends. We conducted a secondary analysis of the Goals for Reaching Optimal Wellness (GROWell) study, which was a randomized control trial of a mobile health application to improve diet quality for pregnant Californians with overweight/obesity. Specifically, we investigated the relationship between climate change-related environmental exposures and health outcomes during and after pregnancy. We aggregated 7-, 30-, and 90-day averages of PM 2.5, a measure of poor air quality, from EPA air quality monitoring stations closest to the location of 398 GROWell participants. Of these, on average, 153 were exposed to low levels (below 12 µg/m3) compared to 2 who were exposed to high levels over 35 µg/m3.Other factors monitored in the study include differences in diet, physical activity,and high heat days, all which directly affect maternal and neonatal health outcomes, such as low birth weight (LBW). Findings from this study can be used to develop policy recommendations to improve care for vulnerable populations and mitigate adverse health outcomes due to the impacts of ongoing climate change.

First Step Towards Exploring Proteome Destruction Machinery in Chloroplasts

Darian DeBortoli
Sponsor: Nitzan Shabek, Ph.D.
Plant Biology

Chloroplasts are essential organelles in plants responsible for energy production via photosynthesis and many other important biological processes. Understanding the regulatory mechanisms within chloroplasts for plant growth in response to environmental cues is important in our ever changing environment. Among these mechanisms, the ubiquitin-proteasome system has emerged as a fundamental component in eukaryotic cells, governing the targeted degradation of proteins and the regulation of various cellular processes. Ubiquitination involves attaching ubiquitin markers to target proteins via enzymes (E1, E2, and E3). This process can occur multiple times, resulting in the formation of polyubiquitin chains attached to the target protein, which then serve as signals for proteasomal degradation. The presence and roles of ubiquitin system machinery within and/or associated with chloroplasts remain unclear, representing an open area of investigation. Emerging research is revealing substantial, previously unknown functions of ubiquitin-dependent protein modifications in chloroplasts. Leveraging this knowledge could revolutionize agriculture by enabling the development of crop varieties that are more resilient to environmental stressors like drought or increased CO2 levels, leading to increased food security. This project aims to investigate the chloroplast proteome to identify the presence of proteins interacting with and/or utilizing ubiquitin molecules.

Piscivorous Birds Are Selecting for Restored Tidal Habitat Aimed Towards Fish Conservation in Suisun Marsh, San Francisco Estuary

Abigale Deen
Sponsor: John Durand, M.D.,Ph.D.
Center For Watershed Sciences

Tidal wetland restoration in the San Francisco Estuary's Suisun Marsh is targeted toward the conservation of endangered fishes. Though ongoing monitoring tracks fish abundance and assemblages within many of these wetlands, and some research has characterized patterns of predation among fishes (Young et al. 2022), little data exists to describe habitat use by fish predators, such as piscivorous birds. We conducted visual bird surveys and beach seines in two tidal restoration sites to evaluate habitat usage among both predatory piscivorous birds and prey species of fish. We calculated total abundances of each bird species and quantified their behavior at time of observation (foraging, resting, flying, etc.). Piscivorous birds such as herons, cormorants, and egrets were observed hunting in these restorations, likely on the novel assemblages of fishes and other aquatic organisms frequenting these habitats. We will visualize the relationship among fish and piscivorous birds in restored tidal wetlands to better understand the complex food webs and intra-taxonomic communities that are developing in these novel habitats. Understanding how piscivorous birds select for and use restored habitats will help quantify predation pressures for fishes on-site, and can inform future restoration designs to encourage or discourage piscivorous bird use.

Fabrication of Biodegradable, Reusable, and Biocidal Nanofibrous Membrane Filters

Elle Defensor
Sponsor: Gang Sun, Ph.D.
Biological & Ag Engineering

Face masks greatly mitigate the risk of pathogenic infection for users in medical environments. Current nonwoven olefin surgical and N95 masks possess up to 95% filtration efficiency against airborne particles. However, when considering the masks' human and environmental health impacts, we must assess two primary drawbacks. One, viral particles can survive on mask surfaces during and after usage, increasing the risk of cross-contamination. Second, as olefin-based materials, these single-use, non-biodegradable masks accumulate in landfills and become environmental hazards. To address these concerns, this project is developing an alternative filtration material for N95 masks. Poly-lactic acid (PLA), a bio-based polymer, was selected as the alternative base polymer for its biodegradability under specific environmental conditions. The PLA filtration material is manufactured via electrospinning with a photosensitizer to mimic a melt blown material. Under daylight exposure, the photosensitizer generates reactive oxygen species (ROS), which results in light-induced antibacterial properties. Effective ROS production potentially realizes mask reusability and cross-contamination reduction. Furthermore, these masks displayed improved filtration efficiency and comfortability. Following this proof of concept, this research will study the biodegradation rates and longevity of the filtration material. Developing this technology will lead to materials with improved human and environmental protection.

Multiproxy Stalagmite Climate Reconstruction of the 8.2 ka event in the Southern Sierra Nevada, California

Mikayla Deigan
Sponsor: Isabel Montanez, Ph.D.
Earth And Planetary Sciences

Models project increased "whiplash climate", alternating periods of wet and dry conditions, for 21st-century California. Climate archives indicate that California has experienced similar whiplash climate phenomena during the last 11,700 years. Rainfall patterns in California under different climate states are not fully understood, prompting further research. Stalagmites are multiproxy climate archives that precipitate from cave drip water, preserving the chemical signature of the water, and allowing for geochemical analysis of trace elements and stable isotopes for climate reconstructions. We present a high-resolution multiproxy time series from a stalagmite in the southern Sierra Nevada that grew during the 8.2ka event. This significant climate change event occurred ~8,000 years ago and altered global temperature and precipitation patterns. The geochemical data supports "whiplash climate" conditions during the 8.2ka event. Previous studies have utilized a coastal California stalagmite to emphasize highly variable hydroclimate, vegetation, and wildfire conditions during and after the 8.2ka event. By comparing alpine and coastal cave records, we found that California experienced "whiplash climate", the coastal cave suggests an above-average amount of precipitation while the alpine cave shows a concurrent rise in drought conditions demonstrating the complexity and variability of regional climate response during the event.

Shifting Values of Femininity, Family Responsibility, and Collectivism: Gender and Family Representations in Early 2020s Children's Films

Julianna DeNeve
Sponsor: Yael Teff-Seker, Ph.D.
Sociology

This study explores the representation of gender and family in recent children's films. These media representations are constructed by societal norms about gender and family and, in turn, construct the norms as impactful socializing tools for young audiences. Existing literature on the topic has analyzed work from 1937 to 2019 and generally criticizes the pattern of limited, underdeveloped female characters. My research examines children's films from the sociological perspectives of gender, family, feminism, and culture, and analyzes the messages that these movies provide for their audiences. Using an abductive analysis, I consider gender and family in *Onward (2020)*, *Raya and the Last Dragon (2021)*, *Encanto (2021)*, *Turning Red (2022)*, *Strange World (2022)*, *The Little Mermaid (2023)*, and *Elemental (2023)*. Preliminary findings indicate that compared to earlier children's films, these seven represent gender expression with greater complexity, especially for female characters, and incorporate more culturally diverse families. In these films, the strength and capability of women and girls is grounded in their familial responsibilities. Gender and family constructions in recent children's films also reflect contemporary understandings of non-white feminisms. The films seem to acknowledge agency in family care, encouraging values of collectivism rather than unrestrained Western individualism.

End Effector and Computer Vision System for an Automated Mushroom Harvester

Tazlina Dentinger
Sponsor: Ali Moghimi, Ph.D.
Biological & Ag Engineering

With consumer diets becoming more healthy, the demand for mushrooms has increased due to the excellent health benefits mushrooms provide. Despite mushrooms being a multi billion dollar industry, mushroom farmers struggle to find workers amidst the declining agriculture workforce. To combat this, robotics are being implemented across all areas of agriculture, including harvesting, but automated harvesting of mushrooms is under-explored, with current solutions often resulting in a lower quality product. Our research investigated the integration of mushroom-specific end effector and fine-tuned a computer vision model to the FarmBot, an open-source CNC (Computer Numerical Control) farming robot. After evaluating different end effectors for FarmBot integration, a pneumatic suction cup proved optimal. A vacuum system was found to minimize mushroom bruising during picking. The fine-tuning of our computer vision model involves a two-stage process which significantly improves processing time and accuracy: first, applying image segmentation technique using deep learning model, YOLOv8, to locate mushrooms in real time, followed by classification using MobileNet to determine mushroom ripeness. In conclusion, our research evaluated a cost effective robotic mushroom harvesting system that can ease the labor shortage while maintaining a similar quality of product to manual harvesting.

Reproductive Trends in the Monogamous Prairie Vole (*Microtus ochrogaster)*

Balreet Deol
Sponsor: Karen Bales, Ph.D.
Psychology

Prairie voles (*Microtus ochrogaster*) are a monogamous rodent species that are commonly used in research as a model species. This is because of their use of biparental care, and extensive body of established literature. Studies done with prairie voles inform us about the mechanisms underlying important social behaviors, so they've become popular laboratory study species within the field of biological psychology. Examination of expansive colony datasets would give information about what factors influence success of a colony, such as reproductive success, as well as providing interesting translational insight into human reproductive trends. We will use archival data spanning the course of 14 years, from a research lab that uses prairie voles to study social behavior to determine the effects of age and time on reproductive output. We hypothesize that age and time of breeding affects several factors such as litter size and interbreeding interval. This is thought to be true because age affects reproductive health and sexual maturity even in laboratory settings.

Reproductive Trends in the Monogamous Prairie Vole (*Microtus ochrogaster)*

Sukhreet Deol
Sponsor: Karen Bales, Ph.D.
Psychology

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Does a Runner's Foot-strike Angle Predict Future Musculoskeletal Overuse Injury?

Cade Depeel
Sponsor: Dovin Kiernan, Ph.D.
Neuro Physio & Behavior

Running is a popular sport enjoyed by millions of people across the US. While running offers many health benefits it also poses a high risk for musculoskeletal overuse injury. Previous research has hypothesized that a runner's foot strike angle (the angle between their foot and the ground when they first land) may predispose them to injury or elevate their risk of certain injuries. The limited research on this topic to date has, however, yielded conflicting results. To address this gap in the literature, we recruited 48 uninjured runners and had them run overground while recording their foot strike angle. We then tracked running injury development across a 12-week prospective period via a weekly online survey. Forty runners completed the study, and of those, half (20) sustained a time-loss injury. Foot strike angles across injured and uninjured runners will be compared via t-test. Further, the number of days spent injured will be plotted as a function of foot strike angle and the coefficient of determination will be calculated. These results will provide insight on the relation between foot-strike angle and the development of running injury, which can be used to guide and inform future injury prevention practices and studies.

Cortical Tracking of Phonetic Information in Children With Cochlear Implants

Anand Derick
Sponsor: David Corina, Ph.D.
Linguistics

This study delves into the neural mechanisms underlying speech processing in children with Cochlear Implants (CI) compared to their Normal Hearing (NH) peers, emphasizing the interplay between auditory and visual cues. Utilizing EEG data from 24 CI and 24 NH children, we employ two distinct predictive models to analyze their cortical responses to speech features amidst visual distractions. Based on 38 IPA phonemes represented by indicator vectors, the Phoneme Model allows us to investigate categorical phoneme perception by identifying moments when specific phonemes are identified in the speech stream. Conversely, the Phonetic Feature Model, incorporating articulatory and acoustic features such as voiceness, place and manner of articulation through binary vectors, enables a granular analysis of time course of perception of phonemic features as well as quality of such percepts across the groups. By applying machine learning techniques, we aim to quantify cortical tracking of these speech attributes and understand the time course of phonetic discrimination in the face of auditory deprivation and imperfect auditory input. We expect to see delayed phoneme discrimination and overall lower precision of phoneme discrimination in CI group compared to hearing group.

Impact of IL-13 and Caldecott PM 2.5 Exposure on Airway Epithelial Cells Grown in Air Liquid Interface Conditions

Shanna Desai
Sponsor: Nicholas Kenyon, M.D.
MED: Int Med Pulmonary (sac)

Exposure to traffic pollution has been shown to exacerbate respiratory symptoms and increase lung inflammation in asthmatics. Individuals with asthma exhibit elevated levels of the type 2 inflammatory cytokine IL-13, which contributes to airway hyperreactivity and increased mucus production. Additionally, exposure to fine particulate matter (PM 2.5) can worsen asthmatic symptoms and increase expression of cytokines such as IL-4 and IL-33, due to its ability to infiltrate deep into smaller airways. Elevated levels of these inflammatory cytokines intensify airway inflammation, presenting potential targets for the identification of possible therapeutic interventions. However, whether the increased expression of IL-4 and IL-33 is due to the presence of increased IL-13 in combination with PM 2.5, remains unexplored in air liquid interface (ALI) conditions. We are proposing to measure the expression of inflammatory cytokines, IL-4 and IL-33, using an ELISA, in response to the co-exposure of IL-13 and PM 2.5 derived from the Caldecott Tunnel on human airway epithelial cells grown in ALI. We anticipate increased IL-4 and IL-33 expression after exposure to the combination of IL-13 and PM 2.5.

Digital Gait Markers from GAITrite for Potential Pre-Diagnosis of Fragile X-Associated Tremor/ Ataxia Syndrome

Aniket Desarkar
Sponsor: Randi Hagerman, M.D.
MED: Pediatrics

Fragile X-associated tremor/ataxia syndrome (FXTAS) is a neurodegenerative disease that is seen in premutation carriers (55-200 CGG repeats) of the fragile X messenger ribonucleoprotein 1 (FMR1) gene. It's currently not possible to identify whether or not a premutation will develop FXTAS before common symptoms such as severe ataxia, lowered cognition, and executive dysfunction are present. The GAITrite is a 15ft long mat that uses pressure sensors and switches to make measurements such as patient stride length, heel-base support, stance, footfall, heel-off time, and step time deviations. It is often used for FXTAS, Parkinson's, and Essential Tremor patients to measure many factors regarding their ataxia The purpose of this study was to compare GAITrite scores over multiple patient visits between male premutations who developed the symptoms of FXTAS, those who did not, and controls (males without the permutation or FXTAS symptoms) to determine if the GAITrite can be used for early diagnosis and tracking the development of FXTAS. This could potentially lead to earlier preventative measures to slow down the progression of the disease.

Stone Tool Material Sources of Southern Japan in the Upper Paleolithic to Incipient Jomon Eras

Claire DesBaillets
Sponsor: Nicolas Zwyns, Ph.D.
Anthropology

Stone tools play a significant role in the development of human civilization, and access to quality material for said tools is critical in their creation. Long-distance transport of raw materials and the use of specialized methods of stone tool productions are well documented in the Paleolithic record of Japan. While most lithic studies focus on the Northern shores of Honshu and Hokkaido islands, the development of stone tool technology on Kyushu and in Southern Japan has received less attention. I will be focusing on the Upper Paleolithic and transition to Incipient Jomon eras, placing my era of study from approximately 20,000 BP to 8,000 BP. By mapping locations of primary sources of lithic material (obsidian, andesite, rhyolite, etc.), analyzing the chemical makeup of different tools found at sites throughout Southern Japan (Kyushu), and comparing and categorizing them, I hope to draw models for collection, transport and possible trade patterns throughout Japan. In order to do so, I will also model hunter-gatherer mobility patterns to theorize possible trade and interaction patterns. Expanding on stone trade, I will similarly analyze how trade of raw material may line up with exchange of lithic and cultural practices throughout time.

Dietary Intervention in Kidney Transplant Recipients: An Ongoing Randomized Controlled Trial

Gloria Devitt
Sponsor: Ling-xin Chen, M.D.
Med Int Med-kidney Transplant

A whole-food, plant-based diet pattern is effective in delaying chronic kidney disease progression, yet kidney transplant recipients rarely receive dietary education post-transplant. We aim to assess the impact of a dietary education and counseling intervention on health outcomes in kidney transplant recipients. We are conducting a prospective randomized controlled trial of an online dietary curriculum in adults within one year of receiving a kidney transplant. The curriculum comprises 6 months of biweekly online classes about whole-food, plant-based eating and a cookbook. The outcome of interest was dietary intake as determined by 24-hour recall. This preliminary analysis included 9 participants in the control arm and 10 participants in the intervention arm who completed 6 months of follow-up. At 3 and 6 months, intervention arm participants demonstrated increased fiber intake and decreased sodium and saturated fat intake compared to their baseline and to the control group, which did not change over 6 months. The intervention arm decreased their dairy intake and increased consumption of whole grains and legumes in the 6-month period, in contrast to the control group. The dietary education curriculum has been successful in improving the diets of participants toward a more whole-food, plant-based pattern.

PegRNA Optimization for *In Vitro* Prime Editing of *Ppp2r5d* in Neuro2A Cells

Rency Dhaduk
Sponsor: Kyle Fink, Ph.D.
MED: Neurology

PPP2 syndrome type R5D, or Jordan's syndrome (JS), is a rare intellectual disability disorder caused by de novo missense mutations that occur within the PPP2R5D gene. Currently, there is no cure for JS, and the current standard of care only offers symptomatic treatments. Therefore, we propose prime editing (PE) as a novel therapeutic intervention for the treatment of JS. Previous research from our lab has utilized prime editing to target and correct pathogenic Ppp2r5d mutations. However, with current lead prime editing gRNA (epegRNA), due to the protospacer adjacent motif (PAM) still intact, Cas9 nickase continues to cut our target site even after successful editing, leading to an increase in insertions and deletions over time. To improve the overall safety profile of prime editing, we aim to optimize additional epegRNAs that incorporate silent mutations to disrupt the PAM site. To facilitate epegRNA screening, epegRNA constructs with altering primer binding sites will be assembled into plasmids and transfected into mouse Neuro2a cells. To evaluate the PE efficiency of silent-PAM epegRNAs, treated cells will be assessed 72 hours post-transfection via amplicon sequencing. In summary, our study aims to identify an optimized epegRNA that yields improved gene editing of Ppp2r5d with reduced indel formation.

Effects a Ketogenic Diet and Ketone Supplementation on Isometric Muscle Endurance in Aging Mice

Lupita Diaz
Sponsor: Jon Ramsey, Ph.D.
VM: Molecular Bio Sciences

Incorporating and maintaining specialized diets have been used for various things such as loss of body fat and preventing possible diseases such diabetes or heart disease. Recent studies focusing on the effects of a ketogenic diet have shown an increase in lifespan and healthspan, including motor function, in aging mice. Investigating if increasing circulating ketones without eliminating carbohydrates is sufficient to increase muscle endurance under isometric conditions, similar to a ketogenic diet, is an area that has yet to be studied. To test muscle endurance in mice fed ketone esters, the four-limb wire hang was performed at 21 and 26 months (5 or 10 months on diet). Our findings indicate that at 21 months there is a diet effect that influences wire hang performance across diet groups: the ketogenic group showing the highest muscle endurance. In addition, a sex effect was seen where females surpassed male performance throughout all diet groups. An age effect is seen where mice at 21 months outperformed themselves at 26 months, implying that none of the diet groups showed prevention of decrease in muscle endurance. Though there was an overall diet effect at 21 months, our data does not show an impact on age-related decline.

Comparing Directive language in Monolingual and Bilingual Caregivers

Julissa Diaz Garcia
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Infants' attention and behaviors are modified by caregivers' verbal cues. One type of utterance that caregivers use with their infants are directives, which are attempts to control an infants' behavior or attention (Rantalainen et al., 2022). Prior research has been mixed, suggesting the use of directive can either support or hinder infant's language development. In addition, prior research has been conducted with monolingual English-speaking dyads, which does not provide understanding of bilingual caregivers that are part of multicultural communities. The goal of the study is to examine English-speaking monolinguals and Spanish-English bilingual caregivers' directive while playing with their infants. We are coding caregivers' use of directive subcategories (e.g. attentional, behavioral, prohibitory, intrusive, and supportive) . We will also analyze caregivers' language use and the rate of directives produced in Spanish and English. We predict that Spanish-English bilingual caregivers will have higher rates of directives used and higher rates of intrusive directives due to cultural background (Cabrera et al., 2006). It is important to know the differences between how monolingual and bilingual caregivers speak to their children so that we can understand how to further help caregivers to effectively communicate with their children.

The Squeezing of Trapdoor Spider Populations on the California Coast

Kylie Dickinson
Sponsor: Jason Bond, Ph.D.
Entomology/Nematology

The trapdoor spider *Aptostichus stephencolberti* is endemic to the fragile and shifting coastal dune ecosystems where they construct silken burrows into dune faces. These isolated and threatened coastal populations will likely experience intensifying coastal squeeze with predicted sea level rise and encroaching development. To understand their population dynamics and ecological role, population surveys were completed at two state beaches along the Central California coast during the 2022 and 2023 summer field seasons. Our main objective was to estimate population size and population density of *A. stephencolberti*. Our second objective was to determine if a relationship exists between spider density and native plant density. We took photographs of each sample plot and identified the plant species present and the percent plant cover. We then tested whether trapdoor spider burrow density was correlated with the presence of native versus non-native plants and plant density. These relationships could potentially inform future conservation strategies.

Identifying force-dependent protein interactions surrounding actin filaments

Agustina Diener
Sponsor: Soichiro Yamada, Ph.D.
Biomedical Engineering

Mechano-transduction is the process by which a cell senses, integrates, and converts mechanical stimuli into biochemical signals. This results in intracellular changes that regulate cell adhesion and cell behavior. Upon physical stimulation, actin filaments are thought to recruit vital regulatory proteins, but the comprehensive list of proteins surrounding the "tensed" actin network has not been described. To identify force-dependent interactions surrounding actin, we fused TurboID, a biotin ligase that promiscuously biotinylates proximal proteins, with F-tractin, an actin-binding domain of ITPKA. The biotinylated proteins surrounding actin filaments from control and mechanically stimulated conditions were purified using streptavidin beads, and analyzed using mass spectrometry. Our screening assay identified proteins that are already known to bind to tensed actin filaments, suggesting that this method is working. Currently, we are using CRISPR/Cas9 knockout candidate proteins to assess the effect on cell force-sensitivity and determine the function of these proteins in mechano-transduction. By identifying the comprehensive list of proteins that interact with actin under force bearing conditions, the molecular basis of mechano-transduction will be better understood.

Exploring The Art That Makes Davis

Alyannah Erika Dimaano
Sponsor: William Mead, M.F.A.
Department Of Design

This project aims to create an interactive digital website that explores the public art in the City of Davis. This city is filled with a rich and vibrant art culture, from the numerous influential artists to the countless murals and sculptures found all over the streets. Preliminary research shows that in spite of the diverse and growing art scene, the general public remains largely unaware of the history and culture behind the art they see. Hence, to bridge this gap in public consciousness, this project plans to bring to light the valuable learning experiences that public art in Davis has to offer.

This project will look further into how people interact with public art and ways to strengthen their connections with it. It will make use of literature review, competitive analysis, user tests and interviews to create a new, immersive digital experience. This project hopes to encourage people to visit and explore the public art found in Davis, as well as foster a new appreciation and understanding of the city through the lens of its art.

Histology Assessment of Effects of Different Traffic-Related Air Pollution Components on Inflammation in the Lung

Kalvin Dinh
Sponsor: Laura Van Winkle, Ph.D.
VM: Anat Physio & Cell Biology

Traffic-related air pollution (TRAP) is heterogeneous and composed of particulate matter (PM) and gas vapor emissions from both light-duty (LDV) and heavy-duty vehicles (HDV). Studies have suggested a potential link between TRAP exposure and disease outcomes not only in the lungs but also in the brain. This study examines toxic effects of TRAP on the lung and brain of rats that express human AD susceptible genes. We hypothesized that the animals exposed to PM+gas from LDV+HDV exhaust will develop the most severe lung inflammation. To test this hypothesis,rats were exposed to real-time TRAP drawn from the Caldecott tunnel in an adjacent exposure facility. Exposure groups included: 1) filtered air control, 2) PM+gas from LDV+HDV, 3) Gas from LDV+HDV, 4) PM from LDV+HDV, 5) PM+gas from LDV, and 6) PM from LDV. Animals were continuously exposed to TRAP for 11 months and euthanized at 12 months of age for lung collection. Collected lung was fixed, paraffin-embedded, and sectioned for H&E staining to visualize inflammation in the airway. Assessment of H&E is in progress using a semi-automated quantification using ImageJ and a semi-quantitative subjective scoring method.Results from these analyses will indicate the differential inflammatory effects of TRAP components in the lung.

NEW YORK TIMES MEDIA PROJECT: The Representation of Algerians in the 1960s

Hadil Djadri
Sponsor: Suad Joseph, Ph.D.
Anthropology

How did the New York Times (NYT) represent Algerians in the 1960s? So far in the decade, there is a consistent pattern where the NYT represents the Algerian War of Independence as a “rebellion” rather than a revolution and Algerians involved in the fighting as “terrorists” and “nationalist rebels.” Towards the end of 1960, a pattern emerged where Algerian self-determination gained greater credibility in the NYT as France’s efforts in the war became more futile. However, the NYT continued to depict Algerians as "terrorists" and "rebels.” The framing of the independence war as a “rebellion” and Algerians as “rebels” and “terrorists” discredits the struggle for independence. As a leading newspaper with a global audience, the NYT representation of individuals who fought for self-determination during the 1960s likely shaped mainstream perceptions of anti-colonial movements. I searched the NYT archive on ProQuest using the term “Algeria*,” which produced 8,617 articles. I have screened 958 articles between January 1960 and October 1960, of which 64 are relevant. This research is part of a long-term analysis project of the NYT from 1850 to the present from the Suad Joseph Lab. This project analyzes the representation of Islam and Muslims over 150 years.

Reduced T-Cell Receptor Diversity is not Diagnostic for Intestinal Lymphoma in Cats

Elizabeth Do
Sponsor: Stefan Keller, D.V.M.,Ph.D.
VM: Pathology, Micro, & Immun

Senior cats often suffer from chronic enteropathy (CE), encompassing inflammatory boweldisease (IBD) and intestinal lymphoma. Affected cats present with vomiting, diarrhea, andweight loss, often culminating in euthanasia. The gold standard for diagnosing intestinallymphoma involves demonstrating a reduced T cell receptor (TCR) diversity in intestinalbiopsies using clonality testing. This project aimed to characterize TCR diversity in cats. Wehypothesized that 1) TCR diversity decreases with age and 2) there is no significant difference inTCR diversity between cats with and without CE. DNA was extracted from formalin-fixed andparaffin-embedded intestinal biopsies from 50 cats with and without CE, the hypervariableregion of the TCR gene was amplified by PCR and TCR diversity was scored semi-quantitatively(from 1/low to 4/high). Results showed that TCR diversity decreased with age and that thisdecrease was most notable in cats older than 10 years. Unexpectedly, cats with CE had a highermean diversity score than cats without CE (2.9 vs. 2.7) but this difference was not statisticallysignificant. These findings suggest that low TCR diversity could, in part, represent an age-relatedchange and that it is not indicative of intestinal lymphoma in call cases.

MARCKS in Macrophages Contributes to Lung Cancer Progression

Anjolie Doan
Sponsor: Ching-hsien Chen, Ph.D.
MED: Int Med Nephrology (sac)

Lung cancer is one of the leading causes of death in the United States, with more than 130,000 deaths per year. We identified MARCKS, myristoylated alanine-rich c-kinase substrate, as a potential therapeutic target for lung cancer, where its phosphorylation increases tumorigenesis and cancer cell migration. MARCKS also exhibited abundant expression in tumor-associated macrophages (TAMs) which have garnered attention for their involvement in cancer progression. To understand the function of MARCKS in TAMs in lung cancer development, the differential expressed genes (DEGs) in MARCKS-expressing TAMs from lung cancer scRNAseq analysis were used for DAVID pathway enrichment. The enriched pathways included Efferocytosis pathway which created a tumor-favorable microenvironment, several interleukin pathways, IL10, IL4, IL13, and IL6, and CD163 mediating anti-inflammatory responses, which are involved in macrophage polarization towards an M2-like (anti-inflammation) phenotype, and CCR5 chemokine receptor binding pathway which promoted cancer proliferation and migration. Furthermore, the identification of the pathway, negative regulation of T cell-mediated immune response to tumor cells, suggested MARCKS in TAMs may also play a role in tumor immune evasion. In summary, MARCKS-expressing TAMs play a pivotal role in lung cancer progression, influencing tumor microenvironment and immune evasion mechanisms and highlighting its potential as a therapeutic target.

Web-Accessible Life-Threatening Diagnostic Test Results for Urgent Clinician Notification

Jenna Dohner
Sponsor: Gerald Kost, M.D.,Ph.D.
MED: Pathology & Lab Medicine

This research aimed to examine critical limits and values available on the World Wide Web, assess drift in quantitative low/high thresholds since 1990-93, streamline urgent notification practices, and promote global accessibility. We identified Web-posted lists of critical limits/values at university hospitals. We compared 2023 to 1990-93 archived notification thresholds. We found critical notification lists for 26 university hospitals. The median number of tests was 62 (range 21-116). The breadth of listings increased. Statistically significant differences in 2023 versus 1990 critical limits were observed for blood gas (pO_2, pCO_2), chemistry (glucose, calcium, magnesium), and hematology (hemoglobin, platelets, PTT, WBC) tests, and for newborn glucose, potassium, pO_2, and hematocrit. Fourteen hospitals listed troponin measurements. Qualitative critical values expanded across disciplines. Bioterrorism agents, contagious pathogens, and pathology were listed frequently, although only three hospitals listed COVID-19. Only one notification lists detailed point-of-care tests. Urgent notifications should prioritize life-threatening conditions. We recommend that hospital staff evaluate drift over the past three decades for clinical impact. Notification lists expanded, especially qualitative tests, suggesting that automation might improve efficiency. Sharing notification lists and policies on the Web will improve accessibility and harmonization of urgent notification and critical care practices in the 21st Century.

Evaluating the Relationship Between Temporal Discounting and Age Using Motor Adaptation to Visual Feedback Perturbations

Francisca Dogbe
Sponsor: Wilsaan Joiner, Ph.D.
MED: Neurology

Temporal discounting, where rewards lose value over time, is crucial in decision-making processes involving delayed outcomes. Movement, which requires effort, is one such decision that is influenced by temporal discounting. As individuals age, changes in cognitive abilities, including executive function and time perception, may alter their temporal discounting rates, impacting movement dynamics. Understanding how age and other external factors interact with temporal discounting in shaping movement behavior is essential for comprehending decision-making processes. We hypothesize that temporal discounting, in addition to age, affects the movement dynamics of older subjects. Utilizing a visuomotor rotation paradigm (VMR), a well-established assessment of motor learning, we evaluated short-term discounting in young (18-25) and older participants (60-90) with respect to explicit and implicit learning processes. Explicit motor learning processes are conscious changes in motor output, while implicit are unconscious motor adjustments. For this experiment, explicit actions were assessed by the subject moving a selection arrow in response to the visual feedback perturbation, while implicit was quantified by the actual reaching direction of the subject. Additionally, we imposed a random delay (0-90s) to compute temporal changes in these processes. Our results show the complex interplay between temporal discounting, age-related changes, and external influences on movement dynamics.

Individual Flight Initiation Distances Do Not Predict Home Range Size in California Ground Squirrels

Haoyue Dong
Sponsor: Andrew Sih, Ph.D.
Environmental Science & Policy

The presence of humans has profound influences on wildlife space use, behavior, and fitness. Thereby, not all individuals are affected by human presence to the same extent. Here, we investigate how boldness impacts space use in California ground squirrels (*Otospermophilus beecheyi*) in human-disturbed areas, hypothesizing that bolder individuals have larger home ranges. Fieldwork was conducted in Briones Regional Park, encompassing the trapping and marking of individual squirrels. We collected spatial data on individual squirrels through 15-min scan sampling and conducted between one and six flight initiation distance (FID) trails per individual as a measure of individual boldness. Home range sizes were calculated using kernel density estimates. In a generalized linear model, we tested whether FID and individuals' age (juvenile versus adult) affect home range size. We found no significant evidence that individual FID (N = 57 squirrels, t-value = -0.56; p = 0.60) or age (t-value = -0.58; p = 0.60) predicted home range size. This suggests that other factors, such as the sex of the ground squirrels, the presence of natural predators, and vegetation, may be more important determinants of home range size. Future studies should therefore consider including environmental covariates to further investigate squirrels' space use in human-disturbed areas.

Investigating the Relationship between Genetic Ancestry and Social Identity in South African Populations.

Lance Dornan
Sponsor: Cristina Moya, Ph.D.
Anthropology

This study examines the extent to which social identity maps onto genetic ancestry among 708 participants from the region between the Cederberg Mountains and the southern Kalahari in South Africa, an ethnically and genetically diverse region where social identities map onto significant inequalities, and until recently, legal rights. Participants submitted DNA samples and reported their own, their parents', and grandparents' ethnic identities. This results in a total of 4,248 parent-offspring dyads through which we can assess how identities are inherited. We conducted statistical analysis to examine the extent to which different ethnic identities are intergenerationally transmitted, whether there are gendered patterns of transmission, and how well these map on to genetic ancestry. Our goal is to understand the role of status differences between ethnic groups, age, language, gender, and genetic ancestry in the identities that people express. Results from this study indicate a strong correlation between the identities of parent-child pairs across ethnic groups, showing strong consistency between matrilineal and patrilineal inheritance of identity. Ethnic identities are often construed as being about shared ancestry; social scientists have argued convincingly that such group boundaries reflect political goals and are, therefore, often divorced from such genetic inheritance. Further analyses will test this claim.

Assessing the Safety and Efficacy of Ocular CRISPR-Cas9 Genome Editing Therapy for Choroidal Neovascularization in Nonhuman Primate Eyes

Jack Dragoli
Sponsor: Glenn Yiu, M.D.,Ph.D.
MED: Eye Center

CRISPR-based genome editing alleviates the burden of frequent intravitreal injections in patients with neovascular age-related macular degeneration (nAMD) by allowing for the targeted and permanent disruption of pro-angiogenic factors, such as vascular endothelial growth factor (VEGF). We subretinally injected adeno-associated viral (AAV) vectors with *S. pyogenes* Cas9 (SpCas9) and single guide RNAs (gRNAs) targeting conserved regions in exon 1 of *VEGFA* across mice, rhesus macaques, and humans. Retinal tissues and tissues from brain, heart, liver, kidney, spleen, and gonad were collected 12 weeks after subretinal injection for cryoembedding, immunohistochemistry (IHC), and biodistribution assay, respectively. We also collected aqueous, serum, and peripheral blood mononuclear cells each month post-injection to measure host immune responses. Regardless of eyes that received active or control gRNA, or at low and high dose, IHC showed glial and microglial activation, suggesting retinal inflammation. Subretinal AAV8 didn't indicate significant concentrations of binding and neutralizing antibodies or IFN-gamma-secreting T-cells against AAV8. Peripheral organ tissues collected at necropsy showed minimal systemic biodistribution of AAV8. Our study demonstrated that subretinal delivery of AAV8-CRISPR-Cas9 and gRNAs could elicit local inflammation but with minimal egress of viral vector to peripheral organs. Further studies are needed to assess the source of local retinal inflammation.

Development of Perineuronal Nets Is Altered in 22q11.2 Deletion Syndrome Mouse Model

Christine Du
Sponsor: Karen Zito, Ph.D.
Neuro Physio & Behavior

The 22q11.2 deletion syndrome (22q) is the most common de novo microdeletion syndrome in humans, affecting up to 1 in 2000 individuals. Among other physiological deficits, 22q is associated with cognitive impairment and up to 30% of affected individuals will develop various forms of psychosis, including a higher risk of developing schizophrenia in early adolescence. Modern medicine is advanced enough to address and correct almost all physiological deficits associated with 22q, however the treatment of cognitive impairments only addresses the symptoms without a clear way of addressing the root cause of the specific neurological condition. Interestingly, the onset of some of those neurological changes is closely connected in time with the development of perineuronal nets (PNNs), the specialized extracellular matrix structures that play a role in synaptic stabilization, plasticity and neuronal survivability in the adult brain. The brain resident immune cells, microglia, help to regulate perineuronal nets, and are responsible for their correct growth and function. Microglia also have been shown to regulate synapses, having a direct effect on learning and memory. Here we present our analysis of PNN development and microglia distribution in the hippocampus over the lifespan of 22q model mice.

Identification of Items Assessing Generativity and Ego Integrity in a Longitudinal Study of Aging

Olivia Duchow
Sponsor: Tomiko Yoneda, Ph.D.
Psychology

Generativity, the seventh stage from Erikson's psychosocial stages of development, is defined as the willingness to guide younger generations to promote generational wellbeing. The final stage, ego integrity, is characterized by an overall sense of life accomplishment. Although reminiscence therapy increases generativity and ego integrity, these constructs associated with health outcomes in older adulthood are unclear, as most work relies on experimental designs and small samples. Thus, we aim to develop a scale assessing generativity and ego integrity based on items administered to older adults in the Memory and Aging Project (MAP; N=~1700; Mage=65 years), which is a longitudinal study of older adults in the Chicago region with up to 24 annual measurements until death. Development of this scale will permit follow-up investigation of the impact of generativity and ego integrity on long-term health outcomes, such as incident dementia diagnosis. Based on existing literature, we identified numerous generativity and ego integrity scales (k=12). We then identified all potential items administered to MAP participants that may overlap with these items. Using ChatGPT, we identified conceptually overlapping items to create a novel scale assessing generativity and ego integrity in MAP. We will discuss the discriminant validity and test-retest reliability of this scale.

Evaluating Healthcare Trends and Disparities in Rural Communities: A Comparative Analysis of Annual Patient Data at the Knights Landing One Health Center

Adrian Duenas Ramirez
Sponsor: Brenden Tu, M.D.
Student Hlth & Counseling Svcs

The Knights Landing One Health Center (KLOHC) in Knights Landing, California delivers comprehensive healthcare services to its diverse rural and farmworking population. In recent years, KLOHC has generated annual patient reports measuring the quality of patient care. This research study performs a comparative analysis of patient data spanning the years 2022-2023 and 2023-2024, with an emphasis on several factors to identify trends and disparities, to inform targeted interventions aimed at enhancing the standard of medical treatment in Knights Landing. This quality improvement study will involve the comparison of data extracted from patient medical records within the specified time periods. Data parameters include patient demographics (age, gender, ethnicity, primary language, zip code), current diagnoses, treated medical conditions, prescribed medications, PHQ-9 scores, clinic appointments (in-person and telehealth), mental health and physical therapy consultations, laboratory examinations, and specialty clinic referrals. Statistical descriptions and correlations will be applied to identify patterns and inconsistencies between the two timeframes. The comparative analysis of patient data will provide valuable insights into demographic shifts, healthcare usage trends, and fluctuations in prevalent health conditions. By utilizing these findings, KLOHC can adapt its healthcare services, enhance targeted interventions, and improve health outcomes for its multifaceted patient demographic.

Characterizing the Trafficking of Human Proteins During Cell-Nibbling by the Pathogenic Amoeba *Entamoeba histolytica*

Aaron Dukes
Sponsor: Katherine Ralston, Ph.D.
Microbiology & Molec Genetics

E. histolytica infects millions a year, causing amoebiasis, an often fatal dysentery in developing countries. Our lab is investigating the parasite's pathogenesis. Trogocytosis is one way the amoeba consumes cells. Unlike phagocytosis, in which one cell is swallowed by another, trogocytosis is one cell biting off pieces of another. We have shown that the amoeba evades the host's immune complement system after trogocytosis. To hide, *E. histolytica* steals the host cell's complement regulatory protein CD59 and presents the negative regulator on its membrane. To determine how CD59 reaches the *E. histolytica* surface, we will use fluorescent live-cell imaging microscopy to track the localization of human CD59-mCherry-GPI during trogocytosis. We will clone CD59-mCherry-GPI into a lentiviral construct that will enable us to generate a stable expression of CD59-mCherry-GPI in human cells so that these cells can be used for live imaging studies. This will be done by using PCR to amplify the lentiviral vector and CD59-mCherry-GPI insert, and by using Gibson assembly to subsequently form the plasmid. To characterize the cloned plasmid, we will be using restriction digest and Sanger sequencing. After the transduction of human cells, we can then use live imaging to determine how *E. histolytica* processes CD59.

Purkinje Cell Arborization in an Animal Model of Autism

Jade Lin Dungca
Sponsor: Diasynou Fioravante, Ph.D.
Neuro Physio & Behavior

In addition to motor control, the cerebellum is now understood to modulate cognition and emotion[1,2] and to be an important target in cognitive and neurodevelopmental disorders[3]. *CHD8*, a gene associated with intellectual disability (ID) and autism, is expressed throughout the brain early in development[4] but its expression remains high well into adulthood only in the cerebellum. The roles of *CHD8* in cerebellar structure and function are not well understood. To address this question, we have launched electrophysiological/morphological analyses of the primary output neurons of the cerebellar cortex, the Purkinje cells (PCs)[5], in mutant mice with germline *chd8* haploinsufficiency[ref]. Our hypothesis is that synaptic inputs onto PCs and PC dendritic morphology will be impaired in *chd8*$^{+/-}$ mice compared to wildtype controls. Spontaneous excitatory and inhibitory synaptic inputs on PCs were assessed using whole-cell patch clamp recordings. At the end of recording, PCs were labeled with biocytin-streptavidin to visualize cell morphology and imaged. Z-stacks of confocal images spanning the whole dendritic arbor were acquired and underwent sholl analysis (ImageJ) for differences in dendritic complexity. Our analysis indicated that *chd8* regulates PC dendritic arborization and synaptic connectivity, with mechanistic implications for the cerebellum in ID and autism.

Intergenerational Trauma Amongst Vietnamese American Undergraduates

Tina Duong
Sponsor: Oanh Meyer, Ph.D.
MED: Neurology

Little is known regarding how culture and history impact the manifestations of intergenerational trauma (IT) in diverse populations affected by war, especially among refugee children and grandchildren. The purpose of this study was to determine if students with families affected by war trauma will have worse mental health outcomes. The sample includes Vietnamese American undergraduates who had at least one parent alive in Vietnam before 1975 and who had immigrated to the United States. Participants are administered a 30-minute psychosocial survey that assesses family history, parent-child relationships growing up, and current mental health of students. Thus far, we have a total of 47 participants: 17% male, 74% female, 8% other; mean age=19.30 years, SD=1.29. We predict that young adults whose parents were more exposed to war will report poorer mental health, less stability growing up, and more cultural dissonance or familial strain than those with parents less exposed to the war experience. This study will help set a foundation to improve upon for future IT work in all communities and allow for more culturally- and trauma- informed care.

Examining the Impact of Face Concern on Self-Disclosure among a Multicultural Sample

Akhhill Durainath
Sponsor: Nolan Zane, Ph.D.
Psychology

Face concern is a multidimensional concept wherein people of all cultures try to maintain and negotiate face in interpersonal communication revolves around the delicate balance individuals strive to maintain in preserving their self-image. Individuals attempt to maintain face to preserve their own self image. As such, face concern can affect the way we behave in society, including in therapeutic or clinical settings. The current study involves the transcription, review, and analysis of videotaped interactions between participants of varying ethnic backgrounds and a trained research assistant (confederate) to determine the impact of face concern on self-disclosure tendencies. Study participants (N = 372) completed a "Brick Test," a test for cognitive abilities, and were randomly assigned to receive either "fake" negative or neutral feedback about their performance on the test. The feedback process was recorded, and we are currently transcribing the audio recordings. We will conduct a thematic analysis of the qualitative transcripts this spring to generate initial codes and identify common themes. The implications of our qualitative results include gaining a deeper understanding of interactions between face concern and self-disclosure patterns among ethnically diverse patients, thus, empowering mental health professionals to develop more efficient and effective therapeutic intervention protocols for these patients.

Article 26 Backpack: Bridging the Digital Divide in Higher Education for Refugee and Displaced Students

Dheera Dusanapudi
Sponsor: Keith Watenpaugh, Ph.D.
Religious Studies

Article 26 Backpack aims to make the promise of the 26th article of the Universal Declaration of Human Rights achievable: quality higher education, accessible to everyone. Backpack, which currently supports over 4500 displaced students, was developed to meet the needs of displaced Syrian students pursuing higher education in neighboring countries, not only provides crucial document storage to students who may have limited safe places to store personal information, but also a wealth of scholarship and employment opportunities, free academic credentialing, and test vouchers. As a result of our experience working directly with refugee communities and alongside college counselors with lived experience of displacement, Article 26 Backpack has extensive knowledge of the barriers displacement presents to pursuing higher education. Our presentation will address Backpack's key findings over its seven years of work, examining programming models and survey results from Rwanda to Afghanistan to identify key points of difficulty that hamstring refugee students on their pursuit of higher education, among them the severe financial strain of application prerequisites and limited digital literacy and wifi access.

Exploring Biomarkers and Enriched Pathways in Idiopathic Pulmonary Fibrosis: AComparative Analysis in Patients With and Without Smoking History

Aashika Duvoor
Sponsor: Ching-hsien Chen, Ph.D.
MED: Int Med Nephrology (sac)

Idiopathic Pulmonary Fibrosis (IPF) is a chronic lung disease characterized by the thickening and scarring of lung tissue, and it currently lacks effective biomarkers for early detection. Cigarette smoking has been characterized as a major risk factor for IPF patients, prompting a study using whole blood samples for RNAseq analysis. Differential expressed genes (DEGs) from smokers and non-smokers with IPF were identified using the DEseq2 R package and subsequently analyzed in DAVID for pathway enrichment. In IPF smokers, downregulated pathways include Interferon gamma signaling, PLK-mediated events, p53 signaling, Phagosome, MDA-5 signaling pathway, and interleukin-27-mediated signaling. These pathways are associated with immune responses, cell cycle regulation, and fibrosis suppression. Dysregulation of these pathways may be pivotal in the accelerated progression of IPF exacerbated by smoking. Conversely, IPF non-smokers exhibited enrichment in pathways Regulation of Complement cascade, Interferon alpha/beta signaling, and JAK-STAT cascade, contributing to inflammation and chronic lung injury. Furthermore, several DEGs, associated with the enriched pathways, were identified as potential biomarkers for IPF diagnosis, including STAT1, STAT2, IRF7, CHEK1, and MSR1. This study not only illuminates potential biomarkers, considering smoking history, but also underscores pathways crucial to understanding IPF pathogenesis.

Calcium Signaling in Cerebellar Parabrachial Nuclei Pathways during Threat and Safety Assessment

Alicia Dye
Sponsor: Diasynou Fioravante, Ph.D.
Neuro Physio & Behavior

Survival in dynamic environments hinges upon an animal's capacity to predict danger and respond adaptively. Crucially, animals must also unlearn responses to stimuli no longer predicting threat. This learning process relies on the brain's ability to anticipate danger or safety, with the cerebellum playing a vital role in such assessments. The cerebellum's output nuclei (DCN) project to threat- and fear-processing centers via intermediary nodes, such as the parabrachial nucleus (PBN), influencing the acquisition of learned defensive behavior. However, our understanding of neuronal activation dynamics underlying threat and safety assessment remains limited.

This study aims to investigate the activation of DCN-PBN projections during both the acquisition and extinction of learned defensive behavior. I hypothesize that these projections are active during acquisition and extinction, which will be assessed using fiber photometry during a differential fear conditioning paradigm. By measuring fear-related defensive behavior and recording calcium signaling, this research seeks to elucidate the role of the DCN-PBN pathway in threat and safety prediction. The pattern of calcium activity during the presentation of threat and safety stimuli will contribute to our understanding of how and when such information is encoded by the brain.

Physiological Effects of Combined Drought and Salinity Stress on Four Commercially Available Pistachio Rootstocks

Shaina Eagle
Sponsor: Georgia Drakakaki, Ph.D.
Plant Sciences

Drought is becoming increasingly common in California. As water evaporates from the soil, excess salt ions are left behind. Resulting soil salinization compounds the negative effects of drought on crops. Pistachios are drought and salt tolerant compared to other perennial tree crops like almonds. Despite our understanding of individual drought or salt tolerance mechanisms, combined drought and salinity tolerance in pistachios have not been studied. We aim to quantify physiological effects of combined drought and salinity stress on four pistachio rootstocks. Rootstocks influence a tree's tolerance to below-ground stresses like drought and salinity. We observed that two hybrids – UCB1 and Platinum– were more tolerant than their parental cultivars *Pistacia integerrima* and *Pistacia atlantica*. After two months of treatment, UCB1 and Platinum seedlings had a higher proportion of plants with healthy leaf phenotypes, taller shoots, thicker trunks, and reduced leaf drop. Chlorophyll content and shoot water potential were not significantly different between cultivars, suggesting that photosynthesis was not severely impacted. This data in combination with root morphology and genetic analyses will inform which cultivars perform best under separate and combined drought and salt stress. Furthermore, this study could be used to develop orchard management practices in the face of climate change.

Measuring Visual Adaptation in the Human Brain

Daniel Egziabher
Sponsor: Steven Luck, Ph.D.
Psychology

Neuronal adaptation is the decline in neural responsiveness to a repeated stimulus. The visual N1, a negative ERP component, reflects this adaptation. The visual N1 is a negative ERP component in response to visual stimuli. Neuronal adaptation is detected by measuring changes in N1 amplitude after presenting two slightly different stimuli sequentially on the screen. Using a circular squarewave gradient as the optimal stimulus, we observed changes in N1 amplitude based on orientation differences. We hypothesize that the N1 amplitude will be significantly greater for larger differences in orientation and lesser for smaller differences in orientation. To test our hypothesis, we recorded EEG brain activity in 20 UC Davis students, presenting 8 orientation gratings 160 times in controlled sequences over five 10-minute blocks. To maintain attention, occasional real-life images were shown for valence rating. Our results support the hypothesis, revealing decreased N1 amplitude when the previous orientation is closer to the current one, with the smallest amplitude observed for identical orientations. We also observed a significant effect on visual P1, reflecting early visual processing. These findings are crucial, indicating N1 and P1 as tools for understanding cognitive deficits in schizophrenic patients, potentially revealing differences in N1 amplitude during adaptation.

Beyond Single Mating: Investigating Polyandry and Sperm Utilization in *Anopheles coluzzii* Mosquitoes and Their Implications for Gene-Drive Strategies

Omkar Ekbote
Sponsor: Gregory Lanzaro, Ph.D.
VM: Pathology, Micro, & Immun

Recent research challenges the belief that female *Anopheles* mosquitoes mate only once, suggesting they could be polyandrous (i.e. mate multiple times). The novel technology for malaria control using genetically engineered mosquitoes (GEMs) with gene-drive relies on successful mosquito mating behaviors, and female polyandry behavior could diverge from initial predictions of how gene-drives will spread in nature. Our study aims to investigate female polyandry rate and sperm utilization in *Anopheles coluzzii* under competitive mating setups using two molecularly identifiable strains, named MOPTI and MALI-NIH. First, we perform intra-strain crosses to establish baseline mating rates, followed by competitive inter-strain crosses to reveal female mating preferences and double mating frequencies. Mating status is determined by dissecting the female's spermatheca, then the sperm bundles are used for DNA extraction and molecular strain identification. Our results show no significant differences in baseline mating rates for the two strains of *Anopheles coluzzii*, demonstrating equal mating competitiveness. This could suggest that females mate multiple times and potentially use sperm from different mates; important to provide values for more accurate models to predict the behavior of genetically modified mosquitoes in nature.

The Relationship Between Perspective Taking and Peer Diversity: Moderated by Racial/Ethnic Identity

Shruti Elanthiraiyan
Sponsor: Adrienne Nishina, Ph.D.
Human Ecology

Perspective taking is the ability to understand situations from others' points of view and is related to higher conflict management, academic success, and relationship satisfaction, making it an important skill to understand. Additionally, more cross-ethnic friendships are associated with less prejudicial attitudes, possibly due to interactions that promote perspective taking. We hypothesized that a) more friend group diversity would be related to higher perspective taking, b) this relationship would be stronger for White students than students of Color and c) White students would have lower perspective taking than students of Color. We used a multiple regression to test the association between friend group diversity and perspective taking, moderated by student ethnicity, in a sample of 10th grade students from California and Oregon (50% male, 50% female; 30% White, 70% students of Color). We found that friend diversity did not predict perspective taking (β = .09, SE = .02, p = .06) and student ethnicity did not moderate the relationship between friend diversity and perspective taking (β = .07, SE = .04, p = .14). Identifying as White was related to lower perspective taking than identifying as a student of Color (β = -.13, SE = .06, p = .002).

Pyridostatin Causes Cell Cycle Arrest in G2/M in CH12 Mouse B Cells

Mehad Elshaikh
Sponsor: Irina Vaysertreyger, Ph.D.
Microbiology & Molec Genetics

DNA secondary G-quadruplex (G4) structures can impair and obstruct DNA replication, leading to replication stress, a common property of both B cell cancers and hyperproliferative premalignant cells. G4 stabilization increases the levels of apoptosis, decreases cell viability, and can cause cell cycle arrest in malignant cells thus hindering overall growth and reducing tumor size. Pyridostatin (PDS) is a G4 inducer and stabilizer that decreases the growth of cancer cells by inducing replication stress. Here, we define the role G4 structures play in inducing G2/M arrest in malignant CH12 mouse lymphoma B cells.

CH12 cells were treated with different PDS doses (1 uM, 2 uM, 5 uM, and an untreated control) for 48 hours, and then harvested. Using TUNEL assay we found that PDS caused mild apoptosis in CH12 cells. Similarly, PDS caused a mild dose-dependent decrease in cell viability. Using flow cytometry we analyzed the effect of PDS on the cell cycle and found that PDS causes a significant dose-dependent G2/M arrest in CH12 cells - 50% of cells were arrested in G2/M at 5 uM of PDS. These data suggest that PDS causes genomic instability in CH12 cells leading to extensive G2/M arrest.

Establishing Effective Laboratory Rearing Protocols for *Botryllus schlosseri*

Isabel Rose Enriquez
Sponsor: Dietmar Kueltz, Ph.D.
Animal Science

Botryllus schlosseri, a colonial marine tunicate, employs blastogenesis for its colonial expansion, a process occurring in weekly cycles. A colony comprises numerous zooids residing within a shared tunic, capable of exponential zooid proliferation and colony splitting under optimal environmental conditions. Establishing a reliable laboratory rearing protocol is crucial for the long-term study of *B. schlosseri*. Wecollected wild colonies and initiated breeding in the laboratory, subsequently rearing successive generations in artificial seawater. This study monitored the growth and health of tunicate colonies over several months post-fertilization across 30 genotypes. We observed a consistent expansion rate in colonial size, demonstrating the efficacy of our rearing method. This protocol facilitates a range of research projects previously unfeasible with wild colonies alone, including proteomic analyses of blastogenic stages. Genotypic verification was conducted using PCR, confirming the diversity of our samples. This research lays the groundwork for advanced studies in tunicate biology, offering insights into their developmental processes and genetic diversity.

Investigating *Ralstonia solanacearum* IIB-4 Host Colonization Traits

Ariana Enriquez
Sponsor: Tiffany Lowe-Power, Ph.D.
Plant Pathology

Ralstonia solanacearum species complex are soilborne plant pathogens that can infect and kill 400 different plant species, including economically important crops. In particular, the *R. solanacearum* IIB-4 strains are known to cause the destructive Moko disease epidemic in plantains, bananas, and *Heliconia* sp. in Central and South America in the 1960s. However, the underlying colonization mechanisms of the *R. solanacearum* IIB-4 strains are poorly understood. In this project, we use a pan-Genome-Wide Association (pan-GWA) mapping approach to identify the underlying colonization mechanisms of the *R. solanacearum* IIB-4 strains in the plant model tomato. This approach is based on statistically correlating the presence or absence of microbial genes to the tomato's disease response. Our pilot experiments have revealed the presence of colonization genes with diverse functions such as secondary metabolite biosynthesis, regulation of cellular processes, enzymatic activity, and horizontal gene transfer. This project will generate genomic-driven knowledge that helps accelerate the development of control measures.

The Effects of Soil Amendments on Nematode Indicators of Carbon Cycling

Saira Erfan
Sponsor: Amanda Hodson, Ph.D.
Entomology/Nematology

Soil amendments are widely utilized for improving various aspects of soil health, both physical and biological. Aerated compost tea (ACT), a mixture of water, compost, worm castings and nutrients, is recognized for its potential for fostering beneficial aerobic microorganisms, thus benefiting plant growth. Our study aimed to assess how ACT and composting combined with ACT impacted soil health indicators, olive yield, leaf nutrients, and the relationship of these indicators with nematode indicators of ecological function. Treatments showed variable effects on nematode communities. In one side of the orchard, ACT combined with composting reduced relative abundances of root feeding nematodes compared to controls, while on the opposite side, ACT increased the total number of nematodes and abundances of the bacterial feeding nematode, *Acrobeloides*, compared to controls. Leaf nutrient levels did not significantly differ, but ACT-treated trees had higher leaf nitrogen levels than compost-treated ones. Furthermore, ACT combined with composting increased olive yield compared to composting alone. Nematode indicators correlated with soil properties such as macroaggregates, microbial biomass carbon and areas rich in organic matter and nutrients. Overall, these findings suggest that aerated compost tea may elicit nutrient effects and highlight the relevance of nematode communities as biological soil health indicators.

Temporal Progression of Neuroinflammation and Neurodegeneration in a Monkey Model of Alzheimer's Disease

Carissa Erices
Sponsor: John Morrison, Ph.D.
MED: Neurology

Sporadic Alzheimer's disease (AD) is a fatal neurodegenerative disorder that predominantly occurs in older individuals. To better understand the degenerative phase of the disease, our group developed a Rhesus monkey model of tau pathology by injecting a viral vector carrying an aggregation-prone variant of human tau (AAV-2xTau) into the entorhinal cortex (ERC). We observed extensive spread of misfolded tau 12 and 24 weeks after the injection. Our next steps are to examine the earliest events occurring before the accelerated disease. We looked at the ERC and hippocampal formation (HF) of animals 6 weeks post-injection. Combining high-resolution quantitative microscopy with a longitudinal collection of fluid biomarkers, we observed several tau pathology-associated markers but less microglial and astrocytic activation than present at 3 months. Tau pathology was mostly associated with early signs of neuroinflammation, including the presence of activated microglia, just in the vicinity of ptau+ neurons. These results likely reflect the earliest stage of tau propagation and neuronal dysfunction, preceding the frank neurodegeneration and exacerbated neuroinflammation and glial recruitment observed at more advanced stages of the disease. Taken together, these results reinforce the potential of the present animal model as a proxy for early events in the tau pathology cascade.

Investigating the Molecular and Cellular Basis of Smith-Kingsmore Syndrome

Shea Erler
Sponsor: Joanna Chiu, Ph.D.
Entomology/Nematology

Smith-Kingsmore Syndrome (SKS) is a rare, neurodevelopmental brain disorder with symptoms ranging from macrocephaly to sleep disruption. SKS was discovered in 2013 and is caused by a mutation in the gene *Mechanistic Target of Rapamycin (mTOR)* and currently has no FDA-approved treatment. This gene plays a crucial role in regulating cell growth and metabolism, but the connection between *mTOR* mutations and SKS isn't well understood, hindering the development of therapeutic interventions. This is partly because no animal models exist to study these mutations. Therefore, we developed *Drosophila* models of SKS to better understand SKS's molecular and cellular mechanisms, focusing on how *mTOR* mutations cause sleep defects. Sleep disruption is a main concern for families and caretakers of SKS patients. We hypothesize that *mTOR* mutations found in SKS patients result in hyperactivity of the mTOR protein, causing sleep disruption due to the gene's involvement in modulating key proteins regulating sleep. Using Rapid Iterative Negative Geotaxis (RING) to investigate the association between *mTOR* and activity, we aim to gain new insights into how *mTOR* variants affect sleep and understand the mechanisms underlying SKS symptoms. Our results will ultimately pave the way to new therapeutic interventions that can improve patient's health and well-being.

Early Fixations Across Learning During 3D Visual Search

Eliana Ertsey
Sponsor: Joy Geng, Ph.D.
Psychology

Previous research on visual search, predominantly utilizing simple 2D displays and short trials, revealed that search efficiency improves with repeated exposure to the same environment. However, the generalizability of these findings to more complex, naturalistic settings remains uncertain. This study investigates the impact of participants' curiosity, measured by the Curiosity 5-Dimension Scale, on their visual search behavior in a virtual reality (VR) furniture store over repeated search trials. By tracking eye and position movements, we explore how early eye movements, search initiation times, and responses to distractions evolve as participants learn the spatial layout and task. Our findings indicate a significant decrease in the number of initial fixations in the entryway across trials, suggesting that participants learn to initiate their searches more efficiently. Further analyses aim to assess the contribution of exploration patterns and trait curiosity to search initiation behaviors. This research enhances our understanding of visual search dynamics in three-dimensional settings, highlighting the complex interplay between cognitive processes, curiosity, and learning in search efficiency.

An Empirical Study of Student Confidence and Time Allocation in Chinese L2 Learning

Yvette Esteban
Sponsor: Chengzhi Chu, Ph.D.
East Asian Lang. & Cultures

This paper presents an empirical study on the varied challenges experienced by students in learning Chinese as a Foreign Language (CFL). The study is based on a survey conducted among CFL students at the University of California, Davis. It focuses on four key questions: (1) The perceived difficulty and comfortability among CFL students in learning different facets of Chinese knowledge and skills. (2) The student reported time allocation dedicated to these different facets and how it relates to their comfort level in each area. (3) The alignment between students' study time allocation and teachers' expectations, as reflected in the curriculum. (4) Students' perspectives on the feasibility of adjusting their study time allocation in Chinese learning. Data was gathered through an online survey administered over two quarters in two academic years, with a participant pool of 57 L2 Chinese students. The survey covered eight key knowledge and skill areas: Handwriting Characters, Typing Characters, Vocabulary, Grammar, Listening, Speaking, Reading, and Composing Essays. The study aims to provide an empirical understanding of student's perspectives on the difficulty, confidence level, and time distribution in various learning aspects of Chinese. The findings are expected to inform improvements in CFL curriculum design and pedagogical strategies.

Temperature Dependent Hypocotyl Elongation Phenotypes in *Arabidopsis elf3* Mutants Complemented with Sunflower *ELF3*

Kaila Esters
Sponsor: Stacey Harmer, Ph.D.
Ag Plant Biology

The plant circadian clock regulates flowering time and growth to coordinate these processes' daily variations in the environment. *EARLY FLOWERING 3 (ELF3)*, a core component of the circadian system in *Arabidopsis thaliana*, has been shown to control thermoresponsive growth through inhibiting elongation growth at lower temperatures and triggering elongation growth at higher temperatures. In domesticated Sunflower *(Helianthus annuus)*, circadian regulation of several processes has been described, but little is known about whether the *ELF3* homolog *HaELF3_3* is involved in thermoregulation. We identified an allele of this gene, Ha*elf3_3,* which bears a missense mutation that is predicted to affect the disorder of the protein. We seek to quantify the function of wild type and this mutant *HaELF3* allele across temperatures. Since temperature-dependent phenotypes are best-characterized in *Arabidopsis*, we complemented *Arabidopsis* plants that do not make any functional *ELF3* protein with wild-type and mutant versions of *HaELF3*. Hypocotyl elongation was quantified at two temperatures. We hypothesize that the predicted lower disorder of the mutant allele should allow for stronger inhibition of hypocotyl elongation at higher temperatures, leading to smaller differences in hypocotyl length across temperatures in plants expressing the mutant *Haelf3* allele compared to those expressing wild-type *HaELF3*.

Evaluating Misconceptions in Prenatal Nutrition Recommendations in College Students

Keila Estrada
Sponsor: Debbie Fetter, Ph.D.
Nutrition

Nutrition during gestation plays a vital role in both fetal development and health during pregnancy. Adverse health outcomes associated with poor prenatal nutrition include low birth weight, fetal micronutrient deficiencies, and neurodevelopment issues. Health before conception is also strongly linked to the outcome of pregnancy. However, nearly half of pregnancies are unintended, which means the pregnant person may not have adequate nutritional status to support a healthy pregnancy. Currently, there is no data reflecting pregnancy-related nutrition knowledge of college students, a population of individuals who fall within the reproductive age. The purpose of this study is to measure pregnancy-related nutrition knowledge amongst undergraduate college students. In winter 2024, students enrolled in an introductory nutrition class at UC Davis will be asked to complete the Pregnancy Nutrition Knowledge Questionnaire (PNKQ). Frequency of response for each question will be compared between demographic variables. The results can be used to create educational intervention programs to fill the existing knowledge gap among this age group.

Analyzing the Potential of IMU Motion Capture To Advance ASL Research

Jack Fagan
Sponsor: David Corina, Ph.D.
Linguistics

The exploration of American Sign Language and other visual languages presents unique challenges in research primarily due to their visual medium. Inertial Measurement Unit (IMU) motion capture shows promise in gaining a more holistic understanding of visual language processing, and our project's goal is to explain the benefits and potential applications of this technology in the future. By making use of acceleration and time data recorded by the motion capture technology, we can correlate the movements of a signer to EEG activity, and gain insight into the exact moment a movement conveys meaning to the viewer. Similarly, because the IMU motion capture data is recorded in a 3D space, we avoid limitations that are associated with 2D recordings, such as image occlusion. We can also manipulate the space to show different frames of reference and see how this influences EEG activity and learning in children. The final major benefit of IMU motion capture is that 3D creation software like Blender enables the manipulation of natural human movements into impossible movements and inhuman avatars. By using IMU motion capture, we will be able to explore the potential for a more holistic approach to capturing the intricacies of visual language processing.

Exploring Enzymatic Detoxification Mechanisms of Botrytis Cinerea via Isoflavones

Lucca Faieta
Sponsor: Dan Kliebenstein, Ph.D.
Plant Sciences

Botrytis cinerea is a necrotrophic fungal pathogen that infects a wide array of plants. Plants use unique specialized metabolites to attack the pathogen, which in turn must detoxify these defense compounds for successful infection. However, many of these diverse detoxification mechanisms are not fully understood. From previous studies, we hypothesized an enzyme in the pathogen that may demethylate plant metabolites as a generalized detoxification mechanism. We tested this enzyme on two isoflavones, compounds found in beans that function in defense. To test the activity of this enzyme, we used four isolates of *B. cinerea* to account for genetic diversity. We grew liquid cultures of the pathogen and spiked them with pure isoflavones. We sampled the liquid culture across a time course and analyzed it using liquid chromatography. We saw the active conversion of toxic defense compounds into demethylated analogs over time. To corroborate that the conversion is fully associated with the enzyme, we will perform RNAi to knockdown the gene in vitro and also test the enzyme on other plant metabolites across other *B. cinerea* hosts.This experiment is critical in explaining plant-fungal interactions and in testing the broad nature of detoxification in generalist pathogens.

Perception of Emotional Qualities in Shape-Based Animation

Chuyi Fang
Sponsor: Michael Neff, Ph.D.
Cinema & Digital Media

Character animation in the present day places heavy emphasis on using facial expressions and gestural movements in displaying the emotional qualities of human-like characters, but few explore the emotional expression for shapes as a separate subject. To fill this gap, this study examines the ability to perceive emotions within shape-based character animations, as well as the impacts that timing, condition, and deformation may bring to the perception of its emotional qualities. Using the PAD (Pleasure, Arousal, Dominance) model of measuring emotional states, four surveys are being designed, comparing animated stimuli with varied attributes in the timing, condition, and deformation of a ball character. Responses will be collected detailing the rating and description of the perceived emotions within each stimulus. Through initial experimentations with animation attributes, the complexity of a character's emotional state seems to be reduced to a more generalized interpretation, but still perceivable when presented in a shape form. This demonstrates the capacity of animation to generate lively, sympathetic characters in the absence of facial expressions and observable limbs. In further analysis of future survey results, this study aims to enrich the understanding of emotional display within shape-based characters, as well as the perception of emotion through motion.

Naphthalene Toxicity in Female Juvenile Mouse Lung and Impact of Ergothioneine Pre-Treatment

Isaul Flores
Sponsor: Laura Van Winkle, Ph.D.
VM: Anat Physio & Cell Biology

Biological disparities between males and females, along with age-specific susceptibilities, significantly affect how lungs respond to toxic substances. Naphthalene (NA), commonly found in wildfire smoke and vehicle emissions, poses a risk to respiratory health. Previous studies have shown increased toxicity in lung epithelial club cells of the conducting airways following NA exposure in adult mice. These cells produce club cell secretory protein (CCSP), which defends against oxidative stress. Ergothioneine (ET), a dietary antioxidant, was investigated as a potential protective pre-treatment. This study aimed to investigate whether ET could mitigate NA-induced club cell toxicity, focusing on juvenile female mice. Female mice (N=3/group) received oral ET (70 mg/kg) or saline control (SA/CO) for five days. Two experimental groups (ET/NA; SA/NA) were also given the same treatments and then all mice were injected with 150 mg/kg NA intraperitoneally, and lung tissues were examined after 24 hours. Histopathology and unbiased stereology were used to quantify epithelial changes. Preliminary findings suggest that the SA/NA group showed increased vacuolated club cells, while the ET/NA group exhibited intact, healthy cells. This implies that ET can alleviate NA-induced toxicity in the proximal airways of juvenile female mice.

Improving Laboratory Pig Welfare: Comparing Stress Behaviors between Pigs With and Without Positive Reinforcement Training

Esther Feinstein
Sponsor: Jamie Peyton, D.V.M.
VM: One Health Institute

In laboratory research, pigs are a valuable model that undergo medical procedures and daily handling. These occurrences can increase their stress levels and impact their overall welfare. In addition, this can negatively impact scientific results and affect the safety of the handlers and husbandry personnel. Therefore, our hypothesis was that Positive reinforcement (PR) using clicker training may reduce stress and increase animal welfare. This observational study aims to compare stress behaviors in laboratory pigs with and without positive reinforcement training, directly after being transported and in normal housing conditions. This was accomplished by recording the pigs during transport and housing and having 4 individual reviewers score the videos. We found that directly after transportation, pigs with PR training had a lower frequency of high frequency vocalizations, steps taken forward and backward, and a higher frequency of sitting. Hence, pigs with PR training exhibited less stress behaviors than the pigs without PR training. Therefore, based on our study, we recommend implementing a PR training program for pigs used in laboratory research to continue to improve animal welfare, maintain valid scientific results, and ensure handler safety.

Predictive Modeling Reveals a Concern for Zinc Deficiency in First-Year, Female Vegetarian UC Davis College Students

Sheyla Flores-Martinez
Sponsor: Andrew Hall, Ph.D.
Nutrition

Zinc is an essential micronutrient and is a common deficiency. US Dietary recommendations do not account for reduced zinc bioavailability of plant-based diets. Our objective was to estimate zinc absorption of a vegetarian, female UC Davis first-year college student living in student housing and explore the potential effects of reduced phytic acid on zinc bioavailability. We based our calculations of zinc absorption on a dietary pattern recommended by the UC Davis Dining Commons (DC), assuming an 18 year old female. We calculated the zinc, protein, and calcium content based on values from the USDA Database of Standard Reference and phytate based on World Health Organization values. We calculated zinc absorption using Miller's 2013 model with and without phytate reduction. We estimated risk for zinc deficiency in relation to the Institute of Medicine physiological requirement for absorbed zinc. We found phytate content decreases zinc bioavailability of the recommended UC Davis diet. Phytate reduction would decrease the risk for zinc deficiency of female vegetarians consuming the recommended DC diet. This predictive modeling indicates a concern for zinc deficiency and, given the importance of zinc in health, warrants further research on the potential for zinc deficiency in this population.

Accessibility and Inclusion in Outdoor Recreation Activities

Greta Foehr
Sponsor: Yael Teff-Seker, Ph.D.
Sociology

This research examines the culture of outdoor recreation activities and how they are experienced differently by different groups, specifically by non-white participants. People of color have historically been excluded from these spaces. Socially and culturally, outdoor recreation activities have been portrayed as the purview of "white people" through ads, lived experiences, and demographics of current participants. There is little research on the cultural effect of the lack of representation in outdoor recreation for non-white publics. This study examines whether outdoor recreation environments are perceived to be unwelcoming spaces for non-white potential participants, and whether this further perpetuates a white hegemony in these spaces. I distributed a survey with a goal of 200 responses (currently at 180), and will conduct 15 interviews (7 already conducted). Preliminary findings and analysis suggest that outdoor recreation spaces do lack non-white representation, with some participants of color reporting feeling unwelcome, financially unable to participate, or hesitant to participate because of the lack of minority representation in said spaces. These findings indicate the need to address the narrative about who belongs in outdoor recreation spaces, and to make these spaces more welcoming to diverse populations, ideally in a process of co-creation.

Dichotomizing β1AR and β2AR Signaling Pathways Contribute to Nuclear cAMP

Kacie Fong
Sponsor: Yang Xiang, Ph.D.
MED: Pharmacology

Heart failure (HF) is a chronic condition characterized by impaired cardiomyocyte contraction, leading to decreased oxygen and nutrient availability, and eventually death. In HF, desensitization of the β-adrenergic receptor (βAR) results in decreased levels of cAMP, leading to downstream signaling consequences such as reduced cAMP-induced contraction. Stimulation of β1AR and β2AR contributes to the production of subcellular cAMP; however, the mechanisms that differentiate between the two receptor pathways are not fully understood. We have previously established the vital role of the GRK2-Arr3-PDE4D5 in β2AR-induced nuclear cAMP. Here, we have shown that only β1 nuclear cAMP signaling is sensitive to soluble adenylyl cyclase (sAC), which is activated by calcium, suggesting these two receptors may increase nuclear cAMP via independent pathways. We hypothesize that β1AR promotes nuclear cAMP through calcium release via the PLC-IP3R-sAC pathway whereas the β2AR induces nuclear cAMP through endocytosis. To test this hypothesis, FRET-based subcellular cAMP biosensors were transfected into Hek293 QBI cells and subsequently probed with various pharmacological inhibitors. Future experimental validation in cardiomyocytes of these pathways will allow for potential therapeutic approaches to rescuing the cAMP signal in patients with HF.

Pioneering Progress: Black Women's Activism and Community Building in Early Oakland

Jane Fogarty
Sponsor: Gregory Downs, Ph.D.
History

Beginning in the mid-nineteenth century, Black women in Oakland worked to found schools, social clubs, and churches. Historians have concluded that Black women contributed tremendously to institution-building, pioneering social and political change as educators and activists. Building on the literature of historians such as Michelle Mitchell and Martha Jones, my study examines gendered activism from the 1870s through the early twentieth century in the East Bay. During this period, the South, and to an extent, the East Coast grappled with Jim Crow laws and widespread, deeply-rooted racial segregation. I ask whether Oakland's small population affected their work and whether acknowledging the struggles on the West Coast changes the narrative around Black female activism during the turbulent Reconstruction period. I analyze primary news sources and writings from several lesser-known early Black female reformers, namely, Mary Sanderson-Grases, Elizabeth Thorn Scott Flood, and Ida Louise Jackson to track a chronological shift from grassroots activism and subtle resistance to a more unified and explicit approach to racial progress, with class differences within the movement creating supplemental tensions. While Black men largely receive credit for legislative and representative advocacy work, their female counterparts kept sites of community uplift afloat in the growing city.

Sterilization as a Contraceptive Method: An Empirical Analysis of the Impact of Catholic Hospital Market Share on Estimated Demand of Contraceptives & Sterilization Procedures

Simona Forster
Sponsor: Richard Kravitz, M.D.
MED: Int Med - Genl Medicine

Contraceptive use varies across the United States. Sterilization is the most common contraceptive method in this country, often used by fertile women who have completed their families. Although religious beliefs are strongly associated with attitudes toward contraception, there is little research on the relationship between religious hospital coverage and the use of sterilization as a contraceptive method. This empirical study aims to fill that gap by analyzing the relationship between the proportion of hospital beds operated by Catholic healthcare organizations in a given state to sterilization procedures and the potential demand for contraceptives in that state, using linear regression. I hypothesize that states with a greater percentage of Catholic hospital beds will have a lower number of sterilizations per capita, a greater number of women of childbearing age seeking to avoid pregnancy, and higher usage of less effective temporary contraceptive methods. However, preliminary results show the Catholic hospital market share is not the primary predictor of the contraceptive demand or sterilizations, pointing to other factors such as Democratic vote share. The changing legal landscape of reproductive health necessitates more research to inform lawmakers about the implications of factors such as religious affiliation and local political affiliation on reproductive access.

The Economics of Anaerobic Digester System Implementation on Dairy Farms Across the US

Allyson Francisco
Sponsor: Daniel Sumner, Ph.D.
Ag & Resource Economics

On-farm methane production from the anaerobic digestion of dairy manure and organic compounds into biogas and digestate has expanded over the past two decades with increased incentives to reduce greenhouse gas (GHG) emissions. Biogas is utilized as renewable natural gas, electricity generation, and transportation fuel, while digestate is used as fertilizer. Little empirical economic research to date considers positive and negative externalities that drive the adoption of digesters. Determining what effects implementation will help improve digester feasibility and encourage dairy farmers and third parties to finance a digester system. This study models digester adoption across counties and years in response to farm characteristics, market incentives, regulations, subsidies, and related costs and benefits. The economics of digester adoption evaluates long-term investment considerations, manure handling costs, biogas markets, and government programs. My econometric explanation draws on a unique data set of all dairy digesters, approximately 300, across 500 US counties from 1997 through 2022. Then, I created the dependent variable with data from the US EPA AgStar digester database and USDA dairy farm characteristic database. My econometric model relates exogenous farm and county explanators to the dependent variable, the share of cows on farms with a digester in each county.

Article 26 Backpack: Bridging the Digital Divide in Higher Education for Refugee and Displaced Students

Heavenly Frazier
Sponsor: Keith Watenpaugh, Ph.D.
Religious Studies

Article 26 Backpack aims to make the promise of the 26th article of the Universal Declaration of Human Rights achievable: quality higher education, accessible to everyone. Backpack, which currently supports over 4500 displaced students, was developed to meet the needs of displaced Syrian students pursuing higher education in neighboring countries, not only provides crucial document storage to students who may have limited safe places to store personal information, but also a wealth of scholarship and employment opportunities, free academic credentialing, and test vouchers. As a result of our experience working directly with refugee communities and alongside college counselors with lived experience of displacement, Article 26 Backpack has extensive knowledge of the barriers displacement presents to pursuing higher education. Our presentation will address Backpack's key findings over its seven years of work, examining programming models and survey results from Rwanda to Afghanistan to identify key points of difficulty that hamstring refugee students on their pursuit of higher education, among them the severe financial strain of application prerequisites and limited digital literacy and wifi access.

Evaluating the Function of CHD4 on Oocyte Meiotic Progression During Ovarian Reserve Formation

Amelia Fritz
Sponsor: Satoshi Namekawa, Ph.D.
Microbiology & Molec Genetics

A female's reproductive lifespan relies on her ovarian reserve. In humans, the ovarian reserve is maintained for several decades by oocytes arrested in the dictyate stage of meiosis I. The oocyte remains in a dormant state and meiotic arrest in this stage. This preserves the limited oocytes a female has for reproduction. During this dormant state, the oocyte may maintain a repressive chromatin state, such as transcription repression, independent of DNA methylation. It was previously unknown whether CHD4, a repressive chromatin remodeler, was essential for maintaining the ovarian reserve. In our previous experiments using mouse models, we found that CHD4 is essential for ovarian reserve maintenance. This study focused on whether CHD4 affects meiotic progression during ovarian reserve formation. Here we hypothesized that the disruption of meiotic progression due to CHD4 deficiency would result in failure of ovarian reserve formation, since it had previously been found that CHD4 deficiency in oocytes results in failure of ovarian reserve formation. The results of immunofluorescence staining of SYCP3, a meiotic marker, showed no change in meiotic progression with CHD4. We conclude that CHD4 does not affect meiotic prophase I progression but is required for ovarian reserve formation.

Bioengineered miRNAs Suppress Growth of Human Non-Small Cell Lung Cancer Cells

Rayna Fukumoto
Sponsor: Aiming Yu, Ph.D.
MED: Biochem & Molecular Med

The 5-year relative survival rate for patients with non-small cell lung cancer (NSCLC) is approximately 28%. Understanding of lung cancer-associated, tumor-suppressive microRNAs (miRNAs or miRs) provide insight into developing new possible therapies for the treatment of NSCLC. However, current research and development uses highly modified miRNAs and made *in vitro* that may no longer represent natural miRNAs produced *in vivo*. Thus, our laboratory has established an innovative, *in vivo* RNA molecular bioengineered technology to offer functional miRNAs (BioRNA/miRNAs) to better represent natural miRNAs. In this study, we assessed the effects of two model BioRNA/miRNAs, namely miR-7-5p and miR-124-3p, on human A549 NSCLC cell viability. By using an Incucyte Live-Cell Imaging System to monitor cell growth, our data showed that introduction of both BioRNA/miRNAs sharply reduced cell confluence over time, as compared to controls. The results indicate the effectiveness of bioengineered miR-7-5p and miR-124-3p in the control of human NSCLC cell growth. The success of this BioRNA technology to produce functional miRNAs capable of reducing NSCLC cell viability may provide the basis for further development of novel therapeutic RNAs to combat lethal NSCLC.

CRISPR Knockdown of Bed Nucleus of the Stria Terminalis Oxytocin Receptors and its Effects on Social Approach and Vigilance

Liam Gaard
Sponsor: Brian Trainor, Ph.D.
Psychology

Social anxiety disorder is the most widespread form of anxiety disorder in the United States. Unfortunately, ~40% of affected individuals who seek existing treatments do not respond, making new therapeutic approaches essential. Oxytocin is a well-known mediator of social behaviors, with previous research finding that it can inhibit or enhance social approach and anxiety. We hypothesize oxytocin acts in the mesolimbic dopamine system to promote social approach, whereas oxytocin acts in the bed nucleus of the stria terminalis (BNST) to enhance social anxiety. Previous research has used oxytocin receptor agonists and antagonists to determine how these receptors modulate behavior. Pharmacological manipulations targeted receptors on both axon terminals and cell bodies. To determine the contribution of receptors expressed on cell bodies, will use CRISPR gene editing to knockdown oxytocin receptors locally produced in the BNST in female California mice. This approach allows us to determine the extent to which post-synaptic function change affects behavior. After CRISPR delivery, social behavior will be assessed both before and after social defeat testing. We will determine the effects of CRISPR gene knockdown on social behavior both before and after social stress exposure. These data will provide new insights into how oxytocin receptor modulates social behavior.

p53 and 53BP1 Interactions in *C. elegans*

Simranpreet Gakhal
Sponsor: Joanne Engebrecht, Ph.D.
Molecular & Cellular Bio

The tumor suppressor p53 protein influences gene expression by acting as a transcription factor for cell-cycle arrest and DNA-repair genes. 53BP1 was identified as a p53 binding protein and regulates DNA double-stranded break repair by promoting non-homologous end joining. In *Caenorhabditis elegans*, the 53BP1 homolog, HSR-9, also influences DNA repair pathways. Previous work found that HSR-9 promotes apoptosis when double-stranded breaks are induced by irradiation in the same pathway as CEP-1, which is the p53 homolog in *C. elegans*, but their interaction remains unclear. Here we examine potential interactions between CEP-1 and HSR-9 proteins using the yeast two-hybrid system and in *C. elegans* germ cells. We constructed yeast vectors containing CEP-1 and HSR-9 and are currently analyzing the interaction in yeast using the *his3* reporter gene. We also examined whether the localization of GFP::HSR-9 is altered in the absence of CEP-1. GFP::HSR-9 is chromatin-associated and enriched on the X chromosome in wild type. In *cep-1* mutants, we also observe GFP::HSR-9 associated with chromatin and enriched on the X chromosome. These results suggest that CEP-1 is not essential for chromatin association of HSR-9. Together, our studies may provide insight into the relationship between these conserved tumor suppressor proteins.

Ectomycorrhizal Symbiosis Improves Water Relations in Douglas-fir Drought

Demorie Galarza
Sponsor: Laura Bogar, Ph.D.
Plant Biology

Californian landscapes face worsening droughts and heat stress due to climate change, impacting agriculture and forest survival. This project investigates how symbiotic fungi, ectomycorrhizae, affect plant response to drought and heat stress, on seedlings of Douglas-fir, a dominant forest tree in many parts of Northern California. Using lysimetry, a method to measure plant hourly water usage, subsets of Douglas-fir seedlings were assessed with either no fungal symbiont, one fungal species or two fungal species. Plant and fungal gene expression was sequenced in symbiotic roots to identify genes related to drought response and reveal how fungal symbiosis shifts plant gene expression during water-stress. Thus far, initial findings in analyzing lysimetry data have shown that two fungal species helped improve water relations during a short-term period of drought by an estimated 1-8%. Understanding the role of symbiotic fungi in plant stress tolerance will not only improve our ability to predict changes in forest mortality rates and tree productivity with climate change; it will also lay the foundation for creating transgenic crops through molecular breeding, thus improving agricultural practices, and optimizing the yield of crop products under the warmer, drier climate of modern California.

Dietary Factors and Prevalence of Cardiovascular Disease in the Punjabi Sikh Community

Maria Galarza-Gonzalez
Sponsor: Debbie Fetter, Ph.D.
Nutrition

Cardiovascular disease (CVD) is the leading cause of death worldwide. Factors that increase risk of CVD include diabetes, hypertension, and hypercholesterolemia. Cardiovascular disease is especially prominent within the Punjabi Sikh population. However, there is a dearth in the literature with regards to evaluating health-related factors in this specific population. To investigate the association between dietary factors and CVD risk, a questionnaire was administered at one Sikh Gurdwara Sahib in Sacramento. The survey included demographics, medical history, and self-reported dietary intake. Of the 163 respondents, 101 (62%) reported having at least one CVD risk factor. Cardiovascular disease risk was associated with low fruit intake and high intake of vegetables, starch, grains, whole grains, milk, beans, sugar beverages, and sodium. Individuals with a risk factor also had lower diet quality scores (P<0.05). A penalized logistic regression model was used to further analyze associations between CVD risk and predictor variables. It was found that weight, less than 12th grade education level, and sugar-sweetened beverages raise the odds of CVD risk. Knowledge of specific CVD risk factors in the Punjabi Sikh population is essential to improving health education and preventative care initiatives.

Isolation of Starch Hydrolyzing Bacteria from Bioplastic Used in Biosolarization

Adan Gallo Lopez
Sponsor: Christopher Simmons, Ph.D.
Food Science & Technology

Developing agricultural markets' need for cheap and reliable materials leads to an increasing need for plastics. Producer and consumer efforts have increased bioplastic use, but their substrate contribution post-biodegradation is unknown. Biosolarization, an agricultural biocontrol technique which uses plastic film to trap solar radiation to increase temperature and organic amendments to accumulate biopesticides, is being used as a case study to assess the usage of bioplastics as an alternative to polyethylene (PE) film. We hypothesize environmental conditions created by biosolarization will create conditions that select for bioplastic degrading microbes. We isolated bacteria from bioplastic film samples exposed to biosolarized soils in the field and lab. Iodine assays were run on bacterial isolates taken from the bioplastics and grown on starch agar medium showing that 21 of the 24 isolates from 3 month and 6 month points had the ability to hydrolyze starch. To determine if this starch hydrolysis ability carries over to bioplastic degradation, we are currently molecularly identifying the bacterial isolates and will characterize bioplastic degradation using liquid culture screening.

Analyzing the Potential of IMU Motion Capture to Advance ASL Research

Elias Garcia
Sponsor: David Corina, Ph.D.
Linguistics

The exploration of American Sign Language and other visual languages presents unique challenges in research primarily due to their visual medium. Inertial Measurement Unit (IMU) motion capture shows promise in gaining a more holistic understanding of visual language processing, and our project's goal is to explain the benefits and potential applications of this technology in the future. By making use of acceleration and time data recorded by the motion capture technology, we can correlate the movements of a signer to EEG activity, and gain insight into the exact moment a movement conveys meaning to the viewer. Similarly, because the IMU motion capture data is recorded in a 3D space, we avoid limitations that are associated with 2D recordings, such as image occlusion. We can also manipulate the space to show different frames of reference and see how this influences EEG activity and learning in children. The final major benefit of IMU motion capture is that 3D creation software like Blender enables the manipulation of natural human movements into impossible movements and inhuman avatars. By using IMU motion capture, we will be able to explore the potential for a more holistic approach to capturing the intricacies of visual language processing.

Behavioral Consequences of Separation Distress in Prairie Voles (*Microtus ochrogaster)*

Jas Ganev
Sponsor: Karen Bales, Ph.D.
Psychology

Prolonged loneliness can have pernicious effects on health, and is associated with manifestations of various stress behaviors. Studying species like prairie voles informs our understanding of human behavior and biological processes. These rodents are a model organism for exploring social affiliations and pair bonds, key behaviors in humans. Voles exhibit characteristics associated with many pair-bonding species, such as showing a preference for their partner compared to a stranger, engaging in affiliative behaviors like allogrooming (where one vole uses its tongue, mouth, or paws to brush the other vole's body), and exhibiting distress when separated from their partner. In this study we observed adult voles, around three months old, that experienced varying social circumstances: either living alone, in vasectomized pairs, in reproductively intact breeder pairs, or with a same-sex sibling. We examined behavior when the voles were together in their home cage versus separated. We predict that pair-bonded voles will exhibit more stress-related behaviors when separated from their pair-mate, than will a vole separated from their sibling. Isolated voles may have the highest levels of stress-related behaviors, or the lowest if they have habituated to their lack of social interaction.

Cytoskeletal Regulation by Rho GTPase Pathway in Long-Lived Aimes Mice

Massie Gardizi
Sponsor: Aldrin Gomes, Ph.D.
MED: Physiology & Membrane Biol

Ames dwarf mice are commonly used in laboratories to study the mechanisms of extended longevity, as they exhibit increased lifespan compared to wild-type mice with the same genetic background. Using proteomics, one of the pathways found to be altered in Ames's mice was the Rho GTPase Pathway, as compared to wild-type mice. Rho GTPases, including RhoA, Rac1, and Cdc42 (the most extensively studied), directly or indirectly influence myosin activation and the assembly/disassembly of filamentous actin. These GTPases play a crucial role in the creation of lamellipodia and filopodia regions, and thus are vital to cell migration. Moreover, research has demonstrated that ROS-damaged DNA can induce Rho-activated repair in fibroblasts through cytoskeletal rearrangement. Dysregulation of Rho GTPases is a common feature in the etiology of many degenerative disorders, and therapeutic interventions have successfully targeted these GTPases. Aging in mammals involves the long-term deterioration of stem cells, associated with intracellular downstream effectors of obese state pathways such as insulin, IGF-1, and leptin signaling. In Ames mice, proteins associated with the Rho GTPase Pathway—Vasp (vasodilator-stimulated phosphoprotein), Myh's (myosin heavy polypeptide) 7B, 9, 11, 14, and myosin light chain kinase—were upregulated, while Myh's 1, 2, 4, 6, 7, 8, and 13 were downregulated.

Synthesis and Optimization of Thermoelectric Performance of Zintl Eu_3ZnAs_3

Delaney Gash
Sponsor: Susan Kauzlarich, Ph.D.
Chemistry

With the constant energy demands of a growing society, thermoelectric materials provide an alternative and efficient energy supply by converting heat to energy. With thermoelectrics, energy previously lost in the form of heat can be utilized and converted into usable electrical energy. Of these thermoelectrics, efficiency is demonstrated with a high electrical conductivity and a low thermal conductivity. The performance and electrical conductivity of thermoelectric materials is known to be enhanced with elemental doping which is a potential approach to materials with improved properties. Uniform distribution of the elements is a challenge in solid state synthesis of phase pure compounds.Though high energy ball milling helps in this regard, the loss of elements due to cold welding to the milling vial makes the composition deficient of certain elements. Binary precursors have been used to address this issue. In this work, we explore the binary-based synthesis of phase pure polycrystalline Eu_3ZnAs_3. This involves utilizing air-sensitive techniques, high energy material attrition, and high temperature solid state synthesis to make target compounds. We also investigate the thermoelectric properties of the compound and delve into the optimization of the thermoelectric properties by introducing dopant.

The Role of R-Loops on Targeting Nucleophagy Pathway Under Replication Stress

Francesca Corinna Gasperini
Sponsor: Kenneth Kaplan, Ph.D.
Ag Molecular & Cellular Bio

Nuclear homeostasis in cells is fundamental for maintaining transcriptional regulation and genome integrity, especially under conditions of cellular stress. ReSIN (Replication Stress Induced Nucleophagy) is a pathway required to preserve nuclear subdomains (e.g., the phase-separated nucleolus) during DNA replication stress by targeting nucleolar proteins for degradation in the vacuole. We hypothesize that ReSIN is triggered by changes in phase-separated states, mediated by RNA-DNA hybrids known as R-loops. Our study aims to better understand the role of R-loops in ReSIN and their necessity for its induction. To test the hypothesis we expressed RNAseH in cells, to remove R-loops, and induce replication stress using HU. Compared to the control conditions, we predict that RNAseH treatment will reduce R-loops, changing the phase-separated state of the nucleolus, therefore impacting ReSIN activity. Our preliminary findings suggest that ReSIN activity is activated by RNAseH (R-loops loss) expression in the absence of replication stress. In contrast, R-loop removal reduces ReSIN activity during replication stress. Understanding ReSIN and its connection to R-loops provides insight into how cells respond to replication stress, contributing to a broader understanding of nuclear homeostasis and pathways involved in cellular stress response.

Analysis of Previous Cardiopulmonary Clinic Data to Improve Patient Cardiopulmonary Healthcare Services

Brandon Gatanaga
Sponsor: Ronald Jan, M.D.
MED: Surgery

Cardiovascular and pulmonary diseases are prominent health problems in underserved communities due to limited access to proper healthcare, language barriers, financial difficulties, and being uninsured. The Cardiopulmonary Committee of Paul Hom Asian Clinic was founded in 2015 to provide free cardiopulmonary assessments to those in the underserved community. This project aims to improve the health monitoring progress and treatments of patients enrolled in Cardiopulmonary Specialty Clinic through use of an established database. Data was gathered from patients' lab tests between 2015 and 2022 and averages were generated from patients entering our specialty clinic per year. Patient entries (n=102) consist of ages ranging from 17 to 77 years old. 68 patients were male and 34 were female. Findings indicate slightly elevated mean LDL and above-normal mean HDL among patients. Additionally, higher-than-normal fasting glucose and elevated BMI values in Asian patients raise concerns about potential cardiovascular and pulmonary risks. The database will permit improved patient follow-ups, monitoring of health progress, and potential interventions to address recognized health indicators; furthermore, the demographic and vitals data can be used to identify future cardiopulmonary patients at the clinic.

Before the Bay: Fish and Waterfowl Bones from a 7500 Year-Old Archaeological Site in San Francisco

Angeline Gatchalian
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

During recent construction activities in the city of San Francisco, archaeological materials were found over 50 feet below the modern ground surface, and over 30 feet below current sea levels, within ancient bay mud deposits. These cultural materials, including shells, animal bones, and charred plant materials, as well as small numbers of stone and bone artifacts, were left behind between 7900 and 7500 years ago. Most of the items reflect the byproducts of ancient dietary activities by people living on the edge of a marshland that existed before today's famous San Francisco Bay formed. Sea levels during this Early Holocene site occupation were about 11-13 meters lower than they are today. The location was at the mouth where a paleo-channel of Mission Creek entered an estuarine marshlands. This poster describes research conducted with modern Ohlone tribal support to study the ecology of fish and waterfowl in this wetland environment. Species represented include jacksmelt, silversides, herring, surfperch, and the extinct flightless duck (Chendytes lawi).

Investigating the Interplay between ATF7IP2 and ATF7 in Meiotic Gene Regulation

Amr Gebrail
Sponsor: Satoshi Namekawa, Ph.D.
Microbiology & Molec Genetics

Our lab recently demonstrated the novel role of meiosis-specific protein, ATF7IP2, in regulating H3K9 methylation and gene expression in the male germline. Interestingly, ATF7IP2 had distinct activation and repressive roles in regulating the autosomal and XY chromosomes, respectively. To further understand the dual regulatory role of ATF7IP2, we will investigate potential binding partners of ATF7IP2. One well-studied transcription factor known to interact with ATF7IP2 in mitotic cells is Activating transcription factor 7 (ATF7). However, it is not known if ATF7IP2 and ATF7 interact in meiosis. Since these proteins interact in somatic cells, I hypothesize that ATF7IP2 and ATF7 indeed interact in meiotic germ cells. To test this hypothesis, I will cross-analyze our lab's recently published ATF7IP2 CUT&Tag data and previously published ATF7 ChIP-seq data, both performed in meiotic germ cells. I will identify target loci of each protein, compare the overlap of these targets, and perform gene ontology analysis to determine common biological pathways. In addition, I will separately analyze the autosomal and XY chromosomes target loci to identify any preferential overlap of targets. Overall, this work will further our understanding of ATF7IP2's role in meiosis and gene regulation.

Attaining Designed Surface Tension Using Micropatterning of Surface Functionalities

Allison Gee
Sponsor: Gang-yu Liu, Ph.D.
Chemistry

Frequently used means to tune surface tension is by varying of surface functionality, e.g., self-assembled monolayers (SAMs) with CH3-, HO-, and HOOC-termini. Mixing of two termini also provide another means to regulate surface tension. This work explores a new means to tune surface tension, i.e., micro- and nano-patterning of two extreme functionalities, e.g., hydrophobic CH3- and hydrophilic HOOC-terminated SAMs. Various patterns (lines, rectangles, crosses, and diamonds) are produced via microcontact printing followed by structure characterization using atomic force microscopy (AFM). The geometry and dimension of the patterns are correlated with the surface tension, quantified by contact angle measurements (using the sessile drop method). With demonstration of feasibility and principle, our approach provides a new means to attain designed surface tension, via micro- and nano-fabrication. This would enable programming of surface tension via engineering approaches in contrast to laborious trial-and-error surface modification chemistry. Applications in surface modifications for passivation, devices and sensors are envisioned.

Life Beneath the Ice: Antarctic Microbial Mat Morphology and Spatial Ecology

David Gee
Sponsor: Dawn Sumner, Ph.D.
OR: Feminist Research Institute

In the perennially-frozen saline lakes of Antarctica's dry valleys, benthic microbial communities are the dominant life forms. The communities, largely composed of cyanobacteria, form "mats" of combined biological material and sediment that build up over time. A key structure present in the mat's topography are pinnacles. Video data taken from a variety of sites in the lake spanning a distribution of environmental conditions allows us to examine how pinnacle spatial patterning varies along these environmental gradients. I have analyzed the topography of these microbial mats by using video data of the mats to create photogrammetric models. Spatial statistical metrics of the 3-D point clouds, including Voronoi diagrams, Ripley's L, and Clark-Evans R-index of dispersion, can help better understand the distribution of pinnacles. We observe clustered, regularly spaced, and randomly distributed spatial patterning at different sites, although the causes of these variations have not been identified. Future work will allow us to understand if and how these variations are caused by environmental changes. By investigating modern mat formation and the connection between morphology and environment, we also aim to better understand how polar ecosystems are impacted by changing environments.

Manual Belt Grinding Simulation for Operator Feedback

Brandon Gee
Sponsor: Barbara Linke, Ph.D.
Mechanical & Aerospace Engr

Abrasive belt grinding is a manufacturing process used for surface finishing. This process involves a belt bonded with abrasive particles, which uses geometrically undefined cutting edges. Current research focuses on abrasive belt grinding simulations intended for robot operations, but belt grinding simulations intended to assist operators in determining process parameters before the actual grinding process is still under investigation. Automated belt grinding relies heavily on an operator's input in determining grinding parameters, such as depth of cut and feed rate, whereas manual belt grinding works only with the sensual operator's skill (e.g. pressure). This research study investigates kinematic belt grinding simulation parameters to improve and assist an operator in a manual belt grinding process. The simulation model was created in MATLAB App Designer, which opens a user interface window. The user interface window allows the operator to input process parameters, such as belt specifications, workpiece material and geometry. The simulation generates the belt topography and initial workpiece surface, then predicts the feed rate, cutting speed, and surface quality. Actual experiments using an automated belt grinding machine will be used to validate this model.

Investigating *E. coli* CTP Synthetase Glutamine Hydrolysis Regulation via a Gutamate-Dehydrogenase-Based Assay

Evan Gehres
Sponsor: Enoch Baldwin, Ph.D.
Molecular & Cellular Bio

Cytidine triphosphate (CTP) is synthesized by *E. coli* CTP synthetase (*Ec*CTPS) via glutamine hydrolyzing amidotransferase and uridine triphosphate (UTP) amidoligase activities. *Ec*CTPS activity regulation is complex. While for all CTPSs, guanosine triphosphate (GTP) allosterically activates glutamine hydrolysis at low concentrations, in bacterial CTPSs, high GTP concentrations noncompetitively inhibit CTP synthesis without inhibiting glutamine hydrolysis. Whether other inhibitors also prevent CTP synthesis without reducing glutamine hydrolysis like GTP is unknown. This project aims to characterize the mechanisms of several *Ec*CTPS inhibitors by determining which activities are blocked. While methods of measuring CTP synthesis are already known, we are developing a spectrophotometric glutamine hydrolysis assay to quantify glutamate production using the enzyme glutamate dehydrogenase (GDH). Thus far, we have defined glutamate concentrations that yield a linear response under standard *Ec*CTPS assay conditions. We are now further optimizing assays to minimize potential interference by high inhibitor concentrations. Once established, we will assess the effects of characterized and novel *Ec*CTPS inhibitors on the glutamine hydrolysis step. Determining the inhibitory mechanisms of CTPS enzymes in general, which are highly conserved, can help better define pyrimidine regulation in cells, as well as direct anti-CTPS therapeutic design to fight lymphoma, sleeping sickness, and autoimmune diseases.

Try-hards and Tarts: How the Website *GreekRank* Reproduces Gender Inequalities Online

Sabrina Gelini
Sponsor: Laura Grindstaff, Ph.D.
Sociology

Sociological literature suggests that when individuals or groups are perceived as violating expectations of "appropriate" gendered behavior, they are subject to corrective action by others. This regulation is called "gender policing." However, there is a notable lack of literature examining why those who seemingly adhere to normative gender expectations might nevertheless be subject to gender policing, and even more surprisingly, from "insiders" who share group membership. This study uses the case of GreekRank - an anonymous website used by fraternities and sororities in the US to "rank" each other – to examine how and why sororities police the gendered behavior of other chapters' members. Specifically, I analyze messages posted by members of the ten Panhellenic sororities at UC Davis from 2019 to 2024 to theorize (a) the ranking criteria that sororities use, and (b) how these criteria reproduce gender inequalities by upholding gender double standards. As a member of a UCD sorority myself, my purpose is not to castigate Greek members for the messages they post or to suggest that women are as responsible as men for gender inequality, but to better understand the ways in which young women buy into patriarchal standards.

Safety of Oral Dosed Fluralaner at 10 mg/kg and 25 mg/kg in Healthy Horses

Samantha Gentille
Sponsor: Jessica Morgan, D.V.M.,Ph.D.
VM: Medicine & Epidemiology

Fluralaner has been successfully used in small animals for the prevention of ectoparasites including ticks and mites. The use of a long-acting preventative drug, like fluralaner, could be beneficial for limiting various vector borne diseases as well as skin irritation. However, the safety and effectiveness of this oral ectoparasiticide has not been well documented in the horse. The aim of this study was to observe the safety of orally administered fluralaner at both 10 mg/kg and 25 mg/kg doses in a population of healthy, university owned horses. A total of 12 horses were divided evenly into two groups: 10 mg/kg and 25 mg/kg doses. Physical exams, neurological exams, hematology panels, and chemistry panels were collected from 1 day pre fluralaner dosing, and then regularly throughout the 84 day post dosing period. We observed no adverse side effects. Biochemical and hematological parameters were analyzed with a repeated measures one way ANOVA. The results of blood work from both groups of horses indicate fluralaner did not cause any clinically relevant deviation from normal parameters. Further pharmacokinetic analysis is ongoing, but preliminary data shows fluralaner has potential to be a safe option for future preventative care.

Detection of Neuroinflammatory Responses on the Olfactory Region of the Brain Triggered by Injection of Neurodegenerative Disease-Related Proteins

Alec Gerges
Sponsor: Qizhi Gong, Ph.D.
MED: Cell Biology & Human Anat

Olfactory loss, a common precursor to the characteristic phenotypes of both Alzheimer's and Parkinson's Disease, coincides in timing with the toxic aggregation of extracellular β-amyloid protein plaques or intracellular α-synuclein in the Olfactory Bulb (OB). We hypothesize that these pathogenic aggregates trigger neuronal inflammation which retrogradely propagates to the Olfactory Epithelium (OE), reducing olfaction. To test whether neuroinflammation in the OB can induce OE responses, we utilized stereotaxic surgery to inject Lipopolysaccharide (LPS) in the OB of C57BL/6J mice. Measurement of cytokine transcription via qPCR yielded a 100-fold upregulation of cytokine IL-6 in the OB and a 298-fold upregulation in the OE at 1DPI compared to a PBS vehicle control. We then injected aggregates, validated by transmission electron microscopy (TEM), of highly toxic variants β-amyloid-42 (Abeta42) and a-Synuclein with A53T mutation (aSynA53T). aSynA53T triggered a 10-fold upregulation at 1DPI and 115-fold upregulation at 7DPI for cytokine IL-1B expression. We plan to evaluate fold changes in the OE after OB injection with Abeta42 and aSynA53T, conduct morphological analysis to visualize the aggregates with the surrounding neuronal environment, and conduct cytokine transcriptomic analyses to potentially make biomarker profiles for each condition for future diagnosis.

Vowel Coarticulation and Expansion Across Styles: Comparing Adults Varying in Age

Benjamin Getz
Sponsor: Georgia Zellou, Ph.D.
Linguistics

This study investigates how adults of different age groups adapt their speech in response to varying communicative contexts. Previous research indicates that speakers modify their speech to enhance intelligibility, employing strategies such as reducing coarticulation (or segmental overlap of speech sounds) and expanding vowel space (making their vowels more distinct). 129 participants, ranging from 18 to 60 years, engaged in an experiment online. Stimuli consisted of 18 target words, produced in the frame "I say [target word] again". They produced target sentences in three style conditions with two repetitions each: clear (produced for individuals with hearing challenges), casual (produced for close friends/family), and fast (produced as if an auctioneer). The sentences were transcribed in Praat, the vowels were segmented with the Montreal Forced Aligner then hand-corrected. Next, we took vowel measurements with FastTrack and Praat scripts. We predict there will be age-related variation in the patterns of vowel expansion and coarticulation across different communicative styles. This research contributes to our understanding of the dynamic interplay between age, communication styles, and speech production strategies.

Understanding Asylum Acceptance Disparities and Political Shifts: Migration Waves into EU and EEA Member States and Switzerland from Predominantly Muslim Nations and Ukraine

Maha Ghafoor
Sponsor: Josephine Andrews, Ph.D.
Political Science

Over the past decade, the 27 European Union (EU) member states, including EU candidate Turkey and former EU member state, the United Kingdom, and European Economic Area (EEA) member states - Iceland, Liechtenstein, and Norway, and Switzerland, a non-EU or EEA member state, yet intricately linked to the EU's single market, have experienced two significant migration waves of asylum-seeking refugees. The first wave, reaching its peak in 2015, was composed of refugees from predominantly Muslim nations, including Afghanistan, Eritrea, Iraq, Libya, and Syria. The second wave, reaching its peak in 2022, was composed of refugees from Ukraine, a predominantly majority-Christian European nation. I explore the differences in asylum acceptance, which I operationalize as changes in support for rightwing, anti-immigration populist parties across these European countries with the two migration waves. EU law requires that all member states admit refugees regardless of country of origin, but some member states have been unwilling to honor this obligation, as seen in 2015. Following Russia's invasion of Ukraine in 2022, countries that resisted acceptance of migrants from predominantly Muslim countries in 2015 have been open to accepting migrants from Ukraine. My paper explores the variation in response by these European countries to each migration wave.

Determining the Role of *Ihx9* Transcription factor in Zebrafish Pre-follicle Cells.

Gurjot Gill
Sponsor: Bruce Draper, Ph.D.
Molecular & Cellular Bio

Pre-follicle cells of the vertebrate ovary surround early stage premeiotic germ cells and give rise to the follicle cells that surround the developing oocytes (called granulosa cells in mammals). They are a transient population in the fetal ovary of mammals, including humans, present only during the time oocytes are being formed. However, they are a stable population in zebrafish ovary because oocytes are continually formed throughout life by a population of oogonial stem cells and we hypothesize that they function as the oogonial stem cell niche. We previously determined that the transcription factor, *Ihx9* is specifically expressed in zebrafish pre-follicle cells and therefore may have a role in their development. To test our hypothesis, we are determining when in development of the ovary pre-follicle cells first develop by examining *Ihx9* expression. We have also produced loss-of-function mutations in *Ihx9* to determine its role in pre-follicle cell development. I have induced mutations in *Ihx9* using CRISPR-Cas 9 genome editing technology and have identified germline founder animals. I am presently determining if any mutations are loss-of-function. In future experiments I will breed these to produce homozygous *Ihx9* mutants and determine its role in pre-follicle cell formation.

Understanding the Role of Media Use and Internalizing Symptoms in Explaining Adolescent Loneliness

Spoorthi Giridhar
Sponsor: Camelia Hostinar, Ph.D.
Psychology

Research has found that screen time use and internalizing symptoms are not only mutually reinforcing, but also associated with low psychological well-being in children and adolescents. My project aims to examine the association between screen time (e.g., social media use) and internalizing symptoms in 11-15-year-olds. Youth (n = 126, 60.3% girls; Mage = 13.53, SD = 1.20) attended in-person laboratory sessions with their parents. After providing consent and assent, they filled out a questionnaire packet that included the following measures: LACA (Loneliness and Aloneness Scale for Children and Adolescents) measuring social isolation, SMFQ (Short Mood and Feelings Questionnaire) measuring depression in adolescents, STAI (State-Trait Anxiety Inventory) measuring anxiety in adolescents, and YSMU (Youth Social Media Use) measuring time spent by adolescents on various media outlets. The SMFQ and STAI will be used to create an internalizing symptoms composite score. Linear regressions controlling for age and sex will examine whether (1) youth social media use, (2) internalizing symptoms, and (3) the interaction between the two are significant predictors of loneliness in youth. This research and future longitudinal studies can inform the development of interventions to improve adolescent mental health.

Examining the Epigenomic Role of SMARCA4 in H3.3 Mutant Glioma

Avantika Gokulnatha
Sponsor: Paul Knoepfler, Ph.D.
MED: Cell Biology & Human Anat

Diffuse midline gliomas (DMGs) are fatal pediatric brain tumors that develop in the pons region of the brainstem. DMGs are driven by the histone H3.3 mutation H3.3K27M. There is an urgent need for knowledge of K27M mechanisms to catalyze new therapy development. In previous research into the K27M neuro-oncogenic pathway, SMARCA4, a key component of the SWI/SNF chromatin remodeling complex, was identified as a potential key effector in H3K27M DMGs. This project aims to understand the role SMARCA4 plays in the H3.3 K27M pathway through loss-of-function approaches including an siRNA-mediated SMARCA4 knockdown and SMARCA4 drug inhibitor treatment. This work is being conducted in two patient-derived cell lines alongside their wild-type counterparts.

Ongoing experiments are being conducted to determine the effects of a SMARCA4 loss-of-function using RNA-seq. Previously, the K27M mutation has been shown to decrease rates of H3K27me3, a repressive mark, and increase H3K27ac, a PTM associated with active transcription. Future steps include evaluating the epigenomic effects of SMARCA4 loss of function. Our overall goal is to identify therapeutic susceptibilities of these tumors as the basis for future clinical trials.

Assessing Relatedness of Captive Panoche Plateau Blunt-Nosed Leopard Lizard (*Gambelia sila)* From Recorded Pairings and SNPs (Single Nucleotide Polymorphisms)

Kobe Goliman
Sponsor: James Statham, Ph.D.
Veterinary Genetics Lab

The blunt-nosed leopard lizard (*Gambelia sila*) is an endemic species that lives in the grassland and desert of central California. They are a federally listed endangered species whose decline can be attributed to habitat degradation and fragmentation. This resulted in isolated populations which limited interbreeding and created a bottleneck in genetic diversity. I received tail samples from the Fresno Chaffee Zoo's captive breeding program in their effort to recover the population in the Panoche plateau. DNA was extracted from the tail and used to construct DNA libraries with the Genotyping by Sequencing method. I constructed a pedigree from recorded pairings provided by the zoo, and determined the coefficient of inbreeding for non-founder individuals. This revealed that the three generations from the limited number of founders have created inbred offspring. The SNPs provided allowed me to determine the relatedness between the founders of the breeding program, which revealed the increased level of inbreeding within the captive population. This data will be beneficial information for the zoo's program to select pairings and determine whether the level of inbreeding within the captive colony necessitates an introduction of new lizards.

Overcoming Barriers: Exploring Deterrents to Naturalization and Potential Solutions

Daniela Gomez Woodward
Sponsor: Jeannette Money, Ph.D.
Political Science

Our research aims to investigate the factors contributing to the relatively low naturalization rate among the millions of Legal Permanent Residents (LPRs) in the United States who are eligible for citizenship. After conducting thorough analyses of various data sources, academic literature, and research studies on this topic, we have identified economic reasons as a significant deterrent. This encompasses the financial expenses associated with the naturalization process and the broader implications of monetary challenges, such as limited access to adult education and lower wages. Our objective is to find the economic and social circumstances of those who do naturalize as citizens in the United States and the perceived benefits of American citizenship. We want to not only uncover any correlation between naturalization and socioeconomic background , and whether the benefits of naturalization can motivate individuals to pursue it, but also to identify the necessary steps that can be taken to address the obstacles to naturalization for those who qualify.

Hyperkinetic Biliary Dyskinesia: An Underrecognized Problem with Good Surgical Outcomes After Cholecystectomy

Neha Gondra
Sponsor: Victoria Lyo, M.D.
MED: Surgery

Hyperkinetic Biliary Dyskinesia (HBD) is an underrecognized condition with poorly defined clinical symptomology and no standardized management guidelines. HBD is characterized by a gallbladder ejection fraction (EF) of greater than 80% on a hepatobiliary iminodiacetic acid (HIDA) scan, but radiographic diagnoses are also inconsistent. This study aimed to identify HBD's prevalence and radiographic reporting, physician referral patterns, and clinical outcomes following cholecystectomy. A retrospective chart review of HIDA scans and patients who underwent cholecystectomies completed between 2002 and 2003 revealed that of 1,851 patients with HIDA scans that reported EFs, 676 (36.5%) had an elevated EF, but Only 9.8% were reported as hyperkinetic. We found that most patients with HBD benefited from cholecystectomy, with 79.1% of patients reported symptom improvement at a median follow-up of 16 days. Many of these patients also had chronic cholecystitis (83%). Patients with persistent symptoms after cholecystectomy were more likely to have confounding gastrointestinal (66.7 vs 14.7%, P=0.004) or psychiatric diagnoses (88.9 vs. 38.2%, P=0.009). HBD is relatively common but often underdiagnosed by radiology and, thus, likely underrecognized by treating physicians. Increased awareness about HBD and postoperative outcomes is needed to ensure HBD is adequately treated.

Reducing Disparities in Hereditary Breast Cancer Risk Assessment - The 'Tu Historia Cuenta' Program

Karla Gonzalez
Sponsor: Laura Fejerman, Ph.D.
MED: Public Health Sciences

Hispanic/Latina (H/L) women in the United States have a 30% higher risk of breast cancer mortality compared to non-Hispanic White women. This is partly due to lower rates of screenings and genetic counseling/testing. To address this disparity, we developed a program that identified, tested, and counseled H/L women at high risk of developing breast cancer in Los Angeles, San Francisco, and Sacramento. Community health educators were trained to outreach, educate, and survey participants. A validated survey collected the cancer-related family history of each participant. Survey responses were scored to identify high-risk participants. Out of 1577 surveyed participants, 102 (6%) were considered high-risk and offered genetic testing. We lost contact with 30 individuals, 21 declined, 18 had already been tested (5 positive, 1 uncertain), and 51 consented to testing. Currently, results for 19 women have been returned: 17 negative, 1 positive, and 1 uncertain. Individuals with a positive or uncertain result underwent genetic counseling. Barriers to successful participation in genetic testing included loss to follow-up and difficulties during the kit activation or interpretation of the results. These barriers can be addressed by providing one-on-one support to participants throughout the process.

Identifying Craniofacial Cartilage Anomalies Resulting From Early Loss of SOX9 in Neural Crest Cells

Ana Gonzalez
Sponsor: Crystal Rogers, Ph.D.
VM: Anat Physio & Cell Biology

Neural crest cells (NCCs) are ectodermally-derived, multipotent, vertebrate embryonic cells. NCCs undergo an epithelial to mesenchymal transition that allows them to migrate to, and invade distant tissues, differentiating into cell types including craniofacial bone and cartilage. NCC formation is tightly controlled by a network of transcriptional regulators, including SOX9. SOX9 regulates NCC specification, migration, and differentiation into chondrocytes and osteocytes. Campomelic Dysplasia (CD) and Pierre Robin Sequence (PRS) are congenital disorders linked to SOX9 mutations and are characterized by cleft palate and micrognathia; two phenotypes associated with NCC defects. To date, no studies have linked these phenotypes to early abnormalities in NCC SOX9 expression. Here, I will determine the effects of SOX9 knockdown on NCC differentiation and craniofacial cartilage formation using avian models. I *hypothesize* that an early SOX9 knockdown will reduce the number of NCC-derived chondrocytes, thus affecting craniofacial beak development. To test this hypothesis, I will knockdown SOX9 during NCC specification in *Gallus gallus* embryos and will perform immunohistochemistry for cartilage markers followed by lightsheet microscopy. I expect to identify alterations in NCC-derived chondrocytes, and to identify structural anomalies resembling phenotypes observed in CD and PRS. These findings will contribute valuable insights into the mechanisms governing craniofacial development.

The Impact of Maternal ACE Scores and Positive Parenting on Child Behavioral Problems

Sofia Gonzalez
Sponsor: Daniel Choe, Ph.D.
Human Ecology

Greater adverse childhood experiences (ACE) relate to greater dysregulation in adulthood. This dysregulation can impact individuals' parenting and increase the risk of behavior problems in their children. This study examines the relationships between mothers' self-reported ACE scores, their parenting, and their young children's behavior problems. Mothers (N = 149; M_{age} = 32.12 years) with an annual household income of less than $50,000 and children between ages 1.5 and 5 years old and were recruited nationwide via Amazon Mechanical Turk (MTurk) and administered an online survey that included a demographics questionnaire, Child Behavior Checklist (CBCL), Parent Behavior Checklist (PBC), and a mothers' ACE questionnaire. We hypothesized that greater maternal ACE scores would relate to greater children's behavior problems and greater positive parenting scores would relate to lower children's behavior problems. Preliminary analyses found a significant positive correlation between mothers' ACE score (α = .83) and children's total behavior problems, $r(149) = .21$, $p < 0.05$. Additionally, positive parenting (alpha = .85) was negatively correlated with children's total behavior problems, $r(149) = -.21$, $p < 0.05$. For future analyses, we will examine whether mothers' ACE scores predict children's total behavior problems and if this relationship depends on mother's positive parenting practices.

Deportation and Reintegration: Migrant Perspectives

Jesus Gonzalez
Sponsor: Robert Irwin, Ph.D.
Spanish & Portuguese

During Barack Obama's presidency, the number of migrants deported reached its highest number in history. However, there's little information on the solutions and resources that are available to help Mexicans deported assimilate back to what others call "home". Those who have been deported after living in the United States, especially those with years in the country, face many obstacles when it comes to integrating or reintegrating themselves back into a country they do not remember. This includes childhood arrivals due to the lack of knowledge of their place of origin. Research has been made on a number of people deported, their demographic profiles, immigration laws, and policies, etc. Yet, little research has been done through the perspectives of the migrants themselves. Through synthesizing and analyzing testimonies of victims of deportation, problems are seen in their battles to assimilate on their return to Mexico. Obstacles in the labor market include discrimination, lack of governmental support, and police abuse, among others. Also, there is a lack of resources to create a smooth transition between the education systems of both countries. The lack of information and investigation of this topic makes it difficult for the integration of the deported migrants and their families.

New York Times Media Project: The Representation of Jordan in the 1960s

Max Gouvalaris
Sponsor: Suad Joseph, Ph.D.
Anthropology

How did the New York Times (NYT) represent Jordan during the early 1960s? The NYT portrays Jordan as moving towards Westernization and as an auxiliary to Western causes. The NYT has a pattern of representing Jordan as oppositional to the Soviet Union during the Cold War and the United Arab Republic, and as having a more noted indifference towards the State of Israel, which all contributed to Jordan being represented as different than many SWANA neighbors. The depiction of Jordan likely contributed to mainstream Western perceptions of domestic development in the country and its attitudes toward the West and its spheres of influence, especially considering changes to Jordanian government in 1957 and the assasination of Prime Minister Hazza' Majali in 1960. I searched the NYT archive on ProQuest using the term "Jordan*," which produced 9,642 articles. I have screened 831 articles between January 1960 and January 1961, of which 31 are relevant. This research is part of a long-term analysis project of the NYT from 1850 to the present from the Suad Joseph Lab. The project analyzes the representation of Islam and Muslims over 150 years.

Safety of Oral Dosed Fluralaner at 10 mg/kg and 25 mg/kg in Healthy Horses

Francesca Goyette
Sponsor: Jessica Morgan, D.V.M.,Ph.D.
VM: Medicine & Epidemiology

Fluralaner has been successfully used in small animals for the prevention of ectoparasites including ticks and mites. The use of a long-acting preventative drug, like fluralaner, could be beneficial for limiting various vector borne diseases as well as skin irritation. However, the safety and effectiveness of this oral ectoparasiticide has not been well documented in the horse. The aim of this study was to observe the safety of orally administered fluralaner at both 10 mg/kg and 25 mg/kg doses in a population of healthy, university owned horses. A total of 12 horses were divided evenly into two groups: 10 mg/kg and 25 mg/kg doses. Physical exams, neurological exams, hematology panels, and chemistry panels were collected from 1 day pre fluralaner dosing, and then regularly throughout the 84 day post dosing period. We observed no adverse side effects. Biochemical and hematological parameters were analyzed with a repeated measures one way ANOVA. The results of blood work from both groups of horses indicate fluralaner did not cause any clinically relevant deviation from normal parameters. Further pharmacokinetic analysis is ongoing, but preliminary data shows fluralaner has potential to be a safe option for future preventative care.

Financial Constraints and Vulnerable Populations: Unraveling the Correlation Between Limited Access to Bank Credit and the Proliferation of Human Trafficking Networks

Pharaoh Granderson
Sponsor: Janine Wilson, Ph.D.
Economics

When access to bank credit for individuals and businesses seeking to finance their entrepreneurial and investment pursuits is limited, the population becomes increasingly susceptible to human trafficking criminal networks. The scarcity of financial opportunities compels citizens to explore alternative means, propelling them toward the black market. This heightened vulnerability stems from the constrained avenues for socioeconomic advancement, creating an impoverished environment where individuals are more likely to succumb to the monetary incentives presented by illicit activities such as human trafficking or become victims of it. This study establishes a positive correlation between limited access to bank credit and victims of human trafficking within their countries of origin (the supply side) by running Ordinary Least Squares (OLS) regressions that draw from a dataset of 30 countries with a critical focus on the independent variable "Firms using bank credit to finance investment" as a percentage of total firms in each country. This paper underscores the need for access to bank credit and microfinancing from international and domestic financial and political entities to improve poor financial institutions. Doing so not only facilitates poverty alleviation in a region but also diminishes the presence of and vulnerability to criminal enterprises like human trafficking networks.

Visiting Chaucer's Kitchens: Analyzing Professional and Domestic Cooks in *The Canterbury Tales*

Emily Granger
Sponsor: Claire Waters, Ph.D.
English

The cooks of *The Canterbury Tales* come in many forms: they are professional cooks and home cooks, cooks that sell their labor and cooks that sell their goods. They appear in the frame, as our company wends its way toward Canterbury, and populate the tales that company tells. The medieval professional cooks carried many negative associations. Cooks were the enablers of gluttony. They represented a method of establishing legitimacy for the growing middle class by giving them access to the same services as noble households. Their position gave them potential for all kinds of mischief or violence, delivered directly to the body through food. However, the associations for domestic cooks are markedly different, though still unfavorable. The domestic cook—a definitively female position—is omitted by the labor she is required to provide. These cooks must step out of Chaucer's tales to fulfill their responsibilities. By comparing the labor, moral characterization, and narrative presence among the cooks in *The Canterbury Tales*, we can get a clearer picture of the role of food preparation in the lives of medieval people: whether it elevated their social position, or removed them from the story.

Genome Analysis of *Ralstonia solanacearum,* to Identify Genetic Differences That Could Influence Host Range and Pathogenic Fitness.

Samantha Green
Sponsor: Tiffany Lowe-Power, Ph.D.
Plant Pathology

Ralstonia solanacearum is a gram-negative bacterial wilt pathogen within the RSSC (*Ralstonia solanacearum* species complex) that has a large host range. The RSSC contains pathogens that will colonize the xylem. Due to the high virulence of *Ralstonia,* bacterial wilt disease causes a significant loss in agricultural production, threatening economic and food security. *Ralstonia solanacearum* has spread to many countries, with unknown origins. Investigating the diversity of gene content in different *Ralstonia* strains can help with identifying genetic influence on host range and disease management. Through this investigation, we will generate hypotheses surrounding the virulence and fitness of the pathogen. Our data collection consisted of extracting DNA from 20 *Ralstonia* strains isolated from Tanzania, followed by genome sequencing. The bulk of our collection was analyzed using the software KBase as our bioinformatic platform. In KBase, we analyzed the quality of the Illumina sequencing data and assembled the raw data into genome sequences. Currently, our cohort is working to construct a phylogenetic tree that compares the evolutionary relationships of our strains with all publically available genomes from the RSSC. We will identify evolutionary relationships between our strains and their relatives to identify which genes can influence host range, virulence, and fitness.

Infants' Attention to and Learning of Faces

Giselle Grench
Sponsor: Lisa Oakes, Ph.D.
Psychology

From birth, infants learn about their worlds through the faces in their environment. Specifically, faces convey information about language, emotions, gender, and much more. Moreover, different features of faces become informationally relevant across development. For example, Oakes and Ellis (2013) showed that younger infants (4 to 6 months) focused more on the eye region while viewing a photograph of a face. In contrast, older infants (8 to 12 months) focused their attention more broadly, presumably reflecting differences in cognitive development. Despite these developmental differences, attention to the eye region has been primarily linked to infants' *learning* of faces. Bolhuis et al. (2015), for example, showed that infants who preferentially looked to the eye region showed stronger memory for that face compared to infants who focused their attention more broadly. Moreover, DeBolt et al. (2023) showed that 6 to 9-month-old infants similarly formed memories for masked and unmasked faces, suggesting that the eye region was sufficient for their learning of the faces. The current study explores how attention to different facial regions and features is related to learning. We focus on a broad developmental range (5 to 12 months) to understand how different attentional strategies may translate to different learning outcomes.

From Preschool to Picasso: What the Art Museum Can Learn From Children's Museum Exhibit Design

Sarah Grimes
Sponsor: Timothy Mcneil, M.A.
Department Of Design

Art museum exhibit design has failed to adapt to changes in audience desires, resulting in an experience that fails to educate and entertain visiting families. By studying the methodologies of children's museum exhibit design, art museums can create gallery spaces that are more engaging and accessible to families and children. From small changes such as creating object labels with open-ended questions to larger ones such as designing interactive elements that create a social experience in the gallery, the art museum is ripe with potential for change. Based on my research conducted using various methods ranging from interviews with industry professionals to a review of relevant scholarly literature, I have created a clear design guide to suggest techniques for exhibition redesign. Successful implementation of these techniques has the potential to result in the cultivation of a new learning environment that would not only benefit children and families, but would create a more welcoming and engaging space for all future visitors, resulting in a new, modern museum for a new, modern audience.

Investigating *Candidatus* Liberibacter solanacearum Effectors Responsible for Morphological Changes in Tomato

Bella Guel
Sponsor: Gitta Coaker, Ph.D.
Plant Pathology

Vector-borne pathogens are responsible for causing devastating plant diseases, and their

prevalence is predicted to increase due to climate change. *Candidatus* Liberibacter solanacearum (Lso) is a phloem-limited pathogen associated with multiple economically important diseases in solanaceous crops, including Psyllid yellow disease in tomatoes. Prior research determined that Lso can cause morphological changes in crops such as carrots and alfalfa. This research aims to examine if Lso-secreted effectors are responsible for altering host morphology and physiology in tomatoes. After mining for candidate effectors, we utilized Potato Virus X as a phloem expression system to express effectors of interest into tomato cv. 'Mirco-Tom' plant. One of the candidates, HPE33, was found to induce dwarfism and stunted growth in the tested plants. We observed drastically reduced plant height and canopy spread. Additionally, yellowing and chlorosis significantly increased in HPE33-expressing plants. The altered morphology mimics the host phenotype induced by actual Lso infection. This study enhances the understanding of how Lso utilizes secreted effectors to facilitate the pathogen spread through the prevention of host senescence and alteration of foliage color to potentially attract insect vectors.

Computational Modeling to Investigate Cardiovascular Responses During Spacecraft Aerodynamic Re-Entry

Aidan Guerra
Sponsor: Rich Whittle, Ph.D.
Mechanical & Aerospace Engr

Re-entry from Low-Earth Orbit presents a unique set of hypergravity conditions that act as stressors on the cardiovascular system. There is a risk that this orthostatic challenge may cause issues in injured/ill crewmembers. This research aims to simulate cardiovascular responses during the re-entry of the UC Davis Space Ambulance concept, based on a X-37B to incorporate a pressurized crew volume, selected for its flight heritage and entry, descent, and landing capabilities. Using an optimized re-entry trajectory based on lifted-body aerodynamics, the resultant force is derived on supine subjects over re-entry. Subsequently, the gravitational profile is applied to a model of the cardiovascular system in simulated subjects to determine the effect of re-entry on cardiovascular function. Results will inform the ergonomics and performance of the vehicle that could be used to extract injured/ill crewmembers. These results act as a baseline against which to compare the response in injured/ill crewmembers in order to determine critical medical constraints. Currently, no spacecraft cater to medical evacuation from the International Space Station or elsewhere. With the broadening demographic and risk profile of commercial spaceflight, there will be a requirement to evacuate patients from space in a more deliberate fashion than existing capabilities.

Capturing Zika Virus Replication in the Absence of the Autolysosome-Fusion Protein, Syntaxin-17, through Live-Cell Imaging

Alexander Guess
Sponsor: Priya Shah, Ph.D.
Microbiology & Molec Genetics

Macroautophagy, herein called autophagy, is a cellular process that recycles misfolded proteins and damaged organelles. In autophagy, an ER-originating vesicle engulfs cellular garbage, which then fuses with a lysosome, forming an autolysosome. The vesicles' contents are exposed to degradative enzymes and are then recycled back into the cytosol. While historically, this process was viewed as critical in the intracellular immune response, more recent studies have suggested that certain viruses, under high selective pressure, have hijacked autophagy to promote replication; the mosquito-borne Zika virus is one such example, replicating within autolysosomes while shielded from innate cell immunity. However, which autophagic stages and proteins act as replication factors is less well understood. As a causative agent of both microcephaly and Guillain–Barré Syndrome, clarity on the replication mechanism of Zika is of significant biomedical relevance. We hypothesize that disrupting the indigenous autophagic pathway by knocking out a key autolysosome fusion protein, Syntaxin-17, will substantially inhibit zika virus replication. In our experiments, we knockout Syntaxin-17 in an immortalized human neuroblastoma cell line. To dynamically visualize infection using live-cell imaging, the cells' autophagic vesicles have been tagged with a red fluorescence marker while our Zika strain has been tagged green.

Whose Life Thrives in the Death of Tomorrow? The Material-Temporal Politics of Revitalization in Sacramento's Oak Park

Jose Guerra
Sponsor: Marisol De LaCadena, Ph.D.
Science & Technology Studies

Revitalization, although associated with contemporary forms of gentrification, has existed as an economic term in Sacramento since the 1950s. Since the inception of revitalization, it has been intertwined with the racial politics of urban governance. Originally mobilized for displacing Japanese and Black residents from the Capitol Mall area, the term is now being used to frame Oak Park - a historically Black and Brown neighborhood - as achieving economic progress. Since the revitalization project began 20 years ago, 37% of the entire Black community has been displaced. Latinx people remain among the most impoverished. The middle-class White population has often described the changes in Oak Park as a "return to the golden years," referring to when it was a white-only segregated neighborhood. I argue that as revitalization re-coheres the collective selfhood of the neighborhood, it functions simultaneously to banish people of color from Oak Park, and displace the Black and Latinx present with the white past. This research thus examines how the built form and urban design engage in a material-semiotics of time by materializing white historicities. This research also works to show alternate visions of the future through examinations of the urban texts of working-class Black and Latinx residents.

Testing and Validation of Attitude Determination and Control System Software for Low Cost Satellite Control Methods

Anjali Gupta
Sponsor: Rich Whittle, Ph.D.
Mechanical & Aerospace Engr

We present the software testing and validation process for the Attitude Determination and Control Systems (ADCS) on REALOP, UC Davis' first undergraduate-led CubeSat mission. ADCS will orient the satellite in space using computer hard disk drives (HDDs), demonstrating their feasibility as a low-cost CubeSat control method. While in orbit, ADCS is susceptible to sensor malfunctions, software bugs, ground station communications issues, and control hardware malfunctions. We describe the various methods we use to mitigate these failures, both by preventing them before the mission and by planning responses to different failures in orbit. Prevention involves using ground tests to catch bugs in the software and simulating experiments to ensure we collect enough data to verify results and detect failures. We plan our responses to failures based on the minimum set of sensors and systems required to perform each experiment. By ensuring software reliability, we increase the likelihood of mission success for REALOP by proving the viability of HDDs as reaction wheels, thereby lowering the cost of entry to space for organizations around the world.

AI-Enhanced Precision in Identifying Sentinel Lymph Node Metastases in Breast Cancer Patients

Krishna Gupta
Sponsor: Mohsen Mesgaran, Ph.D.
Plant Sciences

The prognosis of breast cancer is critically dependent on the presence of metastases in sentinel lymph nodes (SLN). Traditional histopathological examination of these nodes, while standard, is labor-intensive and may miss small metastatic occurrences. Recent advances in pathology have seen the rise of convolutional neural networks (CNNs) as a transformative tool, particularly in automating the analysis of whole-slide images (WSIs). This study focuses on assessing the effectiveness of a CNN-based model in identifying lymph node metastases in breast cancer patients. The study utilized a public dataset from the PatchCamelyon (PCam), and a total of 80,000 patches of healthy tissue and 80,000 patches of metastatic tissue were assessed in the training set, while 57,458 patches of pathological tissue were evaluated in the test dataset. Considering the classification by board certified pathologists as a reference, the trained deep net showed high accuracy (0.937), precision (0.971), validation AUC (0.979), and a low validation loss of 0.016. Our data show that a deep learning system can be trained to recognize metastatic cancer, outperforming pathologists under time constraints (mean AUC of 0.810), showcasing its potential for clinical application.

Acquired Mutations in *Bcor* Promote Thrombocyte Counts

Timothy Gutierrez
Sponsor: Connie Champagne, Ph.D.
Educational Enrichment & Outre

Acquired *BCOR* mutations lead to mutant clonal growth in germline *RUNX1* deficiency, a condition with low platelets and leukemia risk. It is unknown how these mutations impact hematopoiesis. We hypothesize that *BCOR* mutations increase thrombocyte counts, alleviating the platelet defects observed in *RUNX1* deficiency. To test this, we conducted experiments in zebrafish, a vertebrate model organism with hematopoiesis highly homologous to that in humans. We induced mosaic mutations in *bcor* and a control gene using CRISPR-cas9 in 1-cell zebrafish embryos to measure the effects on thrombopoiesis in 3-day embryos. First, we utilized the transgenic zebrafish line cd41:GFP that marks thrombocytes, where we observed a 32.2% increase in GFP mean fluorescence intensity in *bcor* crispants compared to controls (p=0.016). Second, using *in situ* hybridization for *itga2b*, the gene encoding for cd41, we quantified a 48.5% increase in itga2b signal in embryos injected with *bcor* crispants compared to controls (p=0.0001). Lastly, in *bcor* injected *runx1* mutant embryos, there was an increase in *itga2b*-expressing cells compared to controls (p=0.046). Our data indicates that *bcor* mutations potentiate thrombopoiesis in wildtype and *runx1*-deficient zebrafish offering support to our hypothesis that *BCOR* mutations promote thrombopoiesis.

Advancements in Pentafluorosulfanylation using SF5Cl

Zane Haidar
Sponsor: Cody Pitts, Ph.D.
Chemistry

The SF_5 group is valued in medicinal and agricultural chemistry as a replacement for the CF_3 group, offering enhanced molecular properties such as electronegativity and lipophilicity. Historically, installing the SF_5 group has been challenging, due to difficulties in accessing SF_5 transfer reagents. However, in 2019, a key SF_5 transfer reagent, SF_5Cl, became more accessible and may be synthesized safely in-house. This significant advancement opened up many possibilities for the development of new methods in pentafluorosulfanylation. Prior art primarily concentrated on the addition of SF_5 radicals to π-bonds. Our interest, however, lies in investigating the interactions of SF_5 radicals with strained σ-bonds, such those found in structures like [1.1.1]propellane and [1.1.0]bicyclobutanes. In this study, we reveal our latest advancements in developing new methods for "strain-release" pentafluorosulfanylation. We also delve into mechanistic studies to elucidate how [1.1.0]bicyclobutanes react with SF_5 radicals, using a comparative analysis with alkenes of similar structure.

Characterizing the Individual and Combined Effects of MEK-inhibitors and Carboplatin on DNA Double-strand Break Repair Pathways in Ovarian Cancer

Jaskaran Halait
Sponsor: Jeremy Chien, Ph.D.
MED: Obstetrics & Gynecology

With a five-year survival rate of 50.8%, cancers of the ovary and fallopian tube (known together as “ovarian cancer”) continue to rank as the most deadly gynecologic cancer—despite being only the third most common cancer of the female reproductive system. Partly to blame for this disheartening statistic are the high rates of resistance to first-line, platinum-based therapies in patients with recurrent disease. This study is part of a broader body of work on ways to prolong or re-confer platinum sensitivity to patients with ovarian cancer. Specifically, the effects of the anti-cancer therapies ASTX029, Trametinib, and Carboplatin, in isolation and combination, were examined in three ovarian cancer cell lines: OVCAR3, OVSAHO, and SKOV3. Cells harvested at the 6-hour, 48-hour, and 14-day timepoints underwent single-cell RNA sequencing, with the resulting data being used in differential expression of genes analyses and visualization through the CELLxGENE program. When treated with a MEK-inhibitor, one of the three cell lines (OVCAR3) exhibited a preferential downregulation of multiple homologous recombination markers (BRCA1, BRCA2, RAD51) as compared to proteins involved in non-homologous end joining (XRCC4, LIG4). This finding adds to a growing body of evidence on the observed treatment synergism between MEK-inhibitors and DNA-damaging therapies like Carboplatin.

Strawberry Pollen Viability Analysis Using Differential Staining and Automated Image Processing

Ella Halberstadt
Sponsor: Mitchell Feldmann, Ph.D.
Plant Sciences

Pollen viability is essential to agriculture because of its crucial role in plant breeding and yield. Cultivated strawberry, *Fragaria x ananassa*, requires viable pollen to produce fruit and hybrid seed. To breed new strawberry cultivars, it is sometimes necessary to store pollen for making crosses between plants with different flowering habits. As time progresses, pollen loses viability and is rendered unusable, thus demonstrating the need to investigate the longevity of strawberry pollen in storage. To determine viability, I tested a protocol to differentiate between viable and non-viable pollen grains through a specialized combination of dyes. I used image processing software, ImageJ, to measure the ratio of viable to non-viable pollen from samples evaluated at the time of collection and after one and two months of storage at 4ºC to determine the maximum storage time. With this data, I will assess the variation in pollen viability between cultivars and investigate the genetic basis of pollen viability using genome-wide association analysis. This research will allow the UC Davis Strawberry Breeding Program to improve crossing plans that require hybridization between cultivars with different flowering habits and, possibly, to improve pollen viability through selective breeding.

Comparing the Relationship Between Complex Speech Sounds and Auditory Scenes in Recollection and Familiarity

Amaya Hamilton
Sponsor: Andrew Yonelinas, Ph.D.
Psychology

Prior research has established that visual forms of working memory are supported by recollection and familiarity, however, whether these processes also contribute to auditory working memory remains unclear. In this study, we examine auditory working memory for pure tones, complex speech (i.e., pitch, syllable, and location), and auditory scenes. For each paradigm, 24 young adults were given an auditory change-detection task where sounds were presented one after another. Participants were tasked with making confidence judgments indicating whether the sounds were the same or different, and Receiver Operating Characteristics (ROCs) were used to analyze performance. The results indicated that in each paradigm we examined both recollection and familiarity contributed to auditory working memory. Future studies will utilize these paradigms to examine the effects of aging and neurological disorders such as medial temporal lobe amnesia on the neural processes supporting auditory working memory. Additionally, future studies will examine differences in change detection performances between confidence judgments and binary responses (i.e., “perceive” or “sense”).

Harnessing Chaos for Generative Modeling in the Brain

Vivek Handebagh
Sponsor: Rishidev Chaudhuri, Ph.D.
Neuro Physio & Behavior

Many theories about the brain regard it to be continuously processing data, making predictions, and correcting mistakes. But with what kinds of networks and dynamics could it do that is the question we hope to answer. Networks of neurons in the brain have the potential to be exceedingly chaotic. While chaos and noise are often seen as impediments to computation, we show how chaotic activity may instead be used to support generative models in the brain. Specifically, we show that variability corresponding to the chaotic dynamics of strongly coupled recurrent neural networks can be used as a novel sampling scheme for generative models. Furthermore, we propose that the overall network gain parameter could be changed by neuromodulation to control the rate of learning and sampling in these models. As a proof-of-principle, we demonstrate the idea by adapting conventionally used generative models. While the sampling method is slow in traditional digital computing paradigms, we emphasize its applicability in the ability to implement generative architectures both in distributed biological systems and in neuromorphic hardware.

Virtual Reality Shopping: How Does Self-Reported Distractibility Affect Search Behavior in VR?

Zoe Hareng
Sponsor: Joy Geng, Ph.D.
Psychology

Various studies have begun to investigate search behavior in virtual reality (VR) environments, leveraging the ability to manipulate settings realistically while measuring aspects of behavior. Despite the evolving landscape of VR research, a gap exists in studies capturing organic search behavior. Studies have shown that people with high distractibility, such as those diagnosed with ADHD, exhibit less efficient visual search. However, this has primarily been studied using 2D displays, so it is unclear whether these findings extend to 3-dimensional search behaviors. This study addressed this limitation by having participants explore an IKEA-like VR furniture store, followed by a surprise “shopping” search task while their eye movements and position were tracked. Subsequently, participants complete a questionnaire, including the BAARS Inattention Scale to assess trait distractibility. The central question of interest revolves around how self-reported distractibility influences facets of search behavior. Preliminary results (N=53) suggest a small correlation between higher trait inattention scores and lower search efficiency across participants. Additional analyses will assess whether distractibility scores are related to various aspects of search behavior, such as time to find targets and fixations made during search. This research contributes to our understanding of how trait distractibility influences real-world behaviors, specifically within three-dimensional environments.

Assessing Changes in Soil *Fusarium oxysporum* and Fungal Profiles in Response to Biosolarization with Date Residue and Rice Bran Amendments in a Desert Climate

Krishnapriya Hari
Sponsor: Christopher Simmons, Ph.D.
Food Science & Technology

Finding alternative pest management strategies with minimal health and environmental consequences are essential for preserving soil health amidst periodic droughts. Biosolarization is the process of enriching soil with organic matter and covering it with a tarp, which stimulates the production of natural acidic biopesticides by the existing microbes. Unlike synthetic pesticides, biosolarization minimizes environmental and health impacts while reducing costs because it allows for natural biopesticide production in the soil. To investigate whether biosolarization can still be effective under desert conditions, this study examines the *Fusarium oxysporum* profiles resulting from a field trial conducted in Yuma, Arizona where soil was biosolarized with date paste and rice bran co-amendments. Bioassays were used to grow the *Fusarium oxysporum* colonies. The ITS1 and ITS2 regions of the *Fusarium* DNA will be amplified using PCR and sequenced to identify its morphology. The results of this study will provide key insight into the effects of biosolarization on a major fungal pathogen and the wider fungal community, which are essential for preserving soil constitution.

Single Cell Analysis of the VTA Following Morphine Treatment in a Mouse Model of Resilience to Opioid Use Disorder

Neha Hariharan
Sponsor: Alexander Nord, Ph.D.
Neuro Physio & Behavior

80,000+ opioid overdose deaths in the United States in 2021 indicate a critical need to understand cellular/molecular mechanisms of opioid use disorder (OUD). Toward the goal of identifying OUD-driving transcriptional responses to morphine, we utilized mice carrying a mutant mu opioid receptor (RMOR, for recycling-mu-opioid-receptor) that display intact antinociceptive responses to morphine, but do not show tolerance and dependence in paradigms where wild type (WT) mice do. We investigated the transcriptional response to morphine in the ventral tegmental area (VTA) of WT and RMOR mice. Methods include male and female WT and RMOR mice treated for 5-days with 10mg/kg subcutaneous morphine (or saline). On day-6, VTA was dissected and prepared for snRNAseq and differential-expression (DE) analysis. Our results were 51,683 cells passed QC, giving power to identify moderate cell-type specific DE. Expected neuronal and non-neuronal cell types were identified and were responsive to morphine. Genes involved in modulation of cellular excitability, and mediation of pain affect were DE across treatments and genotypes. Ongoing experiments include validation via RNA-FISH. Thusfar, our conclusion is uncovering transcriptional programs that may underlie the transition to dependence. Our results further elucidate molecular mechanisms of morphine response and could offer novel criteria for safer analgesics.

Prelimbic Cortex Involvement in Threat Avoidance

Lia Harvey
Sponsor: Brian Trainor, Ph.D.
Psychology

Continued stress over long periods of time often has negative impacts on mental and emotional health. The social defeat model induces behavioral responses in rodents that are similar to behavioral patterns associated with mental and mood disorders. For example, the anticipation of a potential threat may lead to increased exhibition of anxiety-like behavior. Male California mice (*Peromyscus californicus*) are placed into a waiting room for five minutes. Shortly afterwards, they are placed into a cage with an aggressive mouse of the same sex to get socially defeated. This process is repeated for three consecutive days. On the third day, the mice are only subjected to the waiting room and are not socially defeated. Previous work shows that the amount and duration of certain behaviors, like autogrooming and freezing, increases in the waiting room on the third day, as mice anticipate the onset of social stress. In this study, brains will be collected on the third day to determine patterns of neural activity occurring during the anticipation of social stress. Since the prelimbic cortex has been shown to be involved during threat response, C-Fos immunohistochemistry will be used to identify which neurons are active in the prelimbic cortex.

Preparing Sub Bacterial Particles Capable of Respiring from *Paracoccus denitrificans*

Malik Hassan
Sponsor: James Letts, Ph.D.
Molecular & Cellular Bio

The final stage of cellular respiration in Eukaryotes occurs in the inner mitochondrial membrane and involves the transfer of electrons through a series of membrane protein complexes, complexes, I, II, III and IV. The energy from the electron transfer reactions is used to create a proton motive force that generates ATP via complex V. However, they are typically studied in isolation after their removal from the membrane, which could alter their structure and would give a less accurate representation of the true electron transport chain. My objective was to measure the activity of the respiratory complexes in their native membrane state. I used the model organism *Paracoccus denitrificans* to make inverted membrane vesicles known as sub-bacterial particles (SBPs). *P. denitrificans* is a close relative to the protomitochondria, making it a good candite to serve as a mitochondrial model. To characterize their activity as well as determine the success of SBP formation, I measured the ability of the SBPs to respire under different conditions. Based on the respirometry measurements, the protocol was successful, but the complexes were poorly coupled to ATP synthase indicating that the SBP membrane is leaky. Further optimization of the protocol is needed to form well coupled SBPs.

Perception and Attitudes Towards Research Findings in Social Media Versus General News

Priya Hatangadi
Sponsor: Alison Ledgerwood, Ph.D.
Psychology

Social media has increasingly been used to communicate scientific findings to a wider audience. Existing research suggests a higher percentage of viewership of news through social media, however there is a need for empirical research on the viewers' attitudes towards them. Our study aims to assess perceptions of scientific findings when they are viewed in a social media format versus a general news article. Participants will be asked to take a series of questionnaires through Qualtrics, assessing their trust and interest in scientific findings. Trust will be defined by the article's perceived credibility and a participant's likelihood of sharing the news, measured using Likert-type scales. Interest will be assessed by a participant's time spent on a post or article, how well they understood the research, and their likelihood of doing further research. Utilizing graphic design elements to feign the presentation of social media and news articles, this study aims to measure trust and interest in scientific research when it is communicated over different platforms. We hypothesize that research findings presented on news platforms will gain more trust while those presented on social media will gain more interest. Our results may provide insight into more effective scientific communication.

Development of a DNA methylation assay for the *Mecp2* locus in the mouse genome

Payal Hegde
Sponsor: Kyle Fink, Ph.D.
MED: Neurology

Rett's syndrome (RTT) is a progressive neurodevelopmental disorder that occurs almost exclusively in females, affecting about 1 in 10,000 individuals. Following a brief period of normal infancy, patients experience a regression in developmental markers including difficulty feeding, impaired speech, mobility problems, jerky hand movements, and seizures. RTT is caused by a loss-of-function mutation of the *Mecp2* gene on the X chromosome. The normal copy of *Mecp2* is turned off in neurons by a process called X chromosome inactivation (Xi). A potential treatment for RTT is to reactivate *Mecp2* from Xi by demethylating the promoter region of this gene using CRISPR-based epigenome editing. As such, developing a suitable assay to detect DNA methylation in the *Mecp2* promoter will optimize preclinical therapy development. A promoter DNA methylation pattern analysis was determined by extracting DNA from mouse cells and brain tissue treated with CRISPR epigenome editors. This was followed by a bisulfite conversion, PCR amplification of bisulfite converted DNA, and Sanger sequencing. The development of an epigenome editor that targets hypermethylation of *Mecp2* in the brain has the potential to reverse clinical deficits and ultimately treat patients with RTT.

Community Partner Compensation in Clinical and Translational Science (CTSC) Hubs

Rikiya Hatano
Sponsor: Elizabeth Vasile, Ph.D.
MED: Clin & Trans Science Ctr

Community member participation is critical for shaping health research but the barriers to participating are great. One way to reduce barriers for community participation in health research is to compensate community members for their time and expertise. The purpose of this research is to examine how compensation of community members works within the Clinical Translational Science Award (CTSA) network by investigating sample community-engagement programs. To address this question, multiple research methods were utilized, including an environmental scan of community engaged research program offering within the CTSA network, a literature review of peer-reviewed journals, a survey of CTSA community engagement managers, and information collected from interviews. Our study shows that the compensation system for community partners research is different within each CTSA hub. In addition, the range and rate of compensation varies significantly. The aims of this research are to uncover barriers, make the compensation process less difficult and have community participation increase within the CTSA network.

Developing Anti-Racist Curricula: Exploring Liver Disease in Latiné Populations through Justice-Oriented Case Studies for Pre-health Students

Sanjna Hegde
Sponsor: Brie Tripp, Ph.D.
Neuro Physio & Behavior

Extensive initiatives have aimed to engender an anti-racist paradigm shift in medicine to reduce healthcare disparities. However, many pre-health students receive no education on how science and medicine perpetuate healthcare injustices, nor do they have the opportunity to collectively engage in justice-oriented actions. This study aims to increase awareness among undergraduate pre-health majors on how racism in medicine and society re/produces health disparities and what can be done to advocate against racial injustices. To achieve this, we have developed a series of Anti-Racist Case Studies that engage undergraduates in learning physiology through the lens of healthcare disparities. One such case involves analyzing data on the 1) pathophysiology of liver disease, 2) scientific injustices that perpetuate liver disease disparities in Latiné populations, and 3) ways to advocate with Latiné communities for justice. We will implement this case in an upper-division physiology course to measure changes in pre-health students' pathophysiology knowledge, awareness of factors contributing to healthcare disparities, and confidence to advocate for racial justice through quantitative (survey) and qualitative (interviews) research methods. We hypothesize pre-health students will become more aware of why healthcare disparities exist and feel empowered to act in solidarity with those most affected by systemic racism.

Investigating the Effects of Insulin-like Peptide 6 on Temperature Rhythms Induced Longevity

Grace Heringer
Sponsor: Fumika Hamada, Ph.D.
Neuro Physio & Behavior

Human body temperatures fluctuate throughout the day, playing a role in overall homeostatic regulation. This body temperature rhythm (BTR) is controlled by circadian clocks. We previously demonstrated that Drosophila (fruit flies) show similar BTR and regulatory mechanisms to mammals. The purpose of our research is to determine how BTR impacts longevity and which genes are involved in its regulation. We conducted a lifespan assay under several different temperature cycles and found that the wild-type flies housed in the incubator mimicking BTR (increase during the day and decrease during the night) lived longer than those in incubators with an inverse BTR (decrease during the day and increase during the night) or at a constant 25°C. Next, we performed lifespan experiments on insulin-like peptide 6 (*ilp6*) mutants and circadian clock mutants (*tim01*) to assess the importance of these genes on the lifespan of Drosophila. We discovered that *tim01* mutants showed similar life spans to the wild-type flies while all of the *ilp6* mutants lost their BTR-dependent longevity. These results suggest that BTR has an important role in longevity and that insulin signals help regulate BTR-dependent longevity, while circadian clocks may not.

Using Weighted Gene Correlation Network Analysis for Cross-comparison of Circadian Rhythmic Transcriptomes

Cielo Hernandez
Sponsor: Janine Lasalle, Ph.D.
MED: Medical Microbiology & Imm

Weighted Gene Correlation Network Analysis (WGCNA) is a systems biology approach designed for generating networks from RNAseq gene expression data and uses midweight correlation statistics to build modules of co-expressing genes. These modules define gene-gene interactions and can be used to determine gene regulatory networks based on co-expression. Each module is represented by module eigengenes which can then be used to correlate with a variety of traits associated with the experimental design. In this project, we are using WGCNA to build gene networks based on circadian RNAseq transcriptome data sets and trait measurements associated with each study. Although WGCNA has been used in the circadian biology field to identify co-expressing genes, we have taken the approach a step further using WGCNA to compare across different circadian rhythm transcriptome data sets to identify convergent pathways. Using both the consensus module and module preservation approaches, we can identify which groups of genes and pathways are cycling similarly or differently across different datasets. This could be useful for various applications for identifying rhythmic biological processes across tissue types, sexes, species, and models. Furthermore, this approach can also be applied to other data types including epigenomic, proteomic, and metabolomic in addition to transcriptomic data.

Latina Mathematics Undergraduates at UC Davis: Their Academic Success Factors and Their Identity

Ana Hernandez
Sponsor: Michael Singh, Ph.D.
Chicano Studies

Research shows that 13% of Latina women hold a bachelor's degree, but Latina women continue to be underrepresented in the STEM field. Latina students in the STEM field face various challenges throughout their journey to achieve a bachelor's degree. Challenges include scarcity of representation, lack of resources, and struggles in building and maintaining connections with faculty and peers. Factors Latina culture, like family values and expectations, also play a significant role in a student's academic outcome. This study aims to examine the academic success factors of Latina Mathematics undergraduates at UC Davis and how they view their identity in the STEM field. The purpose of this study is to learn about the lived experiences of Latina math students, the obstacles they have encountered, and their reasons for continuing the pursuit of a bachelor's degree in Mathematics. As well as bringing to light the resources that UC Davis offers that have helped and resources we wish to see for future Latina students.

Assessing the Learning Abilities of Steelhead Trout (*Oncorhynchus mykiss*) in an Isolated and Social Environment

Nancy Hernandez Legaspi
Sponsor: Carly Moody, Ph.D.
Animal Science

Previous research suggests fish in aquaculture are trainable through a variety of methods. Steelhead trout (*Oncorhynchus mykiss*) are reared for conservation and commercial purposes, and little is known about their learning abilities. We aim to elucidate how steelhead trout respond to positive reinforcement training in both an isolated (phase 1) and social environment (phase 2). During phase one, 18 trout will be individually housed and trained to swim through a hoop. Immediately following performance of this task, we will provide a high value food reward as reinforcement which will encourage the fish to repeat this task. Training will be deemed 'complete' when a fish has successfully performed the task 7 out of 10 times during three consecutive training sessions (informed through pilot testing). During phase 2, trained fish will be paired and housed with an untrained fish (n=18 pairs) to assess the influence of a social environment. The untrained fish will be exposed to their trained conspecific performing the task, then the untrained fish will follow the phase 1 training protocol in the presence of the trained fish. We predict fewer training sessions will be needed to successfully train fish in the social setting compared to fish training individually.

Characterizing Proliferation and Differentiation of Primary Bovine Muscle Satellite Cells

Alessandra Hernando
Sponsor: Lucas Smith, Ph.D.
MED: Physical Medicine & Rehab

Cultivated meat is the process of obtaining skeletal muscle cells from an animal, growing and differentiating collected cells in vitro, and processing them into a final meat product. Muscle satellite cells (MuSCs) are myogenic progenitor cells that can differentiate into early muscle structures called myotubes. Due to the scarce prior research of MuSCs, we characterized the differentiation and proliferation capacity of bovine MuSCs over time to establish a baseline of cell behavior in culture. MuSCs were initially isolated from bovine brisket in collaboration with the UC Davis Meat Lab and cultured under growth or differentiation conditions. Immunofluorescence and cell staining were used on the cells, and further analyzed using ImageJ to determine cell cycle stage and myotube development. We hypothesize that differentiation and proliferation capacity decreases over time. The findings of this study contribute to understanding the effectiveness of bovine MuSCs as a source for cultivated meat and to establish baseline characteristics for future studies.

Methyl Deletion Effects on *Epi-Aristolochene* in Tobacco *Epi-Aristolochene* Synthase (TEAS)

Ashleigh Higgins
Sponsor: Dean Tantillo, Ph.D.
Chemistry

Terpenes are a class of natural products found in plants that are most well-known for their fragrant-producing properties. Sesquiterpenes, specifically *epi-aristolochene*, a 15-carbon terpene, is the focus compound in this experiment where the possible mechanism of formation is given without the presence of an enzyme. The purpose of this experiment is to see if a methyl deletion (replaced with a hydrogen) in an intermediate of the mechanism will affect the reactivity predictions given by the predicted mechanism occurring in a Tobacco *epi-aristolochene* synthase (TEAS). With computational chemistry techniques, the mechanism was built and intermediates will be modeled and docked into the enzyme using the *TerDockin* method on Rosetta. It is predicted that the methyl edit will not have a large enough impact to nullify the reaction or change the mechanism. If the methyl deleted carbocation is able to carry out within the mechanism, a 14-carbon terpene will be the product of the mechanism. Currently, there are no known 14-carbon terpenes available, opening up the possibilities of new terpene products produced synthetically.

Root System Architecture of Aquaponic Genovese Basil (*Ocimum basilicum)*

Mikaila Hishaw
Sponsor: Jason Gross, Ph.D.
Animal Science

The use of walnut shells in a hydroponic media has potential to reduce the carbon footprint of the walnut industry. The distribution of roots within a space changes depending on the medium a plant is grown in and is reflective of the plant's acclimation to surroundings. Root systems provide structural stability for plants as well as a method to access and store vital nutrients. In this experiment, genovese basil was grown in 5, 10, 25, 33 and 50% mixtures of crushed walnut shell and coconut coir. 324 plants were randomly distributed by row across 6 replicate trays. After 42 days of growth the plants were harvested and the side and bottom root growth of a randomly selected plant from each treatment on each tray was photographed while the media was still compacted. All 54 images were converted to grayscale in ImageJ and the percentage of space occupied by roots and media were calculated. An analysis of variance (ANOVA) test was used to analyze root area with results suggesting no significant difference in root area for any particular treatment. No negative correlation to area fraction in results suggested walnut shells may be an effective low cost alternative to traditional hydroponic media.

Automated Image Collection and Species Classification for *Anopheles* and non-*Anopheles* Mosquitoes

Cali Ho
Sponsor: Gregory Lanzaro, Ph.D.
VM: Pathology, Micro, & Immun

Anopheles mosquitoes, a set of species capable of transmitting malaria to humans, exhibit unique, visible characteristics that set them apart from other mosquito species. Leveraging these distinguishing features, our project aims to develop an automated system for the classification of *Anopheles* and non-*Anopheles* mosquitoes, facilitating rapid categorization of mosquito samples and accelerating the pace of research on malaria prevention. To achieve this, we designed an automated microscope stage capable of capturing high-quality images of mosquito specimens. We've also built an object detection model, based on the YOLOv8 algorithm, to accurately identify and photograph mosquitoes on the stage without manual intervention. The heart of our methodology is an image classification model that distinguishes between mosquito species by analyzing these images. From here, our goal is to integrate all three of these parts together in a process that is fully automated end-to-end, to build improved versions of the microscope stage prototype, and to improve the image classifier model through hyperparameter tuning and additional training on new images taken using the aforementioned stage and object detector.

PDZ Motif-Dependent Regulation of the Protein Kinase D Interactome

Duong Hoang
Sponsor: Julie Bossuyt, Ph.D.
MED: Pharmacology

Protein Kinase D (PKD) dysregulation is linked to several human diseases including heart failure and cancer, underscoring the importance of understanding its regulation. PKD isoforms have PDZ binding motifs in their C-terminus that are subject to phosphorylation; however, their role in PKD function regulation and targeting remains unclear. PDZ domains are one of the most widespread regulating modules of scaffolding proteins and function by recognizing and binding to short peptide stretches. Interestingly, PKD activation has been linked to phosphorylation of Serine 916 within its PDZ motif. Our goal here is to explore how PDZ binding motif affects the kinase interactome and targeting. Hereto we use non-phosphorylatable (S916A) and phosphomimetic (S916D) mutants of PKD1 in a proximity labeling approach to ascertain the interactome. In addition, we also perform pharmaceutical interventions to activate and inhibit PKD. Biotin labeling of neighboring proteins is assessed by streptavidin probing of western blots prior to streptavidin mediated pulldowns and mass spectrometry analysis of proteins. These experiments should provide new insights into the role of the PDZ binding motif in the functional regulation of PKD.

Modeling the Dynamics of Sediment Detachment in Subducting Plate Systems

Liam Hofmann
Sponsor: Magali Billen, Ph.D.
Earth And Planetary Sciences

Subduction zones are areas where one of Earth's tectonic plates slides under another. In a subducting plate system, sediment is sometimes dragged into the upper mantle on top of the subducted plate. Sediment signatures in arc lavas show that sediment layers often detach and form buoyant diapirs somewhere in the upper mantle, and previous models have predicted that diapirism is a feature in many subduction zones. At the same time, geochemical measurements also show that sediments sometimes sink deep into the Earth's lower mantle. However, it is unknown exactly what initial conditions determine if, when, and how much sediment detaches as the plate first enters the mantle. This study puts into context previous research that hypothesizes growth rates for diapirs corresponding to initial perturbations in the sediment layer. We will run 18 models determining how sediment dynamics are affected by physical parameters such as slab velocity, differences in density, sediment viscosity, and the thickness of the sediment layer. We will also investigate the relationship between sediment detachment and the growth of the thermal boundary layer. These models could be the foundation for more detailed experiments that include realistic sediment compositions and the effects of sediment melt.

Investigating MKRN Gene Family's Function in *Populus trichocarpa* Through Agrobacterium Mediated Transformation and Generation of Transgenic Plantlines

Kody Hofteig
Sponsor: Nitzan Shabek, Ph.D.
Plant Biology

Climate change poses a challenge for California's forests by limiting water and imposing stress on plants through drought. To further understand tree responses to abiotic stress, we are investigating the E3 ubiquitin ligase gene MAKORIN (MKRN) in poplar, a model tree genus. E3 ligases are components within the ubiquitin-proteasome system (UPS) which degrades proteins,controls developmental processes, and targets pathogenic proteins. Highly conserved among eukaryotes, the MKRN gene family likely plays a role in germination, the early stages of morphogenesis and cell differentiation in plants. In poplar trees, preliminary research has linked a MKRN ortholog with wood traits associated to vulnerability to drought. The aim of this studyis to investigate the function of MKRN in Populus tremula x alba (INRA 717 1B4) through a knock-out mutation approach. Specifically, we will generate loss of function mutants through Agrobacterium mediated transformation of a CRISPR CAS9 vector into Populus explants. This will allow for subsequent experiments with the aim of functional characterization.

Mass Spectrometry Imaging of Nutrient Transfer Regions in Placentas for Active and Inactive Pregnancy

Sylvia Holesinger
Sponsor: Elizabeth Neumann, Ph.D.
Chemistry

The positive influence of physical activity on gestational health is widely recognized, however, the extent of its impact on fetal development remains a subject of ongoing research. This study utilized placental tissues to investigate how physical activity during gestation affects placental lipidomic composition. Placentas are the vital life support system for the fetus, facilitating exchange of oxygen, nutrients, antibodies, and fetal waste between the fetus and the pregnant individual— making them invaluable tools for ethically studying fetal development. Full-term placental samples from both physically inactive and active patients were analyzed using Matrix-assisted laser desorption/ ionization mass spectrometry imaging (MALDI-MSI) to examine the spatial distribution of lipidomic composition within nutrient-exchange regions of the placenta. Hematoxylin and Eosin (H&E) staining was performed to determine regions of interest for MALDI-MSI analysis. Preliminary findings indicate that the discerned lipidomic variation detected in the placenta have potential implications in nutrient transfer processes, influencing overall fetal health. This research may guide medical professionals in advising appropriate physical activity during pregnancy, enhancing outcomes in both fetal and pregnancy health.

Effect of Solvent Composition on Low-Concentration Polymer-Solvent Interactions

Megan Hong
Sponsor: Adam Moule, Ph.D.
Chemical Engineering

Polymer dissolution is essential to polymer science and engineering due to its applications in pharmaceutical drug delivery, chemical recycling, and organic semiconductor patterning. The solubility of a polymer in a specific solvent is dependent on the Helmholtz free energy of mixing, the entropy of which is modified by the Flory-Huggins parameter. The Flory interaction parameter (X) characterizes the solution's interactions — polymer-solvent, polymer-polymer and solvent-solvent. Currently, complex polymer-solvent interactions are poorly understood and the X parameters have to be laborously determined using experimentation. The extensive experimentation leads to limited ability to predict solvent selection and dissolution conditions for a new polymer. Our group performed a series of quantitative experiments to explore the effects of solvent quality and temperature on polymer dissolution and X. A "good" solvent is combined with a "poor" solvent, creating a tunable mixture. We determined that the volume ratio is linearly related to the polymer dissolution temperature. We are currently performing additional experiments using varying polymer concentrations, narrower polymer weight distribution, and other solvent combinations. Next, we will model this data using the Flory-Huggins model. The long-term goal of this research is to develop a general model for polymer dissolution as a function of solvent quality.

Assessment of ECG Parameters Recorded With Smartphone-based Electrocardiogram After Exercise in Thoroughbred Racehorses.

Savannah Hopkins
Sponsor: Jessica Morgan, D.V.M.,Ph.D.
VM: Medicine & Epidemiology

Smartphone-based electrocardiograms (ECG) have potential for cardiac arrhythmia screening in racehorses. This study aims to establish standard ECG parameters for Thoroughbred racehorses before and after exercise. We hypothesize racehorses will have a higher average heart rate, lower PQ interval, QRS duration, and QT interval on post-exercise ECGs compared to pre-exercise ECGs. One hundred Thoroughbred racehorses in training underwent thirty-second ECG recordings with this device at rest and after exercise. Measurements of the PQ interval, QRS duration, QT interval, and heart rate from three beats will be averaged for each normal ECG. Statistical analyses include the Shapiro-Wilks test for normality, a paired t-test comparing mean values, and regression analysis of the relationship between heart rate and PQ, QRS, and QT intervals. A preliminary analysis of ten horses indicates significant differences in average PQ interval ($p=0.007$), QT interval ($p=0.04$), and heart rate ($p=0.0001$) post-exercise and a significant negative relationship between PQ interval and heart rate during both periods (pre $p=0.03$, post $p=0.002$) and between QT interval and heart rate in the post-exercise period ($p=0.0002$). These findings suggest differences in PQ interval, QT interval, and heart rate in the racehorse following exercise evaluated with handheld ECGs.

Transcriptomic Analysis of CRISPR/Cas9 Generated *RIN* Gene Promoter Mutants in Tomato

Jasmine Hsiao
Sponsor: Diane Beckles, Ph.D.
Plant Sciences

Tomato is a globally nutritious vegetable and a well-known model for understanding fruit ripening at the molecular level. However, tomatoes are perishable, and techniques to extend shelf life often adversely affect fruit quality, resulting in fruit loss and waste (FLW). Genome editing is a promising solution to enhance fruit quality and diminish FLW. The master transcription factor (TF), Ripening Inhibitor (RIN), governs tomato fruit ripening by binding to its own promoter, and other TFs and genes, regulating ripening transcriptomic network. This work used CRISPR/Cas9 to induce allelic mutations at the cis-regulatory elements and differentially methylated regions of the *RIN* promoter. Over 100 mutants exhibiting diverse promoter mutations showed changes in fruit shelf life, color, and firmness compared to the wild-type. However, how *RIN* promoter mutations induce downstream transcriptional changes and thereby alter fruit phenotype remains unknown. Our study assessed *RIN* expression by qRT-PCR in selected mutants, and will employ RNA-Seq to investigate the impact of the mutations on the fruit transcriptome. Mutations in the *RIN* promoter that differentially changed *RIN* expression should vary the expression of RIN-targeted genes and, in turn, change fruit-ripening physiology. These findings will offer insights into the molecular mechanisms governed by RIN.

Deciphering Evolutionary Relationships of Bacteriophages Found in the Microbiome Based on Connector Protein Divergence

Claire Hsieh
Sponsor: Francisco Arsuaga, Ph.D.
Molecular & Cellular Bio

Human microbiome research has largely focused on bacteria living in the gut despite the fact the crucial role bacteriophages play in this thriving ecosystem by preying on bacteria. A major step of both the lytic and lysogenic bacteriophage life cycle is the packaging and release of DNA into a host, for which the connector protein complex is responsible. Due to its importance, the connector protein is structurally conserved in the vast majority of bacteriophages with some variations among different families. Here we further investigate the connector protein using data from the metagenomic compendium of 189,000 viral genomes gathered from human stool metagenomes in Nayfach et. al's (2021) study of bacteriophages in the human gut. We have created a pipeline for finding and comparing the connector protein in the metagenomic compendium. Based on this data, we will assemble a phylogenetic tree to examine the evolutionary relationships of bacteriophages in the human microbiome by comparing the protein at the sequence and structural level.

Investigating the Role of Zostera Marina's Root Microbiome in Nitrogen Cycling

Kaitlynn Hsieh
Sponsor: Jonathan Eisen, Ph.D.
MED: Medical Microbiology & Imm

Nitrification and denitrification are two important processes of the nitrogen cycle that removes ammonia from sediments and converts them into either nitrate or nitrogen gas. Nitrification and denitrification are important to the coastal ecosystem because they prevent algal blooms, which can cause a decrease in sunlight availability to *Zostera Marina* and other primary producers alike. By studying the root microbiome of *Z. marina*, we can further understand the role they play in nitrogen cycling and how their microbes improve the quality of life and help them thrive in the ever-changing marine environment. Here, we describe the genomes of bacterial isolates from the roots of *Z. marina* and identify their metabolic potentials, including those that are linked to nitrogen cycling. Epiphytes and endophytes in this study were isolated from *Z. marina* roots harvested from Bodega Bay, California, United States. The genome sequencing was performed by Seq Coast and then analyzed by using KBase. Analyses include phylogeny, metabolic pathways, and genes related to nitrification and denitrification.

Investigating the Relationship Between White Matter Cerebrovascular Reactivity and Functional Connectivity Using Resting-State Functional MRI

Claire Hsu
Sponsor: Audrey Fan, Ph.D.
Biomedical Engineering

Cerebrovascular reactivity (CVR), the ability for blood vessels to dilate in response to vasoactive stimuli, is an indicator of cerebrovascular health. In this study, we calculate resting-state CVR (rs-CVR) using the blood-oxygen-level-dependent (BOLD) signal of resting-state functional magnetic resonance imaging (rs-fMRI) scans. Resting-state fMRI is also used to measure functional connectivity (FC), or the correlation between BOLD signals in distinct brain regions, and assess neuronal function. Both these metrics are sensitive to age-related effects and may precede structural cognitive decline, therefore, investigating the relationship between the two may help us gain insight into aging and neurodegeneration. We hypothesize that FC the default mode network (DMN), a functional network that changes in aging and cognitive impairment, will be positively correlated to the rs-CVR values of network-specific white matter (WM) tracts. Resting-state fMRI scans from the Alzheimer's Disease Research Center were used to generate rs-CVR maps and FC maps for 133 participants (63-97 years, 40 male). Our preliminary results identified a negative relationship between FC of the DMN and age ($p=0.0115$). In the future, we hope to use multiple linear regression and mediation analyses to understand the association between rs-CVR, FC, and other indicators of vascular health.

Using *Kluyveromyces lactis* to Express Bovine Casein Protein for Vegan Cheese Production

Kenta Hsu
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

Dairy cows are the third-largest producers of greenhouse gases in the food industry. In response to these environmental concerns, interest in milk alternatives has increased in recent years. While plant-based milks have been commercially successful, vegan cheeses have gained a somewhat poor reputation among consumers. Many plant-based cheeses have a low protein content, and lack the characteristic stretch and mouthfeel that consumers expect with traditional dairy-based cheeses. While there are cheeses that utilize plant-based proteins and have a more cheese-like texture, they often fail to replicate the taste of the cheese they are attempting to emulate. Our research focuses on using the yeast *Kluyveromyces lactis* to synthesize four different bovine casein proteins which, when combined with other components, can be used to make a vegan cheese that resembles real cheese in both texture and taste. We are currently investigating modes of protein expression and several purification methods, and their impact on cost and yield. Additionally, we are also evaluating the manufacturing costs for an eventual product, which involves sourcing the other components for our vegan cheese and researching different cheese varieties in order to select a cost-effective product to make.

Investigating the Role of a Conserved Histidine in the RNA binding domains of ADAR2 on RNA Editing Efficiency

Katherine Htut
Sponsor: Andrew Fisher, Ph.D.
Ag Molecular & Cellular Bio

Adenosine deaminases acting on RNA (ADARs) catalyzes the hydrolytic deamination of adenosine to inosine in regions of dsRNA structure. Inosine mimics guanosine resulting in re-coding specific codons on mRNA, expanding the proteome. A crystal structure of a truncated ADAR2-R2D (dsRBD2 + deaminase domain), revealed ADAR2 binds as an asymmetric homodimer on dsRNA. A catalytic deaminase domain binds to the flipped-out adenosine while the second monomer's deaminase domain binds to the catalytic deaminase domain. This "auxiliary" monomer's dsRBD2 domain binds to dsRNA while the dsRBD2 domain of the catalytic monomer is disordered. A Cryo-EM structure on full-length ADAR2 also revealed an asymmetric homodimer, but surprisingly the dsRBD1 domain is disordered in both monomers. These studies suggest that dsRBD1 may not be necessary for stabilizing the "Michaelis" complex binding to dsRNA. Additionally, these structures reveal conserved histidine residues in dsRBD interacting with RNA. This histidine is conserved in all dsRBDs of ADAR2 and ADAR1 suggesting an important role. This project aims to understand the functional role of the histidine in both dsRBDs in ADAR2. The conserved residues will be mutated (H105A in dsRBD1, H259A in dsRBD2, and the H105A-H259A double mutant) to examine the impact on RNA editing efficiency.

Genome-wide association of growth in *Botrytis cinerea*

Jaisy Huang
Sponsor: Dan Kliebenstein, Ph.D.
Plant Sciences

During plant pathogen interactions, pathogens use a variety of virulence mechanisms to infect their host. However, energetic investment in the mechanisms may come at the expense of the pathogens growth rate. This trade-off is further complicated by pathogens often relying on detoxification strategies that scale with the size of their host. This suggests that growth investment and virulence, may at times not be a trade-off. To test how growth investment and virulence are connected, we leveraged an association mapping population of *Botrytis cinerea*, a host generalist necrotrophic pathogen that uses a wide range of virulence mechanisms. Given this pathogen causes billions of dollars in crop damage, studying the interaction between the pathogen and its host can offer valuable insights into potential genomic connections that could be utilized to reduce agricultural losses. Using a variety of Botrytis isolates, we identified genomic regions associated with growth rate under high resource conditions using genome-wide association. This work links virulence mechanisms targeting the host with basic growth investment to weaken host immunity.

Effect of Woodsmoke Chemicals on Cross-linked Mechanism in Heme Protein

Zixin Huang
Sponsor: Robert Rice, Ph.D.
Environmental Toxicology

Air pollution contributes to serious health problems in human beings. Woodsmoke chemicals, common air pollutants, are used to investigate how proteins respond to smoke exposure. To examine the hypothesis that some smoke chemicals can induce cross-linking of heme proteins, cytochrome C, a heme protein, is exposed to catechol derivatives. Results show that reactant concentrations, exposure times, and buffer additions strongly affect the extent of cross-linking. Through western blot and SDS-PAGE analysis, incorporation of an aliphatic amine is observed in response to treatment. By contrast, exposure to non-heme proteins does not result in protein cross-linking, but aliphatic amine incorporation is still observed. Elucidating the role of buffer addition to the extent of these reactions, which may reflect the activation of sluggish oxidants, is continuing. These experiments highlight the importance of understanding the mechanisms underlying interactions between smoke chemicals and proteins, especially heme proteins. The results may permit the development of a way to monitor exposures by the non-invasive sampling of the human epidermis.

Studying the Roles of a Quinolinic Acid Biosynthesis Factor *BNA1* in NAD^+ Homeostasis Using *Saccharomyces cerevisiae*

Katie Huang
Sponsor: Su-ju Lin, Ph.D.
Microbiology & Molec Genetics

Nicotinamide adenine dinucleotide (NAD^+) is an essential metabolic cofactor involved in redox reactions, cellular signaling, and regulation. Abnormal levels of NAD^+ and its precursors have been shown to play a role in several age-related human disorders. As a result, these metabolites are emerging therapeutic targets. In our previous gene overexpression screenings, we identified *BNA1* as one of the genes that showed an unexpected phenotype. *BNA1* functions in the *de novo* biosynthesis pathway of NAD^+ precursor quinolinic acid (QA). Its overexpression demonstrated an unexpected release of nicotinic acid/nicotinamide (NA/NAM) intermediates, though only increased levels of QA were expected. Increased levels of NA/NAM release have been associated with abnormal mitochondrial function and, notably, autophagy was shown to contribute to increased NA/NAM in some of these mutants. We hypothesize that *BNA1* overexpression may induce QA-mediated cytotoxicity and lead to autophagy and/or mitophagy, causing an increase in NAD^+ turnover. In turn, this would increase NA/NAM levels. Ongoing research is being conducted to investigate the autophagic and mitophagic states as well as the intracellular NAD^+ concentration to elucidate the role of *BNA1* in NAD^+ metabolism.

Larval Rosy Rockfish (*Sebastes rosaceus*) Otolith Core Size as a Function of Maternal Temperature, Rationing, and Fecundity

Sammuel Huang
Sponsor: Nann Fangue, Ph.D.
Wildlife & Fisheries Biology

The Big Old Fat Fecund Female Fish (BOFFFF) hypothesis posits that older, larger females are relatively more fecund than their younger, smaller counterparts. In a recent study, larval survival and growth rate have been correlated with larger otolith core size and distance from shore - which implies larger females with less fishing pressure are producing better quality larvae. Indeed, in another study, bigger and better-fed female rosy rockfish (*Sebastes rosaceus*) produced a higher number of parturitions and larvae, which supports the BOFFFF hypothesis. However, high reproductive output does not necessarily correlate with larval fitness and subsequent recruitment, nor has it been examined to influence otolith core size. In this study, we exposed wild female rosy rockfish to temperature (low, high) and rationing (low, high) treatments. To deduce the significant variable(s) affecting otolith core size, we conducted a multivariate analysis (partial least squares regression) that includes environmental (temperature, ration), maternal (length, weight, gonad and liver weight, parturition number and total fecundity) and larval (notochord length, width, oil globule volume) parameters. Characterizing the factors influencing larval otolith core size has major conservation and fisheries implications that could aid in predicting fish recruitment based upon reproductive output and larval quality.

Investigating the Functions of kaiC in Multiple Myxobacteria Species Through the Development of New CRISPR-Cas9 Systems

Jerry Huang
Sponsor: Mitchell Singer, Ph.D.
Ag Microbiology & Molec Gene

Myxococcales is a distinct class of Gram-negative bacteria with a unique life cycle and a starvation-induced multicellular stage called fruiting bodies. Members of this class include species such as *M. macrosporus*, which under certain light conditions, generate patterns of fruiting bodies in concentric rings, implying a possible circadian clock that is light-responsive and regulates the formation of fruiting bodies. A proposed hypothesis suggests that the *kaiC* gene, which encodes KaiC, is shown to be involved in circadian rhythm pattern formation in Cyanobacteria, and might be the regulating factor. While the Myxococcales are non-photosynthetic, many members contain homologs of the *kaiC* gene, and phytochromes, light-dependent histidine kinases. Currently, the molecular and genetic mechanisms involving *kaiC* are not clearly determined. Therefore, this project aims to investigate the genetics and functions of *kaiC* in development, light response, and metabolism. Unfortunately, many myxobacteria species besides *Myxococcus xanthus*, the current model system, are resistant to gene-editing techniques. The second aim of this project is to design a CRISPR-Cas9 protocol system in previously gene-editing resistant species of myxobacteria such as *S. aurantiaca*. The advancement in genome accessibility and a new model genetic system will have significant implications for the future of genetic analysis within the Myxococcales.

Investigating the Role of HSR-9 in X-Chromosome Segregation during Oogenesis

Erica Huey
Sponsor: Joanne Engebrecht, Ph.D.
Molecular & Cellular Bio

During meiosis, accurate homologous chromosome pairing and synapsis prevent the production of defective and inviable progeny. Checkpoints monitor chromosome pairing and synapsis to facilitate accurate chromosome segregation. 53PB1 is a tumor suppressor protein that functions in DNA repair and cell cycle checkpoints. The *C. elegans* ortholog of 53BP1 is HSR-9.To investigate HSR-9's role in monitoring synapsis, I constructed a double mutant homozygous for *hsr-9* and *zim-2*. ZIM-2 is essential for synapsis of chromosome V; *zim-2* mutants lead to embryonic lethality due to a failure to pair and synapse chromosome V. Additionally, I explored the impact of removing HIM-8, the X chromosome pairing center protein, since HSR-9 is concentrated there. *him-8* mutants disrupt X chromosome segregation, which increases male progeny.

Results indicated that HSR-9 isn't significantly involved when autosomal chromosomes fail to pair and recombine. However, *hsr-9;him-8* mutants produce fewer male progeny compared to *him-8* mutants alone, suggesting HSR-9's role in X chromosome segregation. To understand this reduction, I'm currently investigating if it's specific to oogenesis and measuring nondisjunction events. Currently, I'm generating *hsr-9;him-8* and *him-8* strains with fluorescence markers on each X chromosome to assess how HSR-9 absence affects chromosome nondisjunction events when crossed to wild-type males.

Assessing the Relationship Between Rumen Fluid Variability and In Vitro Digestibility

Katie Huezo
Sponsor: E Depeters, Ph.D.
Animal Science

Conventionally, animal scientists utilize in vitro lab procedures to determine digestibility of numerous feedstuffs by simulating anaerobic fermentation environments of the rumen in a laboratory setting. Feed particle breakdown then occurs as it would in live ruminant animals. Current in vitro rumen fermentation methods recommend mixing rumen fluid from multiple animals to obtain a more representative microbial population and reduce variability of digestibility estimates. The study objective was determining the validity of this recommendation as little research exists supporting use of mixed rumen fluid over fluid from one animal. Rumen fluid collected from three individual rumen-fistulated cows were included as treatments and compared with a rumen-fluid mix of all three cows. Metabolizable energy and in vitro rumen digestibility of dry matter (DM) and neutral-detergent fiber (NDF) of alfalfa varying in forage quality were used for comparison. Study approach used two in vitro methods, an Ankom Daisyll incubator, and a gas production procedure. In vitro digestibility estimates of DM and NDF for alfalfa were more variable between runs for individual cows while mixed rumen fluid yielded more consistent estimates. Study findings support using mixed rumen fluid to reduce variability and improve in vitro digestibility predictions of DM and NDF for feedstuffs.

Increased Temperature Exacerbates Effects of Short-Term Oil Exposure in Developing Zebrafish

Harriet Hughes
Sponsor: Christina Pasparakis, Ph.D.
Environmental Toxicology

In an era of fossil fuel growth, the inevitability of the next major oil spill poses significant threats to marine life. Global warming exacerbates this risk, with recent studies indicating intensified harm when oil exposed fish are raised under elevated temperatures. Embryonic fish are highly vulnerable to crude oil toxicity due to their lack of defense mechanisms, transparency, and limited mobility. Phenanthrene is a three-ringed polycyclic aromatic hydrocarbon (PAH) found in crude oil that has toxic effects on developing fish. While its effects on early-life stage fish are well-studied, there is limited research exploring shorter, stage-specific exposures that may reflect more ecologically relevant environmental conditions. In addition, few studies investigate the combined effects of PAHs with multiple relevant stressors. We conducted a multi-stressor experiment to examine the interactive impacts of a short-term phenanthrene exposure and increased temperature on zebrafish development. We exposed zebrafish embryos to various phenanthrene concentrations for 24 hours at 28°C (ambient) and 32°C (elevated), and measured mortality and physiological responses, including oxygen consumption, heart rate, hatching rate, length, and morphological abnormalities such as spinal curvature and pericardial edema. Our findings suggest that phenanthrene and increased temperature combined have sublethal effects on zebrafish, indicating potential for population-level consequences.

Plants vs. Pests: Evolutionary and Enzyme Engineering Approaches to Construct Efficient Acylsugars for Sustainable Plant Self-Defense

Yu San (Emma) Hui
Sponsor: Yann-ru Lou, Ph.D.
Plant Biology

Acylsugars are specialized metabolites produced for herbivory defense in the Solanaceae family, which includes staple crops such as tomatoes. However, during domestication, crops have lost the ability to produce these natural defense compounds, making them susceptible to pest damage. To reintroduce acylsugars in agricultural applications, knowledge of their evolutionary diversity and resulting activity differences is required. Acylsugars are constructed by acylsugar acyltransferases (ASATs) which catalyze the addition of acyl chains of various lengths to a sugar backbone. Our project investigates the differences in substrate specificity between tomato (*Solanum lycopersicum*) ASAT1, which accepts a range of acyl chain lengths, and black nightshade (*Solanum nigrum*) ASAT1, which only accepts longer acyl chains. To identify the cause of these variations in activity, we utilized *in silico* protein folding to pinpoint key amino acid differences between these homologous enzymes. We performed mutagenesis and introduced *S. nigrum* mutations on a *S. lycopersicum* ASAT1 backbone. Our *in vitro* enzyme assays verified that this approach is promising, with five critical regions that need further investigation. Through understanding different ASAT1 enzyme activities, we aim to engineer more potent acylsugars for sustainable pest management. We hope to reintroduce them in cultivars for improved food safety and security.

Re-imagining the U.S. Demographic Table: Revealing Complex Racial and Ethnic Identities Obscured by Categorical Box-Checking and the 'Other' Label Problem

Andrew Hui
Sponsor: Alice Popejoy, Ph.D.
MED: Public Health Sciences

Undergraduate researchers enrolled in the Quarter at Aggie Square conducted primary research and investigated concepts of race and ethnicity through the lens of advancing health equity. Demographic data (N=4,300 individuals) collected by Community Health Workers in LA county were analyzed to understand how respondents answered the question: 'How would you describe your racial/ethnic background? (Please select all that apply.)' given six options for racial and ethnic categories, plus: 'Prefer not to answer' and 'Other-please specify'. Many people do not see themselves fitting into broad racial and ethnic categories, which are often included on official documents and surveys (e.g., U.S. Census) – and which are ubiquitous on clinical intake forms. As an increasing number of people select 'Other' in these circumstances, often providing additional free-text entries, researchers are grappling with the problem of how to effectively analyze and report this information. Here we provide a proof-of-concept for methods to meaningfully represent how people in this sample choose to self-identify, when given the option to fill in a blank text box. By demonstrating how computational approaches can be used to make sense of unstructured demographic data, we hope to facilitate a shift in how demographic information is collected and reported.

Sustainable Therapeutic Protein Production in Microalgae

Caleb Humphrey
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

The production of therapeutic proteins is currently dominated by a few chassis organisms including *E. coli*, *S. cerevisiae*, CHO cells, and some plants. However, synthetic biologists have, of late, been working to develop alternative chassis organisms that may provide advantages over these traditional chassis. Microbial photosynthesizers, or microalgae, are currently one interesting alternative. By only requiring light, trace minerals, buffer, and a nitrogen source, microalgae provide a potentially low-cost platform for therapeutic protein production that is also ecologically sustainable due to fast growth and photosynthetic ability. The microalgae *Chlamydomonas reinhardtii*'s physiology is well-documented and has been shown to synthesize stable mammalian proteins, making it a prime research candidate as a photosynthetic chassis organism. One of the biggest barriers to using *C. reinhardtii* as a chassis organism is performing a high-efficiency transformation. Our research strives to develop a transformation protocol that can efficiently integrate transgenic DNA into the *C. reinhardtii* genome using exponential electroporation. This transformation protocol can then be applied to a synthetic biology context to produce different therapeutic proteins, reducing the cost both financially and environmentally. Here, we present our recent work to improve transformation protocols for *C. reinhardtii*.

Antifungal Assay using Novel Maize Diterpene Metabolites against *Fusarium verticillioides*

David Hurd
Sponsor: Philipp Zerbe, Ph.D.
Plant Biology

Maize (*Zea mays*) is grown around the world and is a top caloric provider. Unfortunately, biotic and abiotic stresses cause significant losses in maize crop production every year, and these stresses will only worsen with climate change. Two of Maize's species-specific diterpenoid groups, Kauralexins (KXs) and Dolabralexins (DXs), have demonstrated important roles in fungal pathogen stress response. Recent co-expression studies in tobacco (*Nicotiana benthamiana*) revealed a novel pathway catalyzed by the *Zm*KSL1 diterpene synthase, which has close biochemical branching from DX and KX pathways. The close branching of this pathway, as well as the structural relatedness of *Zm*KSL1 products to KXs and DXs, suggests potential bioactive roles. To investigate antifungal activity, we tested the major products of the *Zm*KSL1pathway using *in vitro* antifungal assays against the growth of *Fusarium verticillioides*, a common maize pathogen. Our results support the importance of studying maize's innate antifungal metabolites to progress sustainable agricultural practices.

Food Mapping: Connecting Food Resources with UCDavis Students

Olivia Hurley
Sponsor: Nina Napawan, M.A.
Human Ecology

All over the United States, college students face barriers with accessing EBT, affording food, and budgeting time to cook and eat. This makes eating sufficient nutritional meals a challenge for many college students. A study that synthesized over 40 sources, found that more than one in three students face some form of food insecurity. At the University of California, Davis, efforts like the Pantry, the Student Farm, the Freedges, food centered student organizations, and the Teaching Kitchen work to combat student food insecurity. But, how could their resources work together to reach and help students the most effectively? This project will research and prototype a working database that compiles nutritional, affordable, diverse resources for students (ex: recipes, where to cook on campus, how to cook with a microwave, and how to maximize a low budget). By providing a food map for students, we can increase the use of campus resources and help students struggling with food insecurity access affordable food opportunities.

Expanding the Feminine Sphere: Women's Labour and Patronage in the 20th Century US South

Jackson Huston
Sponsor: Gregory Downs, Ph.D.
History

I examine a case study of women entering the white collar workforce into jobs that they had previously been prohibited from taking in the early 20th Century, utilizing a patronage theory of political economy as a model for expanding women's workforce participation. This project centers women as the driving agents of change, while engaging with the obstacles put in their way and offering one route by which these models were overcome. I find that job slots tended to be extended to women in places where a) they had greater organizational strength, b) the ruling party needs to shore up support, or c) there is a connection between activists and the local ruling party. I also find that these new job openings change the way women participate in electoral politics over time, extending support for agents who can provide access to the labour market. This research helps provide a model for increasing women's labour market participation in regions where access to work for women is greatly circumscribed by both gender, class, and informal access models.

Effects of Traffic-Related Air Pollution on the Locus Coeruleus in the Brain of Rats that Express Human Risk Genes for Alzheimer's Disease

Allyson Ikeda
Sponsor: Pamela Lein, Ph.D.
VM: Molecular Bio Sciences

Alzheimer's disease (AD) is the most prevalent form of dementia. Characteristic pathological features of AD include neuroinflammation, amyloid plaques and neurofibrillary tangles. Traffic related air pollution (TRAP) has recently been linked to aggravation of these AD pathologies, as well as increased neuronal damage and oxidative stress. Recent clinical data implicates the locus coeruleus, a brain region involved in arousal and adaptive behavior, as a site involved in early stages of AD. In this study, we tested the hypothesis that chronic exposure to TRAP accelerates and/or worsens neurodegeneration and/or neuroinflammation in the locus coeruleus. TgF344-AD rats, which express human AD risk genes, were exposed for 11 months to real-time TRAP drawn from a heavily trafficked tunnel; age- and sex-matched controls were exposed to filtered air (FA) at the same exposure facility. At the end of this exposure period, animals were euthanized to collect their brains. The right hemisphere of the brain was fixed in paraformaldehyde and cryosectioned for immunohistochemistry. Immunohistochemical analysis for tyrosine hydroxylase (a biomarker of adrenergic neurons), NeuN (neuronal biomarker), IBA1 (microglial biomarker), and iNOS (oxidative stress biomarker) are in progress.

Identification of CaMKII Methylation at R275

Zara Imran
Sponsor: Julie Bossuyt, Ph.D.
MED: Pharmacology

Calciumlcalmodulin-dependent protein kinase II (CaMKII) is fundamental in our understanding of cardiac signaling and heart disease. CaMKII modulates ion channel function, affects mitochondrial function, and gene regulation. Understanding CaMKII function and regulation is crucial and multiple regulatory post-translational modifications such as phosphorylation, oxidation, nitrosylation, and O-GlcNAcylation have been identified. A recent report suggests that methylation of CaMKII could be regulatory. Here we intend to explore the role of the R275 site on the cardiac CaMKII delta isoform. We transfected HEK cells with wildtype and non methylable R275A Camui constructs (full length CaMKII flanked with GFP and RFP fluorophores). We used immunoblotting and protein methylation altering drugs like 1 µM aldomet (nonspecific methyl donor), 1 µM furamidine (PRMT 1 Methyl Transferase Inhibitor), 1 µM MS023 (pan-PRMT Methyl Transferase Inhibitor), and 1 µM ADOX (aldomet inhibitor) over a 48-hour period. GFP directed pulldowns of CaMKII are used to identify CaMKII methylation state using asymmetric, symmetric, and monomethylation specific antibodies. These experiments provide new insight into the role of R275 methylation as a novel regulatory mechanism of CaMKII.

Decoding Bias in Large Language Models: A Comprehensive Analysis of Implicit and Explicit Biases and Enhancement Strategies

Yash Inani
Sponsor: Setareh Rafatirad, Ph.D.
Engr Computer Science

This study underscores the ever-growing necessity to tackle the inherent biases in Large Language Models in this era of increasingly pervasive generative AI. Large Language Models (LLMs) inherit biases from datasets on which they are trained. This work proposes an automated Bias-Identification Framework to recognize various biases in LLMs. In this study, we use bias-specific benchmarks such as StereoSet and CrowSPairs to evaluate the existence of various biases in multiple generative models such as BERT and GPT 3.5. We adopt a two-pronged approach to detect explicit and implicit biases in text data. Our findings illustrate that, despite having some success, LLMs often over-rely on keyword detection. To illuminate the capability of the analyzed LLMs in detecting implicit biases, we employed Bag-of-Words analysis and unveiled indications of implicit stereotyping within the vocabulary. To bolster the model performance, we applied an enhancement strategy involving fine-tuning models using prompting techniques and data augmentation of the bias benchmarks. The fine-tuned models exhibited promising adaptability during cross-dataset testing and significantly enhanced performance on implicit bias benchmarks, with performance gains of up to 20%.

A Multipart Analysis of Protein Deprivation on Life Expectancy in Male and Female Medflies

Madison Ishigaki
Sponsor: Maxime Pouokam, Ph.D.
Statistics

Studies based on over 400,000 Mediterranean fruit flies showed that on a normal diet (sucrose plus protein), female medflies have a higher life expectancy than male medflies. However, under a protein deprived diet (sucrose only), a sex reversal is observed where male medflies were revealed to have higher life expectancies than female medflies. In this study, we aim to establish these findings using different statistical methods. Given the richness and the complexity of the data, we propose several statistical approaches that help investigate the variabilities in the survival rates of male and female medflies. The statistical methods we propose include, but are not limited to, the Chi-square test for independence, the Mixed Models Random Effects with AR(1) Errors, and Clustering Analysis. Through these statistical techniques, our results can help build a more robust experiment design with fewer biases, paving the way for greater advancements on the impact of diet on life expectancy.

The Role of DAXX in Meiotic Sex Chromosome Inactivation and Male Germ Line Development

Numa Islam
Sponsor: Satoshi Namekawa, Ph.D.
Microbiology & Molec Genetics

Germ cells undergo intricate processes of division to eventually give rise to gametes, which are fundamental for the propagation of future generations. Meiotic Sex Chromosome Inactivation (MSCI) is a gene silencing process which is essential in male germ cell development. During MSCI, epigenetic landscape undergoes remodeling, and histone H3 is replaced by H3.3. DAXX is a multifunctional protein, and is one of the known H3.3 chaperones, but its role in MSCI remains unclear. We propose that DAXX facilitates the turnover from H3 to H3.3 in MSCI and absence of DAXX leads to male germline development defect. We produced DAXX conditional knocked out (CKO) mice strain in germline. Through comparison to the littermate control, we found the testes were significantly smaller in the CKO samples. Through further investigation by immunostaining, we found that there is a significantly larger number of cells undergoing apoptosis, and a greater number of stem cells in the CKO samples compared to the Control at the 4 week stage compared to the 6 month stage. This study sheds light on the critical role of DAXX in MSCI and male germline development.

Soil Carbon and Hydrological Responses to Conservation Management in California's Napa Valley Vineyards

Ivy Israel
Sponsor: Maria Lazcano Larkin, M.D.,Ph.D.
Land Air & Water Resources

California's irrigated vineyards are experiencing increased drought vulnerability from groundwater depletion and a changing climate. As both a climate change mitigation and adaptation strategy, there is growing interest in stacking soil conservation practices (cover crops, no-till, organic amendments, crop-livestock integration) within vineyards due to their potential to build soil organic carbon (SOC) and thus also overall soil health. Soil organic carbon is also important for soil hydrological properties, with increased SOC levels potentially improving soil water retention. However, despite widespread soil conservation practice adoption in California vineyards, little is known about the impact of these practices on soil water storage capacity and SOC in the long term. Therefore, we assessed the SOC pools and soil-water relations in 16 vineyards in Napa County with distinct management legacies and varying soil conservation practice combinations. In summer 2023, we collected soil in vineyard alley rows at a depth of 0-40 cm within each vineyard block to quantify total SOC, particulate organic carbon and mineral-associated organic carbon fractions, and soil water characteristics. We hypothesize that greater soil conservation practice adoption will yield greater SOC and water retention, therefore serving as a dual-purpose climate change adaptation and mitigation strategy for vineyards.

New York Times Media Project: The Representation of Syria in the 1960s

Eva Jabbari
Sponsor: Suad Joseph, Ph.D.
Anthropology

How did the New York Times (NYT) represent Syria in the 1960s? Syria was portrayed as a country lacking discipline; while Syrians were considered "energetic, [and] hardworking," they were simultaneously inhospitable and hostile to foreign influence to the point of "ingratitude." With ProQuest, I searched the NYT archive and screened 701 articles, 22 of which were relevant. Syria's representation frequently fits the lens of the United States' foreign policy agenda, specifically in the context of the Cold War. Once Syria left the United Arab Republic in September 1961, they became susceptible to Soviet influence and were held in lower esteem than Egypt. For instance, Syrians were deemed to "have no tradition of social discipline and order." Given the powerful influence of the New York Times, their portrayal of Syria has a great impact on how Syrians were perceived by people consuming western newsprint media. This research is part of a long-term analysis project of the New York Times from 1850 to the present from the Suad Joseph Lab. The project analyzes the representation of Islam and Muslims over 150 years.

Development of Breath Test for Respiratory Virus Diagnostics

Jasmine Jackson
Sponsor: Cristina Davis, Ph.D.
Mechanical & Aerospace Engr

To increase the capacity to test for respiratory viruses worldwide, such as COVID-19, the development of a new type of test is needed. Due to health complications, many patients may not be able to partake in the widely available nasopharyngeal swab test or blood test, so an alternative noninvasive test is highly desired. The purpose of our study is to distinguish unique breath VOC (volatile organic compounds) biomarkers of respiratory viral infection, and then use these biomarkers to develop a portable breath analysis device that could be used by clinicians to noninvasively diagnose patients. This breath analysis device would use our miniature differential mobility spectrometry (DMS) detector, coupled with chip-based gas chromatography. The device will include a custom chip-based preconcentrator, which will be concentrated with chemical sorbent to allow extraction of VOCs from breath. We currently recruit subjects from the UC Davis Medical Center and collect exhaled breath through Tenax Sorbent Tubes that capture VOC biomarkers and collect nasopharyngeal swabs along with demographic information. Our findings so far indicate that there is variation in the VOCs found between different respiratory viruses, including the distinct strands of COVID-19.

Investigating a Potential Novel Therapeutic Target in Osteosarcoma

Anthony Jacobo Gonzalez
Sponsor: Luke Wittenburg, Ph.D.
VM: Surg/Rad Science

Osteosarcoma (OS) is the most common bone cancer in humans yet there have been no novel therapies that improve patient survival in four decades. Core binding factor beta (CBFβ) is a binding partner to the RUNX family of transcription factors, acting as a transcriptional co-activator RUNX2-CBFβ is the master regulator of bone growth and differentiation. Notably, increased expression of each is correlated with poor patient outcome in sarcomas. Therefore, RUNX2-CBFβ binding may provide a target for OS treatment. Our objective is to characterize CBFβ knockout cells that have been reconstituted with either wild-type or mutant CBFβ that cannot bind RUNX2 in order to validate this binding as a target for treating OS. Cell doubling times will be determined and compared by counting viable cells using trypan blue exclusion. Furthermore, using a Boyden Chamber assay, cell migration and invasion through a matrix will be compared. Finally, we will compare the sensitivity of the cells to a proteasome inhibitor (MG132) and a standard chemotherapy (doxorubicin) by evaluating cell viability using a fluorometric bio-reductive assay. Preliminary results demonstrate that wild-type cells have a substantially faster doubling time (39 vs 55 hrs) suggesting inhibition of CBFβ-RUNX2 binding results in slower tumor cell growth.

Let the Light In: Understanding Importance of Eye Size as an Indicator of Ecological Niches in Brown Rockfish

Jasper Jacobs
Sponsor: Christina Pasparakis, Ph.D.
Environmental Toxicology

Thirty-two locally caught brown rockfish were given to us by the New Sea Angler in the Bodega Head region. Our study on brown rockfish (Sebastes auriculatus) delved into aspects such as size variation and the relationship between iris diameter, the cephalic, and fork length. We compared the iris diameter to the cephalic and fork length to see if there was any correlation between the two. Additionally, comparing the cephalic length in respect to brain size. As older brown rockfish tend to live deeper in the ocean, we speculated that their iris diameter should be bigger due to needing to absorb more light. Being able to absorb more light is important for fish so they can see predators as well as their food source. Due to the reliance on light absorption it's only rational to think the eyes diameter should be bigger in relation with the overall size of the fish. These investigations contribute to understanding rockfish biology and provide valuable insights that can be further explored.

Investigating the Automaticity of Semantic Prediction During Speech Comprehension

Melissa Jacuinde
Sponsor: Tamara Swaab, Ph.D.
Psychology

Prior studies suggest that speech processing is facilitated by prediction of imminent input. But it is unclear if predictive processing is automatic (e.g., Bayesian models) or adaptive (e.g., rational models). We examined this by manipulating the predictability of animacy of critical nouns in spoken sentence contexts (high- or low-constraint) and the proportion of sentences that reliably predict animacy (80% or 20%). If prediction is automatic, then animacy information should be retrieved in the high constraint condition before the critical nouns, regardless of proportion. Activation of animacy will be examined by decoding EEG from a 1000ms silence preceding critical nouns. Facilitated processing of critical nouns will be examined by comparing ERP animacy effects. If prediction is automatic, we expect above-chance decoding accuracy of animacy for high-constraint sentences in both conditions. If pre-activation of animacy automatically facilitates processing of critical nouns, we expect similarly modulated N400 animacy effects in both proportion conditions. However, if facilitated processing of the critical nouns adapts to prediction reliability, we expect reduced N400 animacy effects for high-constraint sentences in the 80% relative to the 20% condition. This latter pattern of results would indicate that pre-activation of animacy is automatic, but facilitation from prediction is not.

Characterizing the Long-Term Performance of Four Corsi-Rosenthal Boxes

Graham Jaeger
Sponsor: Rich Corsi, Ph.D.
Engineering Deans Office

As outdoor air quality worsens due to intensifying wildfires and concern increases about aerosol-borne infectious diseases, securing clean indoor air is more important than ever. Portable air cleaners are one popular solution. The do-it-yourself Corsi-Rosenthal Box (CR box), consisting of four air filters and a box fan, is particularly affordable and effective: it often out-performs pricier, commercially-available air cleaners that utilize high-efficiency particulate air (HEPA) filters. This research seeks to characterize CR box performance over a long period of use. First, we assembled four CR boxes and measured their initial performance. We then placed the CR boxes in different locations around UC Davis and scheduled them to run regularly. We measured their air cleaning performance after 70 and 140 days of use, with plans to test the CR boxes again at 210 and 280 days. We characterize air cleaning performance by calculating the clean air delivery rate (CADR), or volumetric flow rate of clean air, for each CR box across a range of particle sizes (0.3-3 μm). We find that CADR increases with particle size and fan speed (low, medium, and high), but CADR generally decreases with time across all fan speeds and particle sizes.

Unraveling the 'DAPI Hole' and Probing Nucleolus vs. Double-Dense Body in *Atf7ip2*-mutant Germ Cells

Saanvi Jain
Sponsor: Satoshi Namekawa, Ph.D.
Microbiology & Molec Genetics

The Namekawa lab recently characterized the role of meiosis-specific protein, ATF7IP2, in directing H3K9 methylation and meiotic gene regulation in the male germline. We demonstrated the requirement of ATF7IP2 in maintaining the meiotic checkpoint, meiotic sex chromosome inactivation (MSCI). In *Atf7ip2*-KO germ cells, we observed the mislocalization of critical MSCI proteins to a distinct region within the nucleus we call the “DAPI hole.” My project strives to determine the identity of this unknown structure. We hypothesize that this structure could be the nucleolus or the double-dense body, both structures which are not well studied in meiosis. To test my hypothesis, I will perform immunofluorescence to stain against nucleolar-specific protein, Fibrillarin, and double-dense body-specific protein, SCML1, using meiotic chromosome spreads of *Atf7ip2*-control and *Atf7ip2*-KO germ cells. Then, using a blinded approach, I will quantify signal overlap of the DAPI hole with SCML1 or Fibrillarin in each meiotic substage, and distances of SCML1 or Fibrillarin to the XY chromosomes. Through this study, we aim to unravel the identity of the DAPI hole and characterize the behavior of the nucleolus and double-dense body in meiosis. Overall, this work will further our understanding of biology and can lead to discoveries in reproduction and fertility.

Arming Arabidopsis: Exploring Glucosinolate-Mediated Plant Defense Against *Botrytis Cinerea*

Annanya Jain
Sponsor: Dan Kliebenstein, Ph.D.
Plant Sciences

Botrytis cinerea is a pathogenic fungus causing fungal rot in over 1000 plant species, including important agricultural crops. Research suggests that *B. cinerea* works in a necrotrophic manner by actively killing host tissue through cell-wall degrading enzymes, causing infected tissue to produce gray spores. This can wreak havoc on fruit and vegetable crop yields, so we sought to understand how the presence of different glucosinolates induces resistance to *B. cinerea* in *Arabidopsis thaliana*. Moreover, we used transgenic *A. thaliana* expressing GRS1. It produces glucoraphenin, a glucosinolate unique to *Raphanus sativus* that is broken down into sulforaphene. Previous work in the lab showed *R. sativus* had increased resistance to Botrytis. We hypothesize that this resistance was the result of the hydrolysis of glucoraphenin. To test this we used a detached leaf assay with the transgenic *A.thaliana* containing GRS1 and wild type Arabidopsis and infected it with Botrytis. After 72 hours, we took images, and performed image analysis measuring the lesion area. This method will enable us to quantify the extent of tissue infected by Botrytis. If the transgenic lines perform better than the wild type we can suggest glucoraphenin is a good defense compound against gray mold.

Expression of the Mechanosensitive ion Channel Protein Piezo1 is Directly Associated With the Development of Experimental Neonatal Sepsis

Nina Jain
Sponsor: Geoanna Bautista, M.D.
MED: Pediatrics

Neonatal sepsis, a major cause of infant mortality, involves inflammation-induced multi-organ dysfunction, often exacerbated by intestinal injury. Piezo1 is a mechanosensitive channel that plays a crucial role in inflammation and the innate immune system. Heightened expression of Piezo has been previously noted in adult inflammatory bowel diseases. However, its involvement in gut-specific inflammation in neonates remains unclear. Using a well-established murine sepsis model, we aimed to determine if Piezo1 expression in the gut is altered following exposure to experimental sepsis. We hypothesized that sepsis exposure would significantly increase the expression of Piezo1. C57BL/6 mouse pups aged (P)7-8 underwent experimental sepsis, receiving 3.00x107 CFU/ml of NEC*teria* or saline via intraperitoneal injection. We obtained distal ileal segments and assessed Piezo1 mRNA expression using droplet digital PCR and *in situ* hybridization (ISH) via RNA-scope. Sepsis-exposed pups died within 5-6 hours, while sham controls were sacrificed at the end of 8 hours. Piezo1 levels were markedly elevated in sepsis-exposed murine pups (n=11) compared to sham controls (n=13) (9.15 vs. 15.09 copies/ng; p=.0003), as confirmed by ISH. Our findings suggest a potential role of Piezo1 in the intestinal inflammation observed in experimental sepsis, warranting further investigations into the signaling mechanisms driven by Piezo1.

The Association between Triglyceride to High-density Lipoprotein Ratio and Insulin Resistance in Mongolian Adults

Zahraa Jamshed
Sponsor: Enkhmaa Byambaa, M.D.,Ph.D.
MED: Int Med - Endocrinology

Compared to some Asian populations, the emergence of metabolic syndrome, strongly associated with insulin resistance (IR) and type 2 diabetes mellitus, is pronounced in Mongolians. While the homeostatic model assessment for insulin resistance (HOMA-IR) remains the gold standard during clinical assessment of IR, this method can be resource intensive for rural communities and developing countries. This cross-sectional study investigates the potential of utilizing triglyceride to high-density lipoprotein (TG/HDL) ratio as an IR marker among 365 Mongolian adults (mean age 47 years, 37% men) by categorizing waist circumference tertiles and assessing associations between TG/HDL ratio and HOMA-IR. All participants demonstrated a significant positive correlation between TG/HDL ratio and HOMA-IR levels. When considering waist circumference, there was a progressively stronger correlation between the TG/HDL ratio and HOMA-IR with increasing waist circumference. In line with this, the highest waist circumference group had higher insulin, TG/HDL ratio, and HOMA-IR compared to the lowest waist circumference group. When using HOMA-IR cut-off of 2.5, the diagnostic accuracy of the TG/HDL ratio was 0.746. In conclusion, these findings suggest that TG/HDL ratio coupled with waist circumference can serve as an IR indicator in Mongolian adults.

Effects of Combined Drought and Salinity Stress on Suberin in Pistachio Root

Rachel Jang
Sponsor: Georgia Drakakaki, Ph.D.
Plant Sciences

Irrigated farmlands with water amount adapted to the California drought conditions face simultaneous abiotic stress- soil salinization. While there is research on drought stress and salinity stress alone, knowledge of the combined effect of these stresses is limited. In our study, we assessed the effects of varying salinity levels and watering frequencies on two commercially popular pistachio rootstock cultivars, Platinum (*Pistacia integerrima* x *P. atlantica)* and UCB1 (*P. atlantica* x *P. integerrima*). We used a root anatomy based approach to provide new insights on cellular mechanisms in stress response towards sustainable pistachio production. We focused our study on what conditions stimulate the production of suberin, which is a waxy lipid that regulates salt ion entry through cell wall modification. The root tips were harvested after two months of stress treatment and sectioned and stained with Fluorol Yellow to quantify suberin deposition. While the quantification is currently in progress, I hypothesize that higher drought and salinity stress will correlate with an increase in suberin deposition in the endodermis and exodermis.

U.S. Cat Owners' Perceptions of Insect-Based Diets

Yoonjeong Jang
Sponsor: Carly Moody, Ph.D.
Animal Science

Increasing concerns and demands for environmentally sustainable protein sources for pet foods has introduced a new diet option for cats: insect-based foods. However, little is known about U.S. cat owners' attitudes towards feeding their cat an insect-based diet. Thus, we aim to survey U.S. cat owners on their perceptions of insect-based cat foods. To participate, respondents must be 18 years of age or older, live in the U.S., and own at least one companion cat. Survey questions include: 1) participant demographics, 2) cat demographics, 3) cat diet history, 4) ranking factors related to willingness/unwillingness to feed insect-based foods, and 5) the Cat-Owner Relationship Scale (CORS). Participants will be recruited using snowball sampling with an advertisement via social media and an online news article. We predict that: 1) most study participants will be unwilling to feed their cat insect-based foods due to disgust towards insects, 2) willingness to feed cats an insect-based diet will be higher for respondents indicating a concern for environmental sustainability of pet food production, and 3) willingness will decrease for owners with a stronger bond with their cat (higher CORS score) and increase for those with a weaker bond (lower CORS score).

The Guerraz Family Homestead: Ruination of an Adobe House in Northern California

Kaylee Jansema
Sponsor: John Darwent, Ph.D.
Anthropology

The Guerraz homestead was located in the front range of Diablo Mountains near San Jose in what is now the Blue Oaks Ranch Reserve. Based on its appearance on maps in 1876, the homestead, which included a house, was established by John David Guerraz, Jr., on a partition of the former Rancho Canada de Pala in the 1860s. Guerraz, along with his father, J. D. Guerraz, Sr., were attempting to start a small cattle ranching operation. However, by 1889, the property had changed hands, and by 1892, the house no longer appeared on maps. For the last few decades, the location of the homestead was only known from the remnants of a rock wall, but scrub trees and poison oak completely engulfed the area. In 2023, an archaeological field school was initiated by the University of California, Davis, and a discovered house foundation became the focus of its investigation. Based on the foundation and evidence unearthed during initial excavations, we believe it was an adobe structure overrun by a mudslide. Here, we report on our preliminary assessment of the type and timing of events that destroyed the house and the impacts this might have had on the Guerraz family.

Genetic Analysis of Nitrogen Fixation Efficiency in Recombinant Inbred Populations of *C. reticulatum* X *C. arietinum*

Sofia Jauregui
Sponsor: Douglas Cook, Ph.D.
Plant Pathology

Chickpea (*Cicer arietinum)* forms a nitrogen-fixing symbiosis with rhizobium bacteria. The symbiosis occurs within a specialized root "nodule" organ, development of which is triggered by bacterial signals that confer specificity to the interaction. During symbiosis, bacteria convert atmospheric dinitrogen to ammonia, which is assimilated to organic forms by plant enzymes. We have limited understanding of the genetic factors that promote efficient nitrogen fixation in crop species. Understanding genetic control would facilitate breeding for improved nitrogen fixation, thereby reducing fertilizer use. We have previously demonstrated that crop wild progenitors have more efficient symbiosis than cultivated genotypes. Our project investigated symbiotic efficiency in segregating biparental populations of wild *C. reticulatum* crossed with domesticated *C. arietinum*. Thirty-five Recombinant Inbred Lines (RIL's) were phenotyped for shoot, root, and nodule parameters. Eleven RIL's exhibited highly efficient symbiosis, demonstrating that the wild efficiency trait is heritable. This data is being used for QTL analysis to find genetic regions that associate with nitrogen fixation efficiency. This work expands our access to genetic diversity and could help introduce useful novel traits back into domesticated cultivars of *C. arietinum.* Further research efforts will include testing the best genotypes under field conditions and improving the precision of genetic analysis.

Comparing the Relationship Between Complex Speech Sounds and Auditory Scenes in Recollection and Familiarity

Edward Jenkins
Sponsor: Andrew Yonelinas, Ph.D.
Psychology

Prior research has established that visual forms of working memory are supported by recollection and familiarity, however, whether these processes also contribute to auditory working memory remains unclear. In this study, we examine auditory working memory for pure tones, complex speech (i.e., pitch, syllable, and location), and auditory scenes. For each paradigm, 24 young adults were given an auditory change-detection task where sounds were presented one after another. Participants were tasked with making confidence judgments indicating whether the sounds were the same or different, and Receiver Operating Characteristics (ROCs) were used to analyze performance. The results indicated that in each paradigm we examined both recollection and familiarity contributed to auditory working memory. Future studies will utilize these paradigms to examine the effects of aging and neurological disorders such as medial temporal lobe amnesia on the neural processes supporting auditory working memory. Additionally, future studies will examine differences in change detection performances between confidence judgments and binary responses (i.e., "perceive" or "sense").

Modeling Smith Kingsmore Syndrome in *Drosophila*

Derek Jermanis
Sponsor: Joanna Chiu, Ph.D.
Entomology/Nematology

Smith Kingsmore Syndrome (SKS) is a rare neurodevelopmental genetic disease characterized by hyperactivity, sleep disruption, hyperphagia, megalencephaly, learning disabilities, and seizures. Currently, no FDA-approved treatment is available for SKS and this is in part due to a lack of animal models to investigate the molecular basis of SKS. I hypothesize that SKS is caused by gain-of-function mutations in the *mechanistic target of rapamycin* (*mTOR*) gene, which results in a hyperactive form of the mTOR protein, hereafter mTORSKS. To date, clinicians have identified over 30 different mTORSKS variants that are associated with SKS. These variants manifest variable clinical outcomes in affected patients. This project aims to generate *Drosophila* fly modes of SKSl to study the pathophysiology of SKS and identify potential therapeutics. I will use CRISPR-Cas9 genome editing to generate and isolate *Drosophila* fly lines that express multiple mTORSKS variants. I will then test fly lines carrying *mTORSKS* for hyperactivity and dysregulation of sleep by using the *Drosophila* Activity Monitoring System. Fly lines that exhibit hyperactivity and/or sleep disruptions will be used to elucidate the molecular mechanisms that underlie SKS symptoms.

Traffic Related Air Pollution, Stress and Lung Pathology

Asmita Jerrome
Sponsor: Laura Van Winkle, Ph.D.
VM: Anat Physio & Cell Biology

Cardiovascular disease (CVD) is the leading cause of death in the United States, disproportionately affecting those with lower socioeconomic status. Exposure to traffic-related air pollution (TRAP) and chronic stressors prevalent in economically disadvantaged communities can increase this disparity and aggravate lung inflammation and mucus production. However, research on the combined effects of TRAP and chronic stress on cardiopulmonary health is lacking. To address this gap, this study utilizes a tunnel system to capture light-duty vehicle (LDV) and heavy-duty vehicle (HDV) exhaust to simulate TRAP exposures while also inducing chronic unpredictable stress (CUS) and acute restraint stress (ARS) on Sprague-Dawley rats. Following exposure, cardiovascular function and stress-related markers were assessed by another lab, while lung-specific outcomes were studied by our group. We conducted bronchoalveolar lavage and collected lavage fluid (BALF) to measure infiltration of inflammatory cells. The left lung lobe was fixed in 1% paraformaldehyde for histology. We used Hematoxylin and Eosin to localize immune cells as well as Alcian Blue to define mucus cell distribution and abundance. Preliminary data indicates an abundance of these cells in the lungs of rats exposed to combined TRAP and chronic stress, suggesting a possible link between these environmental factors and pulmonary health outcomes.

Low-Cost Microfluidic Device for Single-Cell Isolation and Cloning

Tara Jessen
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

The Microfluidics Research Team in the BioInnovation Group is developing a low-cost microfluidic chip, known as a single-cell capture (SCC) device, to study heterogeneous cellular populations. We expect this device and methodology to enable the capture, cloning, and analysis of single cells from heterogeneous populations without the use of cell surface markers. Monoclonal cell lines cultured *on-chip* can then be extracted and studied in applications such as tissue regeneration. We based our initial device design on examples from literature that used photolithography to create masks for PDMS casting. However, the cost of photolithography limits access to these tools. We propose that common and affordable 3D printing technologies can be used as an alternative to photolithography to create SCC devices that will perform nearly as effectively. Our current device achieves a SCC rate of 35%, comparable to devices created using photolithography (60% capture rate) at 1% of the upfront cost. Our current focus is optimizing cell culturing and proliferation of various mammalian cell types to perform functional assays *on-chip*. Here we report the development of surface treatment techniques to promote growth and the design and testing of a 3D-printed container for environmental control.

The Bats That Call Traver Ranch Home: Genetic Identification of Bat Species at a Roost and a Comparison of Sample Storage Methods

Grace Jiang
Sponsor: James Statham, Ph.D.
Veterinary Genetics Lab

As climate change progresses and threatens species with extinction, understanding organisms' responses to climate change is essential for conservation. Due to their small size as heterotherms and slow reproductive rates, bats (Chiroptera) are especially sensitive and most frequently respond with shifts in range and changes in species diversity patterns. Abandoned structures in protected lands often become hallmark habitats for sensitive species; such is Traver Ranch in the southern Carrizo Plain for bats. Thus, I determined Chiroptera species diversity from 30 fecal samples within these roosts. DNA was extracted and products were amplified using PCR and cytochrome oxidase I primers. The resulting mDNA was quantified, purified, then Sanger-sequenced, and analyzed with BLAST alignment. All samples were found to be Pallid Bat (*Antrozous pallidus*). I also examined sequencing-success differences between the 15 ethanol-stored and 15 desiccant-stored samples. I performed an unpaired t-test on the sequencing-success percentages of the ethanol-stored and desiccant-stored samples. The difference was statistically insignificant, likely because the samples were extracted within two weeks of their arrival (with little aging/ degradation). This data will serve as comparison for future bat range surveys, which will aid management in mitigating the effects of climate change on bats in the Carrizo Plain.

Using Proteomics to Measure Degradation of Enzyme-Based Supplements

Melinda Joe
Sponsor: Gabriela Grigorean, Ph.D.
UC Davis Genome Center

Enzyme-based supplements have been shown to aid in overall well-being, specifically in digestive health. But, like many other supplements and drugs, they require proper storage to maintain efficacy and shelf life. Liquid-Chromatography-Mass-Spectrometry (LC-MS) is an analytical tool that can detect proteins based on the molecular weight of peptide fragments. To detect peptide masses precisely, the mass spectrometer used in the data presented here is a high-mass-accuracy/high-resolution hybrid of two mass analyzers built into one mass spectrometer. The obtained LCMS data is then submitted to proteomic-analysis software that has the ability to identify and quantify proteins from any known organism. This will give insight into protein complexities -such as protein chemical and physical modifications- items that are not directly shown in genetic code alone. In this study, we decided to investigate the stability and degradation of enzymes found in papaya, pineapple, soybeans, and silkworms in an over-the-counter supplement pill using LC-MS. We compared the proteomic data of a control pill, a pill under a UV light, and a pill exposed to high heat for an extended period of time to see if any proteins in any of the enzymes degraded due to these extreme conditions, therefore decreasing their efficacy.

Dietary Factors and Prevalence of Cardiovascular Disease in the Punjabi Sikh Community

Amreen Johal
Sponsor: Debbie Fetter, Ph.D.
Nutrition

Cardiovascular disease (CVD) is the leading cause of death worldwide. Factors that increase risk of CVD include diabetes, hypertension, and hypercholesterolemia. Cardiovascular disease is especially prominent within the Punjabi Sikh population. However, there is a dearth in the literature with regards to evaluating health-related factors in this specific population. To investigate the association between dietary factors and CVD risk, a questionnaire was administered at one Sikh Gurdwara Sahib in Sacramento. The survey included demographics, medical history, and self-reported dietary intake. Of the 163 respondents, 101 (62%) reported having at least one CVD risk factor. Cardiovascular disease risk was associated with low fruit intake and high intake of vegetables, starch, grains, whole grains, milk, beans, sugar beverages, and sodium. Individuals with a risk factor also had lower diet quality scores (P<0.05). A penalized logistic regression model was used to further analyze associations between CVD risk and predictor variables. It was found that weight, less than 12th grade education level, and sugar-sweetened beverages raise the odds of CVD risk. Knowledge of specific CVD risk factors in the Punjabi Sikh population is essential to improving health education and preventative care initiatives.

Does Your Cat Miss You During Their Vet Exam? Investigating Effects of Owner Presence during Veterinary Assessments on Cat Physiological Indicators

Ayla Johnson
Sponsor: Carly Moody, Ph.D.
Animal Science

Veterinary exams are often stressful for cats, which has negative implications on their health and welfare. Research suggests owner presence may help reduce negative responses in dogs during routine examinations, however, this has not been evaluated in cats. Thus, we aim to assess physiological responses during mock veterinary examinations with the owner present and absent. Order of appointment will be counterbalanced across cats with a minimum 2-week washout period between appointments. Participant inclusion criteria are: cat owners 18-years or older living within 1 hour of the UC Davis Veterinary Teaching Hospital, that own a healthy cat between 1-10 years of age. Prior to participation, owners will complete a survey to provide demographic information, their cat's characteristics, ratings of past veterinary clinic experiences, and complete a cat-owner relationship scale to quantify the cat-owner relationship. During the examinations, physiological parameters will be measured including photographing eyes for pupil dilation analysis and recording heart and respiratory rates. We predict cats will show reduced physiological measurements when their owner is present compared to absent. Results of this study aim to provide evidence-based information for reducing cat stress during veterinary examinations.

Modulating the Microbiota-Gut-Brain Axis with Tributyrin: A Therapeutic Strategy for Gastrointestinal and Neurological Symptoms in a mouse model of Angelman Syndrome

Tiana Johnson
Sponsor: Melanie Gareau, Ph.D.
VM: Anat Physio & Cell Biology

Angelman Syndrome (AS) is a neurodevelopmental disorder attributed to anomalies or deletions in the maternal UBE3A gene on chromosome 15, affecting neuronal communication and function. Characterized by significant developmental delays, intellectual disability, movement and balance disorder, and also often encounters various gastrointestinal (GI) symptoms. Previous research has identified gut-brain axis impairments in AS, notably altered gastrointestinal motility and deviations in serotonergic and GABAergic signaling in the gut and brain. These findings suggest a comprehensive impact on both GI function and neuronal communication, potentially contributing to the GI symptoms prevalent in AS patients. In addressing these challenges, our experiment focused on tributyrin administration, a triglyceride form of butyric acid known for its anti-inflammatory and potential neuroprotective properties via modulation of the gut microbiome. This study aimed to assess the impact of tributyrin supplementation (10mM in drinking water for 4 weeks) on the colon's mucosal integrity and the gut microbiome's health in AS-modeled mice. By measuring changes in colon villi length, we sought to evaluate the effectiveness of tributyrin treatment in improving GI health and, by extension, modulating neurotransmitter production or activity, including GABA, within the gut. We hypothesized that tributyrin supplementation would ameliorate GI health in a mouse model of AS.

Potential Role of Piezo1 in Ligament Adaptation to Loading

Jonathan Joseph
Sponsor: Keith Baar, Ph.D.
Neuro Physio & Behavior

Injuries to the anterior cruciate ligament (ACL) are prevalent but heal poorly, resulting in long-term loss of physical function. Mechanical forces are crucial for tissue remodeling, but the mechanisms responsible for driving these changes and their implications in healing are unknown. Piezo1 is a mechanosensitive ion channel proposed to drive tissue remodeling in rats, but its specific role is unclear, and remains uninvestigated in human anterior cruciate ligament cells (hACL). Using monolayer culture of hACLs, I investigated the effect of 1, 5, and 10μM of the Piezo1 activator Yoda1 on tendon/ligament remodeling gene expression 1- and 3-hours later. While some genes increased as hypothesized, others decreased unexpectedly. One possible reason our hypothesis was not fully supported is that the extracellular environment is different from native ligaments. I will repeat this treatment in engineered ligaments that replicate the native structure of hACL tissue. For these experiments, gene expression will be determined after acute treatment, whereas a different cohort of engineered hACLs will be treated with Yoda1 for 6 days to determine whether Piezo1 activation effects on ligament function: measuring mechanical properties, collagen content, and collagen crosslinking.

Analyzing the Potential of IMU Motion Capture to Advance ASL research

Ruhaan Juyal
Sponsor: David Corina, Ph.D.
Linguistics

The exploration of American Sign Language and other visual languages presents unique challenges in research primarily due to their visual medium. Inertial Measurement Unit (IMU) motion capture shows promise in gaining a more holistic understanding of visual language processing, and our project's goal is to explain the benefits and potential applications of this technology in the future. By making use of acceleration and time data recorded by the motion capture technology, we can correlate the movements of a signer to EEG activity, and gain insight into the exact moment a movement conveys meaning to the viewer. Similarly, because the IMU motion capture data is recorded in a 3D space, we avoid limitations that are associated with 2D recordings, such as image occlusion. We can also manipulate the space to show different frames of reference and see how this influences EEG activity and learning in children. The final major benefit of IMU motion capture is that 3D creation software like Blender enables the manipulation of natural human movements into impossible movements and inhuman avatars. By using IMU motion capture, we will be able to explore the potential for a more holistic approach to capturing the intricacies of visual language processing.

NYT MEDIA PROJECT: The Bifurcated Narrative of Lebanese Men in the New York Times in the 1940s

Yara Kaadan
Sponsor: Suad Joseph, Ph.D.
Anthropology

How did the New York Times (NYT) represent Lebanese men in the 1940s? To answer this question, I used Proquest to screen 248 articles of which 21 were relevant. The analysis revealed a pattern of Lebanese men being represented as hyper-militant aggressors when compared to actors in the Zionist movement. When the articles focus on the strategies of Lebanese forces and diplomats, they are described as incompetent and incapable of mounting a serious offense against Zionism. The NYT played a crucial role in shaping American public opinion. Lebanese men are portrayed in a bifurcated manner in the NYT. This research fills a gap in the study of Lebanese men during this critical time in history, through a detail-oriented lens. This is part of a long-term analysis project of the NYT from 1850-present from the Suad Joseph Lab that analyzes the representation of Islam and Muslims over 150 years.

Evaluating Transcriptional Regulation of the Pyruvate Dehydrogenase Complex

Richa Kakde
Sponsor: Dan Kliebenstein, Ph.D.
Plant Sciences

This project focuses on gene regulation in the PDH complex, an intermediate step between glycolysis and the TCA cycle. Different combinations of genes in PDH promoters are targeted and deleted using CRISPR-Cas9. This is done to understand the impacts on the metabolism of our model plant *Arabidopsis thaliana*. After creating 29 genotypes and using Col-0 as the wild-type control, several metrics are used for phenotyping the mutated plants. One method is to infect the plants with *Botrytis cinerea* in detached leaf assays resulting in lesions on the plant surface. Another metric is rosette size measured using Image J and RStudio. For this, the plants are grown in a controlled facility and photographed at fixed intervals. The pixel area of each plant is then processed, and the measurements are standardized to record the growth of each genotype over time. Large lesions and slow plant growth could indicate compromised metabolism caused by mutating different combinations of genes in the PDH complex. Other phenotypic parameters include metabolomics and transcriptomics to evaluate the overall importance of these regulatory interactions.

Breaking the Glass Bottle: Changes in Women's Labor and Decreased Age of Weaning in 19th Century Immigrants

Annalise Kalmanoff
Sponsor: Diana Malarchik, M.A.
Anthropology

The introduction of capitalism and the sharp increase in industrial growth in the second half of the 19th century not only restructured the Californian economy and infrastructure, but also gender and behavioral roles. Women experienced financial and social pressure to enter into the workplace, in both industrial and agricultural roles. A need for women in the workplace also meant changes in the way children were taken care of, specifically regarding breastfeeding and weaning. We examined stable isotope ratios from the dental remains of immigrants who died in San Francisco between 1850 and 1900. Dental remains grow during childhood and reflect the diet of an individual, changing ratios in nitrogen isotopes can reveal breastfeeding behavior on an individual level. We observe adults (who survived childhood) with much shorter breastfeeding periods, and some individuals who were not breastfed at all. Limited breastfeeding would have weakened immune systems, leaving children susceptible to pathogens through exposure to new feeding methods used by working mothers (dry nursing and the use of pap and panada). The impact of economic changes of the 19th century were not limited to changes in who was working but also in the overall health of their children and generations to come.

Exploring the Nexus between Depression and Smoking in Unhoused Populations: Improving Holistic Healthcare at Willow Clinic

Anshul Kamatala
Sponsor: Kirti Malhotra, M.D.
MED: Int Med - Genl Medicine

Current literature posits a connection between smoking and depression. This quality improvement study explores this relationship within the patient population of Willow Clinic, a student-run clinic serving the unhoused population of Sacramento via medical and social services. A retrospective chart review was conducted of past patient medical history, namely to collect information on the PHQ-9 metric (a metric for screening depression) and smoking data. Smoking data, obtained through a comprehensive smoking cessation form, encompassed parameters such as smoking frequency, pack years, and duration of smoking. Results revealed a significant association ($p = 0.002 < 0.05$) between smoking status and PHQ-9 scores when comparing active smokers to non smokers. Among the 190 patients who reported as active smokers, 70 had screened positive for a depression diagnosis, while 84 individuals failed to meet the screening criteria. These findings contribute valuable insights into the complex interplay between depression and smoking habits in unhoused populations. This highlights a need to connect screening practices together, where for example, a positive smoking habits screening leads to a mandatory depression screening. Such dual clinic referrals would improve holistic healthcare practices, which are especially crucial for a transient patient population like the unhoused.

A Review of Mobile Mammography Programs Across the Nation

Ashna Kambhampati
Sponsor: Laura Fejerman, Ph.D.
MED: Public Health Sciences

Among women in the United States, breast cancer is the most common cancer. Studies have described disparities in breast cancer stage at diagnosis by racial/ethnic category, geography, and socioeconomic status. NCI funded Cancer Centers (CC) are required to address disparities affecting their catchment area population and mobile mammography has been identified as a way to facilitate screening in underserved communities. However, there is no resource available that describes existing programs, their characteristics, and impact metrics or explores what CC characteristics are associated with the programs. To address this gap in knowledge, we conducted an online search of CC-based mobile mammography and complemented it with a qualtrics survey sent to 70 NCI funded CC leaders in the country. Survey questions asked about areas served, operating times, insurance coverage, funding of the unit, and follow ups for abnormal screenings. Out of the 38.6% of the CC's that responded to the survey, we have identified that 48% of them have active mobile mammography programs. Of those, 58% are funded by the CC. Additional information on these ongoing programs indicates a need for a CC-wide collaboration to assess their cost-effectiveness and measure their impact on breast cancer health disparities.

Exploring Language Input Dynamics: Joint Attention and Non-Joint Attention Episodes During Naturalistic Puzzle Play

subhiksha kanchadapu
Sponsor: Lisa Oakes, Ph.D.
Psychology

Naturalistic play provides contexts for infants to reason and learn about the world. Infants' joint attention with parents is associated with longer visual attention (Deák et al., 2014). Moreover, when parents touch and talk about objects during joint attention, infants engage in even more sustained attention (Suarez-Rivera et al., 2019). However, it is unknown whether parents talk more during joint attention episodes than at other times. Particularly, we hypothesize that parents provide more language input during joint attention than when only the infant is looking at an object. To test this hypothesis, we will analyze a dataset including 53 parents and their 9-to-11-month-old infants playing with an age-appropriate puzzle while their eye-gaze was recorded with head-mounted eye-trackers. Parents were instructed to play as they would at home. We transcribed the parents' speech and coded where each play partner was looking. Joint attention episodes were identified as periods when both parent and infant were focused on any part of the puzzle. We identified episodes when only the infant was looking at the puzzle or when neither parent nor infant were looking at the puzzle. We anticipate that, on average, parents will say more words during joint attention episodes than other episodes.

Evaluating the Specificity of Indole-3-Acetic Acid (IAA) Protection of Bacteria Against UV

Mia Karlsson
Sponsor: Johannes Leveau, M.D.,Ph.D.
Plant Pathology

Microbes that make their home on the phyllosphere, or plant leaf surface, experience an array of hostilities that they must adapt to. We hypothesize that indole-3-acetic acid (IAA), a secondary metabolite that is produced by many phyllosphere bacteria, acts as a sunscreen against harmful UV radiation in sunlight. Our initial findings suggest that the presence of IAA protects phyllosphere isolate *Pseudomonas putida* 1290 when exposed to UV-B radiation. To examine the specificity of IAA protection to bacteria exposed to UV, I compared the effectiveness of IAA and similarly shaped molecules including analogs of IAA. I also tested IAA's protection on other bacterial strains to determine if IAA-mediated UV protection applies across different bacterial lineages. Lastly, I examined the ability of IAA to protect *P. putida* 1290 from UV-A and UV-C exposure. These findings offer support for IAA as a bacterial sunscreen and for future studies into the mechanism that underlies this phenomenon.

Using Genetic Screenings to Explore Novel Genes Associated with NAD^+ Metabolism and its Regulation in the Model System *Saccharomyces cerevisiae*

Darshan Karthi
Sponsor: Su-ju Lin, Ph.D.
Microbiology & Molec Genetics

Nicotinamide adenine dinucleotide (NAD^+) is an essential metabolic cofactor involved in redox reactions and cellular signaling. NAD^+ is synthesized from tryptophan leading to quinolinic acid production (QA) via the *de novo* pathway or by salvaging precursors such as nicotinic acid/nicotinamide (NA/NAM) and nicotinamide riboside (NR) via their respective pathways. Abnormal NAD^+ levels are associated with age-related human disorders, but NAD^+ regulation is not completely understood due to its complexity. Using *Saccharomyces cerevisiae* and NAD^+ intermediate specific cell-based assay, we identified ~350 genes that may impact NAD^+ intermediate homeostasis. We validated ~100 clones, including known NAD^+ metabolic and novel genes such as transcription factors, signaling pathway components, and autophagy trafficking components. We will be focusing on several targets that show strong phenotypes including QDR2, AFT1, NPY1, and FPY1. These studies will help elucidate the interconnections within NAD^+ metabolism and its regulation as well as aid in developing therapeutic strategies for metabolic disorders related to abnormal NAD^+ levels.

Using *Kluyveromyces lactis* to Express Bovine Casein Protein for Vegan Cheese Production

Sharada Karthik
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

Dairy cows are the third-largest producers of greenhouse gases in the food industry. In response to these environmental concerns, interest in milk alternatives has increased in recent years. While plant-based milks have been commercially successful, vegan cheeses have gained a somewhat poor reputation among consumers. Many plant-based cheeses have a low protein content, and lack the characteristic stretch and mouthfeel that consumers expect with traditional dairy-based cheeses. While there are cheeses that utilize plant-based proteins and have a more cheese-like texture, they often fail to replicate the taste of the cheese they are attempting to emulate. Our research focuses on using the yeast *Kluyveromyces lactis* to synthesize four different bovine casein proteins which, when combined with other components, can be used to make a vegan cheese that resembles real cheese in both texture and taste. We are currently investigating modes of protein expression and several purification methods, and their impact on cost and yield. Additionally, we are also evaluating the manufacturing costs for an eventual product, which involves sourcing the other components for our vegan cheese and researching different cheese varieties in order to select a cost-effective product to make.

Unraveling Plant Physiology: Investigating Succinate Dehydrogenase Activity and Mitochondrial Function Through CII Activity Assay

Shreya Kate
Sponsor: James Letts, Ph.D.
Molecular & Cellular Bio

Succinate dehydrogenase (CII) is vital for the citric acid cycle and mitochondrial electron transport chain (ETC). As plant CII orchestrates bioenergetics, metabolic regulation, and stress responses, elucidating its structure and activity profile will offer translational applications in plant health, crop productivity, human health, and disease. Through a CII coupled activity assay, I aim to uncover crucial aspects of CII enzyme kinetics and substrate interactions. My hypothesis posits that increasing succinate concentration enhances DCPIP reduction rates until reaching a plateau, indicating maximal CII activity. CII catalyzes the oxidation of succinate to fumarate, facilitating electron transfer to a flavin adenine dinucleotide (FAD) cofactor within the complex, and onward to ubiquinone. In this assay, DCPIP functions as an artificial electron acceptor, undergoing decolorization as it accepts electrons from the reduced quinol, enabling measurement of CII activity by recording absorbance changes over time. I quantified SDH activity across succinate concentrations ranging from 10 µM to 500 µM and derived a maximum velocity (Vmax) = 256.1 (nmol/min*mg) and a Michaelis constant (KM) = 105.8 (nmol/min*mg) values by fitting the data to the Michaelis-Menten equation. Studying CII activity paves ways to optimize cellular metabolism and advances plant physiology understanding.

Decreased Differentiating Spermatogonia in MAX-depleted Germ Cells with Later Spermatocytes Present

Shawna Katz
Sponsor: Satoshi Namekawa, Ph.D.
Microbiology & Molec Genetics

During spermatogenesis, undifferentiated spermatogonia undergo differentiation before developing into mature spermatocytes. Previous studies show that MYC Associated Factor X (MAX) is a gene responsible for negative regulation of the initiation of meiosis in embryonic stem cells (ESCs). However, we wanted to understand MAX's role in spermatogenesis regulation in germ cells. We bred *Max* conditional-knockout mice by breeding *Max*-floxed mice with the *Ddx4-Cre* mouse line and followed up with rounds of immunostaining. By staining with cKIT, an antibody indicating differentiating spermatogonia, we found that the number of differentiating spermatogonia had decreased in our postnatal day 7 (P7) and P10 samples. We next stained with SYCP3, an antibody indicating spermatocyte staging, and found that *Max* cKO at P14 still had SYCP3 signaling, despite the depletion of differentiating spermatogonia. These results suggest that *Max* cKO germ cells can successfully enter meiosis despite the decreased differentiating spermatogonia. Finally, we stained with MEIOSIN and STRA8, proteins indicating the switch between mitosis and meiosis to check whether meiosis precociously takes place, similar to ESCs. Unlike ESCs, there was no early expression of STRA8 or MEIOSIN. We conclude that MAX may play a role in germ cell spermatogenesis, different than the currently understood role in ESCs.

Feasible EEG-Based BCI for Hand Gesture Control

Neha Kaul
Sponsor: Lee Miller, Ph.D.
MED: Otolaryngology

The development of single-trial EEG decoding algorithms is necessary for the deployment of real-time non-invasive brain-computer interfaces (BCI) to the masses. One case of particular importance is the use of EEG decoding for limb control. This can be applied in translational settings for robotic prosthetic control and commercially in so much that it allows for the incorporation of naturalistic gestures in virtual/augmented reality environments without the need for computer vision. Of all limb movements, hand gestures provide an ecologically valid way of looking at and assessing how to develop these types of classifiers. In this study, we used EEG data to decode 10 different gestures on a single trial level that yields fourfold above-chance decoding. Additionally, we decoded neural feedback signals for correct and incorrect gesture production, to assess the feasibility of using neural feedback for algorithm updating. We did this both with the raw voltages and with frequency band power that is theoretically related to the signals of interest. We find that using phase-locked voltages in the classification of EEG data yields stronger results than using specific EEG frequency bands related to motor control and feedback. We demonstrate that classifiers utilizing raw voltages result in stable high-accuracy EEG decoding.

Differences in Parental Care in Naive and Experienced Prarie Voles (*Microtus ochrogaster*)

Jasprit Kaur
Sponsor: Karen Bales, Ph.D.
Psychology

The lack of human interaction during the pandemic highlighted the importance of contact time with offspring. Prairie voles are biparental (i.e. both parents participate in infant care); similar to humans, but unlike most other rodent species. Our study aimed to investigate how parental care varied in naive and experienced voles. We quantified the interaction between parental voles and their offspring by scoring maternal and paternal behaviors in first-time vs. experienced parents. Preliminary data suggests that our findings will indicate high contact times in the naive parents specifically in the first two litters. In addition, low contact times by their third litter. Therefore, the results we expect to see by calculating total contact times between parent and offspring are higher mean values for the naive parents compared to the experienced ones. By quantifying parental behavior, we can better understand how different levels of parental behavior affect offspring's social behavior throughout their lifespan.

Healthcare Seeking Behaviors for Abdominal Pain in the Punjabi Sikh Community

Manpreet Kaur
Sponsor: Jasjeet Bindra, M.D.
MED: Radiology

Abdominal pain is the most common symptom reported in ambulatory clinics, emergency rooms, and primary care settings. While the epidemiology of abdominal pain is well-documented in other ethnic groups, there is a dearth of literature and data in the Punjabi Sikh ethnic group. The purpose of this study was to describe the epidemiology, severity, and healthcare-seeking behaviors of Punjabi Sikh individuals in Sacramento with current chronic or intermittent acute abdominal pain. A 29-question survey was distributed online and administered at three Sikh Gurdwaras (places of worship) in Sacramento between 11/2023-01/2024. The survey included questions on demographics, medical history, healthcare-seeking behaviors, and characteristics of belly pain based on NIH Gastrointestinal Patient-Reported Outcomes Measurement Information System (GI-PROMIS). A total of 320 individuals filled the survey. Results showed that of those who sought healthcare (n = 166, 51.9%), 122 (73.5%) underwent testing. The most reported tests were blood, urine, or stool laboratory tests (n = 97, 79.5%), ultrasound (n = 78, 63.9%), and magnetic resonance imaging or computed tomography scan (n = 52, 42.6%). Nearly half (49.1%) of abdominal pain complaints are unaddressed in the Punjabi Sikh community, which may perpetuate ethnic health care disparities and allow progression of potential serious health conditions.

Dietary Intervention in Kidney Transplant Recipients: An Ongoing Randomized Controlled Trial

Kavya Kaushal
Sponsor: Ling-xin Chen, M.D.
Med Int Med-kidney Transplant

A whole-food, plant-based diet pattern is effective in delaying chronic kidney disease progression, yet kidney transplant recipients rarely receive dietary education post-transplant. We aim to assess the impact of a dietary education and counseling intervention on health outcomes in kidney transplant recipients. We are conducting a prospective randomized controlled trial of an online dietary curriculum in adults within one year of receiving a kidney transplant. The curriculum comprises 6 months of biweekly online classes about whole-food, plant-based eating and a cookbook. The outcome of interest was dietary intake as determined by 24-hour recall. This preliminary analysis included 9 participants in the control arm and 10 participants in the intervention arm who completed 6 months of follow-up. At 3 and 6 months, intervention arm participants demonstrated increased fiber intake and decreased sodium and saturated fat intake compared to their baseline and to the control group, which did not change over 6 months. The intervention arm decreased their dairy intake and increased consumption of whole grains and legumes in the 6-month period, in contrast to the control group. The dietary education curriculum has been successful in improving the diets of participants toward a more whole-food, plant-based pattern.

Intercontinental Insights into Autism Spectrum Disorder: A Synthesis of Prevalence, Environmental Influences, and DNA Methylation

Ray Kawai
Sponsor: Janine Lasalle, Ph.D.
MED: Medical Microbiology & Imm

Autism spectrum disorder (ASD) is a neurodevelopmental disorder caused by intricate interplay of genetic and environmental factors. Epigenetic mechanisms focused on DNA methylation, allow insight into gene-environment interactions. However, most published studies of environmental epigenetic investigations in ASD have been geographically limited to Europe and North America. The purpose of this research is to perform a comprehensive literature review studies around six continents and review the potential geographic variations in gene-environment interactions associated with ASD. Regions such as Africa, Oceania and South America have limited published studies on ASD and DNA methylation, so the uniquely prevalent environmental factors and the need for future studies will be discussed. Additionally, we will consider potential causes for the higher incidence of ASD in North America. This will include a discussion of diagnostic ascertainment as well as common environmental risk factors, including social demography, lifestyle, nutrition, supplements, and chemical exposures. Furthermore, studies performed in Asia and Europe investigate DNA methylation alterations which may be caused by urban pollution, smoking and dietary habits. The integration of ASD global prevalence data could enhance future research on biomarker development for early diagnosis and intervention strategies for ASD, while incorporating the extremely diverse environmental and genetic landscapes worldwide.

Advancing Quantum Information Processing With Silicon Carbide Triangular Cross-Section Beam Splitters

Zbynka Kekula
Sponsor: Marina Radulaski, Ph.D.
Elect & Comp Engr

Quantum information processing (QIP) hardware requires scalable implementation of photonic structures to perform critical quantum operations such as entanglement and interferometry. Silicon carbide color center photonic structures are promising for such operations as they host long spin coherence times, and have the availability of spin-spin and spin-photon entangling processes. In this work, we model a low-loss triangular cross-section 50:50 beam splitter with Ansys Lumerical Finite-Difference Time-Domain method and Finite Difference Eigenmode method. We first optimize the width of the waveguide to achieve fundamental transverse electric (TE) single-mode propagation, with more than 80% of the dipole-like emission of the color center coupling into the waveguide mode for three different triangular geometries characterized by the half-angle at the apex. We investigate 50:50 beam splitting with directional coupling by varying the gap between the single-mode waveguides, realizing various designs, which offers an efficient platform for quantum entanglement operations and multi-photon interferometry.

Declarative and Procedural Memory Contributions to Argument Structure and Word Order Learning

SaharaJane Kelsey
Sponsor: David Corina, Ph.D.
Linguistics

This study, grounded in the Declarative/Procedural Hypothesis, seeks to disentangle the learning processes underlying verbal argument structure and basic word order within an artificial language paradigm as a model of second language acquisition. According to the Declarative/Procedural Hypothesis, learning a new argument structure should recruit long-term declarative memory, while learning a new word order should recruit long term procedural memory. Participants will undergo assessment across four memory procedures of declarative and procedural memory. Furthermore, participants will engage in learning sessions featuring sentence structures that are unconventional to English. Grammaticality judgment tasks, administered twice, will gauge participants' ability to distinguish between grammatical and ungrammatical sentences of the artificial language. Ungrammatical sentences will be strategically manipulated to reflect English syntax. Pilot data will be presented, leveraging multiple linear regression. We will analyze response metrics, including reaction time and accuracy as a function of memory measures. By elucidating the intricate interplay between memory systems and grammatical learning, this research promises nuanced insights into language acquisition processes, and paves the way for a deeper understanding of the cognitive mechanisms underlying acquisition of syntax.

Stability Analysis of Over the Wing Distributed Propulsion Using FlightStream

Alex Kerlee
Sponsor: Christina Harvey, Ph.D.
Mechanical & Aerospace Engr

Several studies have analyzed the potential benefits of using an over-the-wing distributed-propulsion (OTWDP) system. This project aims to further explore and quantify the stability of varying OTWDP configurations, including some inspired by avian flight formations. These analyses were accomplished using FlightStream, a medium fidelity computational fluid dynamics (CFD) software. Time-based simulations were run to analyze how the propeller placement changed the longitudinal stability properties of the aircraft. Multiple OTWDP configurations will be analyzed from standard distributions to bio-inspired distributions. We expect to find that an evenly spaced OTWDP system reaffirms the benefits of OTWDP, an increase in aero-propulsive efficiency. For avian inspired OTWDP, two systems will be tested: a flying v formation and paired propulsion systems staggered similar to the flying v angle. We expect these configurations to result in increased efficiency of the aft propellers by utilizing the previously accelerated air from the fore propellers, resulting in reduced energy requirements for the aft propellers, similar to recent wind farm studies. The implications of this project is to investigate if there is a value of implementing biologically inspired approaches within distributed propulsion systems.

Acute Locomotor Inhibition and Chronic Tolerance to Levodopa is Mediated by the Dopamine D3 Receptor

Andrea Keys
Sponsor: Jennifer Whistler, Ph.D.
MED: Physiology & Membrane Biol

Parkinson's disease (PD) is a progressive neurodegenerative disorder characterized by cell death of neurons responsible for the production of dopamine. The primary treatment for PD is levodopa, which increases the remaining neurons' ability to produce dopamine. However, chronic levodopa can lead to levodopa-induced dyskinesia (LID), causing further motor impairment by unknown mechanisms. Here, we examine how acute and chronic levodopa administration alters dopamine dynamics in the brain. We used wild-type (WT) or mice with a conditional knockout for the sorting protein GASP1 (D3FG) and administered either levodopa or saline for three weeks. We tracked mouse locomotion over time in an open-field assay and found that while WT mice become tolerant to the locomotor inhibitory effect of levodopa, D3FG become sensitized to this inhibition and are resistant to cocaine-induced hyperlocomotion. We also examined acute dopamine dynamics using fiber photometry in the nucleus accumbens and found that levodopa in WT mice inhibits dopamine transients elicited by fentanyl, an effect that is not present with D3FG mice. These data suggest that the dopamine D3 receptor is involved in the etiology of LID and could be potentially used as a therapeutic target for the treatment of PD.

The Association between Triglyceride to High-density Lipoprotein Ratio and Insulin Resistance in Mongolian Adults

Muhammad Khan
Sponsor: Enkhmaa Byambaa, M.D.,Ph.D.
MED: Int Med - Endocrinology

Compared to some Asian populations, the emergence of metabolic syndrome, strongly associated with insulin resistance (IR) and type 2 diabetes mellitus, is pronounced in Mongolians. While the homeostatic model assessment for insulin resistance (HOMA-IR) remains the gold standard during clinical assessment of IR, this method can be resource intensive for rural communities and developing countries. This cross-sectional study investigates the potential of utilizing triglyceride to high-density lipoprotein (TG/HDL) ratio as an IR marker among 365 Mongolian adults (mean age 47 years, 37% men) by categorizing waist circumference tertiles and assessing associations between TG/HDL ratio and HOMA-IR. All participants demonstrated a significant positive correlation between TG/HDL ratio and HOMA-IR levels. When considering waist circumference, there was a progressively stronger correlation between the TG/HDL ratio and HOMA-IR with increasing waist circumference. In line with this, the highest waist circumference group had higher insulin, TG/HDL ratio, and HOMA-IR compared to the lowest waist circumference group. When using HOMA-IR cut-off of 2.5, the diagnostic accuracy of the TG/HDL ratio was 0.746. In conclusion, these findings suggest that TG/HDL ratio coupled with waist circumference can serve as an IR indicator in Mongolian adults.

RANTES Immunoadhesions for CCR5 Depletion

Kavya Khandelwal
Sponsor: Dennis Hartigan-o'connor, M.D.
MED: Medical Microbiology & Imm

Treatment of people with HIV (PWH) with antiretroviral therapy (ART) results in sustained suppression of viremia, but HIV persists indefinitely as integrated provirus in CD4-expressing cells. This "rebound competent viral reservoir," is the primary obstacle to achieving a cure. Many in the field have suggested that cure will require reactivation of HIV reservoir cells using a latency-reactivating agent, followed by immune-mediated clearance of the reactivated cells. In cases of cure by transplantation of stem cells that lack CCR5 expression, cure may depend on a combination of reservoir depletion by ablative conditioning and on the graft-versus-reservoir effect. Surprisingly, we recently described long-term SIV remission and apparent cure in SIV-infected infant macaques via targeted depletion of potential reservoir cells that express CCR5. Here we report new immunotoxins and immunoadhesins that can destroy CCR5-expressing cells, and that may be cooperative or synergistic with the bsAb we described. These agents are based on the CCR5-binding chemokine RANTES.We report the biological activities of one immunoadhesin class, which include receptor internalization and chemotaxis. Our results demonstrate that both native RANTES and modified versions can guide effector molecules such as Fc and immunotoxins to HIV target cells, and will guide iterative development of new CCR5 immunoadhesins.

A Novel Method for *in-vitro* Measurement of Myotube Protein Synthesis

Asher Khattak
Sponsor: Keith Baar, Ph.D.
Neuro Physio & Behavior

Measurement of protein synthesis in skeletal muscle has traditionally been performed via the incorporation of isotope tracers or amino acid mimetics. However, these methods are expensive, time consuming, deal poorly with changes in amino acid levels or expose the experimenter to hazardous chemicals. To address these shortcomings, I developed an *in-vitro* model in which protein synthesis is quantified via a luciferase assay. Through the creation of two separate C2C12 cell lines, I was able to measure overall protein synthesis and mechanistic target of rapamycin complex (mTORC1)-dependent protein synthesis. To measure total protein synthesis, I used a luciferase cDNA preceded by a short unstructured 5' UTR whereas for mTORC1-dependent protein synthesis I used a long 5' UTR containing a tract of oligo-pyrimidines. To validate the model, the transfected C2C12 cell lines were differentiated into myotubes and then treated with kinase inhibitors to determine how different molecular regulators of protein synthesis affected luciferase levels. Finally, myotubes were treated with human sera from subjects who consumed either barley/rice protein powder, pea protein isolate, or whey protein isolate. In summary, I have developed an *in-vitro* luciferase-based assay to accurately measure rates of myotube protein synthesis that is well designed for high-throughput screening.

Chemical Characterization of Duckweed (*Lemna Gibba*) and Its Food Innovation Potential

Jenna Khun
Sponsor: Selina Wang, Ph.D.
Food Science & Technology

Protein is a fundamental component of the human diet, crucial for overall health. However, most traditional sources of protein often pose challenges, as they are frequently derived from meat, dairy, nut, egg, or soy products. This has pushed a growing interest in the field of food science to explore alternative protein sources that are more sustainable, plant-based, and allergen-friendly. Duckweed is a highly reproductive aquatic plant, typically found in freshwater ponds and lakes. Though the plant is among the smallest free-floating aquatic plants globally, they contain notable amounts of essential nutrients such as proteins and antioxidants. Compared to other major crops like soybean, rice, and corn, duckweed has a higher than average harvest yield, making this plant a far more economical choice. Recent studies of duckweed protein have found it to serve as an alternative protein source that is not only sustainable, but has high nutritional quality and technical functionality, with similar emulsifying, foaming, and gelling properties as egg white proteins. This study will analyze the chemical components of duckweed, develop a plant-based, gluten and allergen-free sausage with duckweed, and compare the product to commercial meat-based sausages.

Characterizing Proliferation and Differentiation of Primary Bovine Muscle Satellite Cells

Brandon Khuu
Sponsor: Lucas Smith, Ph.D.
MED: Physical Medicine & Rehab

Cultivated meat is the process of obtaining skeletal muscle cells from an animal, growing and differentiating collected cells in vitro, and processing them into a final meat product. Muscle satellite cells (MuSCs) are myogenic progenitor cells that can differentiate into early muscle structures called myotubes. Due to the scarce prior research of MuSCs, we characterized the differentiation and proliferation capacity of bovine MuSCs over time to establish a baseline of cell behavior in culture. MuSCs were initially isolated from bovine brisket in collaboration with the UC Davis Meat Lab and cultured under growth or differentiation conditions. Immunofluorescence and cell staining were used on the cells, and further analyzed using ImageJ to determine cell cycle stage and myotube development. We hypothesize that differentiation and proliferation capacity decreases over time. The findings of this study contribute to understanding the effectiveness of bovine MuSCs as a source for cultivated meat and to establish baseline characteristics for future studies.

The Commodification and Fetishization of the Black Female Body

Ahndiya Kiburi
Sponsor: Akshita Sivakumar, M.A.
Department Of Design

As a part of my thesis project in the Design Department I will be completing a fashion intervention, recontextualizing and challenging the harmful yet persistent stereotyping of Black womanhood in the media. This project will be completed over Spring and Fall Quarter 2024. The final intervention will draw inspiration from a rigorous conceptual development and result in two garments: a top and a skit. The top and bottom garments will utilize multimedia dye techniques on hand crocheted fabric. The color indigo will be used due to its historical ties to African slave trade, and Black culture. Experiments will be conducted with these two dyeing mediums to reimage and deconstruct the racist caricature, Jezebel and its imagery. The purpose is to expose this imagery to the audience and reposition its context to give it a new meaning while acknowledging the past and its connections to the future. I hope to showcase my work and the progress I will have made thus far. I believe this project is prevalent and will open up a dialogue towards a more equitable future.

Elucidating the Mechanisms Behind DMR6-Mediated Inactivation of Salicylic Acid Via X-Ray Crystallography

Hannah Kim
Sponsor: Nitzan Shabek, Ph.D.
Plant Biology

In plants, the hormone salicylic acid (SA) plays a critical role as a regulator of plant immunity and is inhibited by an enzyme called DMR6 (DOWNY MILDEW RESISTANT 6), which catalyzes the inactivation of SA via a hydroxylation reaction at the meta position of salicylic acid. In other words, salicylic acid with an additional hydroxyl functional group at the fifth carbon of the benzene ring is produced. In the model plant *Arabidopsis thaliana*, non-functional DMR6 is linked to increased resistance against pathogens and higher salicylic acid levels, making DMR6 a promising candidate for gene editing for crop improvement. DMR6 is an inhibitor of salicylic acid, but the mechanism by which it binds to SA and catalyzes its inactivation via hydroxylation is not known. The objectives of this project will be to purify DMR6 and set up crystallization trials to obtain crystal structures that can be used for x-ray crystallography to solve the molecular structure of DMR6 to further study its role as an inactivator of salicylic acid.

Ketoester Diet does not affect Citrate Synthase Activity in Gastrocnemius Muscle of Aged Mice

Jessica Kim
Sponsor: Jon Ramsey, Ph.D.
VM: Molecular Bio Sciences

The ketogenic diet (KD) is a low carbohydrate, high fat diet that has been previously shown to preserve cognitive and motor function in aged mice. While a KD may be difficult to maintain, supplementing a normal diet with ketoesters (ketoester diet, KE) can be an attainable option. This elevates circulating ketone levels, which provides both ketone bodies and glucose for energy. The objective of this study is to explore if feeding a KD or KE diet for 10 months (started at 16 months of age) in male or female mice will mitigate age-related reductions in citrate synthase activity. The gastrocnemius muscle (GTM) of aged mice is of interest as aging causes sarcopenia, loss of muscle mass and strength. Citrate synthase activity was assessed and showed no significant differences ($p<0.05$) when comparing the GTM citrate synthase activity levels among diet groups in male and female mice. These results suggest that the impact of KD and KE on muscle metabolism may be through a pathway other than citrate synthase.

Idol Talk: Narratives of Desire in K-pop Fandom

Ravi Kini
Sponsor: Vaidehi Ramanathan-Abbott, Ph.D.
Linguistics

South Korean boy bands, as of late, have enjoyed significant popularity overseas. Like their British and American predecessors, these bands rely on fulfilling primarily female desire, marketing themselves as an alternative softer masculinity in comparison to hegemonic Western masculinity. This paper focuses on fan expressions of desire for male Korean idols from a sociolinguistic perspective, building upon prior scholarship in gender studies, Asian studies, media studies, and performance studies. Toward this end, I analyze both conversations between K-pop fans in a social space geared towards discussing their shared interest and self-insert fanfiction where male Korean idols are framed as targets of desire. By examining themes of intimacy, masculinity, and self-awareness present in the data, I approach a clearer understanding of the linguistic and narrative features used to express desire for idols and argue that fan expressions of desire are intrinsically linked to their implicit social cognition and reflect wider perceptions of Asian masculinity and female sexuality. I conclude with implications for subversion of gender norms in fan spaces, the fan-idol dynamic, and intersections of marginalized sexuality. An understanding of the mechanisms driving fan desire is critical to understanding both the idol industry and the shifting landscape of gender and sexuality.

Exploring Pdzrn3 Isoforms in Pancreatic Ductal Adenocarcinoma

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

Pancreatic Ductal Adenocarcinoma (PDAC) is the third leading cause of cancer-related deaths, with a 13% 5-year survival rate, largely because PDAC is often asymptomatic until the metastasis stage. We previously found that Pdzrn3, a ubiquitin ligase implicated in tumor cell migration, is downregulated in PDAC metastasis, and low expression of Pdzrn3 mRNA is associated with a poorer prognosis. To test the role of Pdzrn3 in pancreatic cancer, we utilized sgRNA targeting Pdzrn3 exon 1 to deplete Pdzrn3 expression. However, Western blotting for Pdzrn3 resulted in multiple bands, suggesting shorter isoforms of Pdzrn3 exist and play distinct roles in pancreatic cancer cells. To test this hypothesis, I performed Reverse Transcription quantitative Polymerase Chain Reaction (RT-qPCR) to determine the relative expression of each isoform in murine pancreatic cancer cell lines. If the short isoform is prevalent in our current KD cell lines, we will generate new cell lines that better target both isoforms of Pdzrn3 and dissect their roles in pancreatic cancer metastasis.

Characterizing Primary Cilia Formation During Embryonic Development

Kordi Kokott
Sponsor: Crystal Rogers, Ph.D.
VM: Anat Physio & Cell Biology

Formation of the neural tube and neural crest cells, which become the central and peripheral nervous systems, is tightly regulated to prevent neural tube closure defects and abnormal cell migration. Normal patterning of the neural tube is controlled by signaling molecules, transcription factors, and dynamic cell adhesion changes. Primary cilia, which are microtubule-based non-motile cilia, are an essential part of propagating many signaling pathways in development. Using immunohistochemistry, we identified that primary cilia form in the developing neural tube and neural crest cells at significantly earlier developmental stages than previously shown. There is very little knowledge about the roles of primary cilia in early neural tube and neural crest cell development, nor how their formation is regulated at these stages. This study will molecularly characterize primary cilia in avian neural tube and neural crest cells using the ADP-ribosylation factor-like family (Arl13b) marker paired with tissue-specific markers of neural tube and neural crest progenitors. I will then examine how the loss of Tubulin-β-III (TUBB3) affects primary cilia formation and function during embryonic development.

Synthesis of Raman-active Core-Shell Nanoparticle Probes for Early Detection of Ovarian Cancer

Anna Kolesov
Sponsor: Randy Carney, Ph.D.
Biomedical Engineering

The 5-year survival rate for ovarian cancer drastically improves to 94% when diagnosed early-stage, compared to only 31% when diagnosed late-stage. Therefore, there is a clear clinical need for a sensitive and non-invasive diagnostic platform to improve early-stage ovarian cancer detection. We aim to create a nanomaterial probe that specifically detects cancer-associated-extracellular vesicles (EVs) in patient samples with readout by surface enhanced Raman spectroscopy (SERS). The nanomaterial probe is a core-shell silica and gold nano-matryoshka, with specific labels to tag EVs. The gold nanoparticle (AuNP) core of the nanoparticle provides plasmonic enhancement enabling SERS, akin to shining a bright light on the cancer biomarkers. A self-assembled monolayer of a Raman-active tag (RT) surrounds the core to act as a unique label for each nanoparticle type. A silica shell encases the Raman-tag to the nanoparticle, providing long term stability and an adhesive surface for EV targeting agents. Each nanoparticle formulation has a direct association between a Raman-active tag and an EV targeting agent, therefore linking the outputted Raman spectra peaks to cancer associated proteins. Five unique nanoparticle formulations have been synthesized and initial antibody conjugation has been successful. This proof-of-concept work provides a promising nanomaterial probe for early-stage ovarian cancer detection.

The Impact of Government Spending on Health: CVD Death Rates in California

Andrew Kope
Sponsor: Katherine Eriksson, Ph.D.
Economics

Since 1921, CVD has been the leading cause of death in the US, and it cost the US government $239.9 billion in 2018. Policy changes aimed at reducing CVD rates are often seen as too harsh or ineffective. I estimate the impact of average government spending over the time periods 2003-2010 and 2011-2018 on CVD death rates at the end of these time periods reported by the CDC for Medicare beneficiaries. Government spending refers to county and city level expenditures broken into the 5 categories: Education and Recreation, Facilities Health and Sanitation, General Government, Public Assistance, and Public Protection, I exclude capital expenditures and enterprise investments. All spending is taken as per capita amounts. I control for age, economic situation, and healthcare capabilities by adding variables for population over 65, median household income, and number of staffed beds. I find that government spending in Education and Recreation is negatively correlated with CVD death rates at the 5% significance level.

Automated Image Collection and Species Classification for *Anopheles* and non-*Anopheles* Mosquitoes

Vishal Koppuru
Sponsor: Gregory Lanzaro, Ph.D.
VM: Pathology, Micro, & Immun

Anopheles mosquitoes, a set of species capable of transmitting malaria to humans, exhibit unique, visible characteristics that set them apart from other mosquito species. Leveraging these distinguishing features, our project aims to develop an automated system for the classification of *Anopheles* and non-*Anopheles* mosquitoes, facilitating rapid categorization of mosquito samples and accelerating the pace of research on malaria prevention. To achieve this, we designed an automated microscope stage capable of capturing high-quality images of mosquito specimens. We've also built an object detection model, based on the YOLOv8 algorithm, to accurately identify and photograph mosquitoes on the stage without manual intervention. The heart of our methodology is an image classification model that distinguishes between mosquito species by analyzing these images. From here, our goal is to integrate all three of these parts together in a process that is fully automated end-to-end, to build improved versions of the microscope stage prototype, and to improve the image classifier model through hyperparameter tuning and additional training on new images taken using the aforementioned stage and object detector.

Influence of Imidacloprid Pesticide on Rat Primary Cortical Cell Tri-Culture

Tushar Kotamraju
Sponsor: Erkin Seker, Ph.D.
Elect & Comp Engr

Pesticides may result in neuro-immune response and activate microglia, resident macrophage of the central nervous system, which in turn results in inflammation that negatively influences neuronal function. One such compound from the neonicotinoid family of pesticides is imidacloprid (IMI). Although IMI is hypothesized to mainly target cholinergic neurons in insects, recent studies hinted at the possibility of IMI affecting mammalian neurons. In this study, we investigated the effect of IMI on neural cell cultures obtained from neonatal rat pups. Specifically, we used a tri-culture of neurons, astrocytes, and microglia to recapitulate the neuroinflammatory response with closer resemblance to its in vivo counterpart and employed cytotoxicity assays and quantitative fluorescence microscopy of immunostained cultures. Using this technology, we also tracked morphological changes in microglia and damages to the neurons and astrocytes at varying concentrations of IMI. Overall, we demonstrate the utility of the tri-culture in studying the influence of suspected environmental toxins on neuroinflammatory response.

Pregnancy After Bariatric Surgery: Persistent Obesity at Conception Influences Peripartum Outcomes

Kanksha Koti
Sponsor: Victoria Lyo, M.D.
MED: Surgery

One third of patients who undergo bariatric surgery (BS) are women of reproductive age. Pregnancy has inherent risks such as gestational diabetes, eclampsia, and the literature on risks of pregnancy in patients who have undergone BS are limited. It is unknown if continued obesity in post-BS patients contributes to pregnancy and peripartum complications. Therefore, we examined pregnancy-related risks using a retrospective chart review study of singleton, live births in post-BS patients from 2009-2023. Data including mother's weight, coexisting conditions in pregnancy, and peripartum results were collected. Obesity was defined via standard criteria. Differences were calculated via chi-square and t-testing. 127 pregnancies in 106 women were analyzed. Mean BMI at BS and conception were 46.9±9.5 kg/m^2 and 34.1±8.1 kg/m^2 respectively. Compared to those with a BMI>30 kg/m^2, Patients with pre-pregnancy BMI < 30 kg/m^2 had significantly lower rates of peripartum hypertension ($p = .02$), diabetes ($p = .005$), and cesarean section ($p < .0001$). Persistent post-BS obesity is associated with increased pregnancy and peripartum complications. Patients looking to conceive after bariatric surgery may require additional weight loss support to reduce peripartum complications.

Obsidian Trade during the Protohistoric Period (1700s-early 1800s) in Owens Valley, California

Lada Krat
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

Archaeological research in 2006 at a site on the edge of Owens Lake revealed a small circular depression that appears to be the foundations of an ancestral Owens Valley Paiute house. The presence of glass trade beads and metal artifacts, and a radiocarbon date, place the age of the house to the late 1700s to early 1800s, prior to colonization by EuroAmerican peoples in the 1860s. Associated with the house is a large assemblage of obsidian artifacts. This material would have been traded in from sources located between 30 and 100 km from the site, to the south, east, northeast, and north. X-Ray Fluorescence (XRF) analyses allow us to trace the source of the obsidian back to these particular locations. Because numerous sources of obsidian are available in this broader region, examining patterns of obsidian sources within the sediments associated with the house, allow us to examine patterns of obsidian trade in the period just before contact. We report on the XRF analyses in this poster and discuss what they reveal about the connections of the family that likely lived in this house some 200 years ago.

Investigating Patterns of Organ Elongation Under Different Light Conditions in Asteraceae Flowers

Isabella Krzesniak
Sponsor: Stacey Harmer, Ph.D.
Ag Plant Biology

Many physiological processes in plants are regulated by a combination of environmental signals and an internal timekeeping mechanism called the circadian clock. Environmental cues like light and temperature can directly stimulate physiological processes in plants. In addition, light can also regulate the clock, which may produce daily rhythms in these processes. We seek to investigate the light and circadian regulation of reproductive organ elongation in the Asteraceae family. First, we investigated the role of light and clock regulation in self-pollinating butterhead lettuce (*Lactuca sativa cv. Diana*) and facultative outcrossing wild lettuce (*Lactuca perennis*). Patterns of floral organ elongation were quantified and analyzed under differing light regimes. We hypothesize that plants with different pollination strategies may regulate these processes differently via clock regulation and/or direct responses to external cues. We also seek to investigate the role of the gene *EARLY FLOWERING 3* (*ELF3*), a core component of the plant circadian clock, in the timing of sunflower (*Helianthus annuus*) floral organ elongation. We compared floral opening patterns in a sunflower mutant for an *ELF3* homolog (*HaELF3_3*) against un-mutagenized control sunflowers. Sunflowers were imaged in constant dark to screen for clock-regulated behavior and assessed for changes in timing of organ elongation.

Shaping Strawberry Selection: Harnessing Near Infrared Spectrometry for Rapid Phenotypic Prediction in Strawberry Breeding

Noah Kulchin
Sponsor: Mitchell Feldmann, Ph.D.
Plant Sciences

Near Infrared Spectrometry (NIRS) has emerged as a promising tool in agriculture for non-destructive and rapid analysis of plant traits. Here we explore the potential of using NIRS data for predicting phenotypic traits in strawberry (*Fragaria × ananassa*). Our research involved the collection of NIRS and phenotypic data from a diverse set of strawberry hybrids in the UC Davis Strawberry Breeding Program. We collected key fruit quality data such as anthocyanin content (antioxidants), °Brix (sweetness), titratable acid (tartness), and ascorbic acid content (vitamin C). These traits are ideal candidates for prediction due to their contribution to the taste, shelf life, and marketability of strawberries. Subsequently, we employed several machine learning algorithms to develop predictive models correlating the spectral signatures with the target phenotypic traits. By integrating spectral data with trait measurements obtained through traditional methods, we plan to evaluate the accuracy of the NIRS-based phenomic prediction. Successful implementation of NIRS for trait prediction could revolutionize strawberry breeding programs, facilitating rapid and efficient selection of superior cultivars with desired traits. In this study we contribute to advancing the utilization of NIRS in strawberry breeding and agricultural research, an exciting milestone towards the rapid assessment of plant traits in cultivated strawberry.

Investigating Decision-Making in Children Through a Neuroeconomics Lens

Sreya Kumar
Sponsor: Yuko Munakata, Ph.D.
Psychology

Prior experiences may influence the likelihood of choosing more difficult or easier tasks. We investigated middle school aged children's decision making in computerized, effort based reinforcement learning games. 60 9-12 year old children were presented with games at 2 levels of difficulty, and their preference for the easier or harder task was examined in three sections. First, children gained experience with the two tasks. Second, children experienced rewards contingent upon their performance and decisions.Third, rewards were removed to assess changes in task preferences. Participants were randomly assigned to be rewarded based on effort, performance or randomly (control). We take a neuroeconomics approach, employing drift diffusion modeling (DDM) to model participant choices by comparing decision values. Habit development is assessed by the individual's drift rate (the rate at which they accumulate enough evidence to stick with a choice). We predict that learned preferences lead to reduced drift rate over time. By analyzing the factors that children pay attention to when deciding to take on harder or easier tasks, we inform current education models that encourage effortful performance.

Characterizing the eEfect of Folate-Deficient Diet on H3K27/K4 Methylation in Spermatogenesis

Rohan Kumar
Sponsor: Satoshi Namekawa, Ph.D.
Microbiology & Molec Genetics

Over 15% of couples have difficulty conceiving a child. Male fertility is conducted through spermatogenesis, which produces sperm from germ cells. In addition to its DNA, the sperm's epigenome is essential for embryonic development. Diet directly affects the epigenome by changing the number of substrates available for chromatin-modifying processes, thus affecting gene expression and development. Our work studies how folate (vitamin B9), a substrate required for methyl groups, in a father's diet can affect offspring health. Specifically, I aim to understand how a folate-deficient model affects H3K4 trimethylation and H3K27 methylation. The epigenetic mark H3K4 trimethylation and H3K27 methylation are associated with the activation of gene transcription. I hypothesize that a diet lacking folate will lead to a decrease in H3K4 trimethylation and H3K27 methylation. I intend to perform immunohistochemistry to visualize the presence of both markers and measure chromatin coverage through immunostaining chromosome spread slides. Subsequently, I will quantitatively assess the fluorescence intensity in each tubule and draw comparisons between the two dietary conditions. The main goal is to provide insight into whether the paternal diet is as significant as the maternal diet and improve current preconception guidelines.

Control of Tiltwing Hover via Trailing Edge Slipstream Deflection and Prop-Rotor Cyclic Pitching

Esther Kung
Sponsor: Camli Badrya, Ph.D.
Mechanical & Aerospace Engr

Tiltwing is a type of VTOL (vertical take-off and landing) aircraft configuration that achieves thrust vectoring by rotating the propulsion-wing element. Such configuration features lower noise and drag in hover, along with shorter transition time compared to other vectored thrust methods. Historically, experimental tiltwings like CL-84 and Vertol VZ-2 had achieved stability in hover by incorporating thrust at the tail to control pitch, but a tailrotor adds complexity and weight. It is also known that tiltwing has limited yaw control, as it is susceptible to gusts and in hover. The implementation of trailing edge flaps and cyclic articulation of the rotors can be a simpler system that provides control in hover. The stability of a tiltwing scale model in hover will be studied by coupling these two mechanisms; the extent to which this system can provide control will be explored by modeling of the flight mechanics and demonstrated with a scaled flight test vehicle.

Regulation of Gene Expression During Cell Plate Development in *Arabidopsis thaliana*

Lindsey Kurtz
Sponsor: Georgia Drakakaki, Ph.D.
Plant Sciences

Plant cytokinesis involves the formation of a cell plate which becomes the cell wall separating the two daughter cells. A key component for cell plate maturation is the deposition of the polysaccharide callose, which is inhibited by Endosidin 7 (ES7) during cell plate formation. By treating wild type (WT) *Arabidopsis thaliana* with ES7 and using RNA sequence analysis, our research identified differentially expressed transcripts in response to this treatment. Analysis of RNAseq data has revealed that the cytokinin signaling pathway is downregulated under ES7 treatment. Cytokinins (CK) are a class of plant hormones that promote cell division, in plant roots and shoots, and are perceived by membrane-localized histidine kinases (AHK). To further validate the differential expression of the cytokinin responsive genes identified in the RNAseq analysis, we have performed qRT-PCR on the WT and an AHK T-DNA mutant (*ahk3-7*) line of Arabidopsis roots. The findings and hypothesis of this result will give us insights to better understand the molecular mechanisms regulating plant cytokinesis.

Testing and Validation of Attitude Determination and Control System Software for Low Cost Satellite Control Methods

Charles Kvoriak
Sponsor: Rich Whittle, Ph.D.
Mechanical & Aerospace Engr

We present the software testing and validation process for the Attitude Determination and Control Systems (ADCS) on REALOP, UC Davis' first undergraduate-led CubeSat mission. ADCS will orient the satellite in space using computer hard disk drives (HDDs), demonstrating their feasibility as a low-cost CubeSat control method. While in orbit, ADCS is susceptible to sensor malfunctions, software bugs, ground station communications issues, and control hardware malfunctions. We describe the various methods we use to mitigate these failures, both by preventing them before the mission and by planning responses to different failures in orbit. Prevention involves using ground tests to catch bugs in the software and simulating experiments to ensure we collect enough data to verify results and detect failures. We plan our responses to failures based on the minimum set of sensors and systems required to perform each experiment. By ensuring software reliability, we increase the likelihood of mission success for REALOP by proving the viability of HDDs as reaction wheels, thereby lowering the cost of entry to space for organizations around the world.

Expression of Long Non-Coding RNA as an Adaptive Mechanism for Thermal Tolerance in a Marine Copepod Tigriopus californicus

David Kwon
Sponsor: Rachael Bay, Ph.D.
Evolution & Ecology

As ocean temperatures rise under anthropogenic climate change, adaptive resilience under intensified heat stress is increasingly necessary for the survival of marine life. The molecular mechanisms that enable population-wide tolerance to normally harmful temperatures, however, are not fully understood. A possible but largely unexplored epigenetic regulator of interest is long non-coding RNA (lncRNA), which are functional RNA molecules that exceed 200 nucleotides but do not code for a protein. Here, we investigate the potential existence of a lncRNA-driven mechanism to mediate expression of heat response genes in an ecologically important intertidal copepod (*Tigriopus californicus*). We analyzed RNA sequencing data from a previous experiment performed on heat-tolerant and heat-sensitive populations. We test whether lncRNAs are differentially expressed between the populations and then whether differentially expressed lncRNAs are co-expressed with heat response proteins. Results from this study will provide insights into novel mechanisms that promote adaptation to an increasingly hostile thermal environment.

Using Genetic Networks to Identify Biomarkers

Eric Kye
Sponsor: Paulina Carmona-Mora, Ph.D.
MED: Neurology

In this study, we delve into an extensive genetic dataset, comprising diverse patient profiles obtained by sequencing RNA from blood samples, with the aim of uncovering the intricate networks of gene interactions. Utilizing GeCoNet, an advanced tool for gene co-expression network construction and analysis, we systematically identify key genes that emerge as significant within these networks. In constructing these networks, GeCoNet employs robust statistical methodologies to calculate Pearson Correlation Coefficients, which serve to identify co-expressed gene pairs. The tool then filters these relationships to highlight core genes—those with the highest degree of connectivity within the network, suggesting their potential as critical regulators in gene-gene interaction landscapes. This insight into the core genes provides a focused perspective on the genetic architecture underlying health conditions, propelling them as candidates of heightened interest in our analysis. These pivotal genes are subsequently integrated into machine learning algorithms to find the most reliable genetic predictors for specific health conditions. Moreover, our approach extends to employing network analyses as a supplementary strategy to uncover genes intimately linked with particular traits. This methodology not only enhances our understanding of the genetic foundations of disease but also paves the way for advancements in personalized medicine.

Investigation of Corneal Innervation of Mucin 4 Knockout Mice

Ivan Lai
Sponsor: Brian Leonard, D.V.M.,Ph.D.
VM: Surg/Rad Science

Mucins are known to contribute to the glycocalyx of various epithelial tissues, including the ocular surface. Membrane-associated mucins, a subset of mucins, are tethered to the cell membrane and can provide protection to the cell. Due to the correlation between corneal innervation and ocular surface disease, we sought to determine the effect of *mucin 4* (*Muc4*), a membrane-associated mucin expressed by corneal epithelial cells, on corneal innervation. Using *in vivo* confocal microscopy (IVCM), the basal epithelial nerves of 4-month-old (n=6 *Muc4* knockout, 5 wildtype) and 10-month-old (n=3 *Muc4* knockout, 2 wildtype) mice were measured. Specifically, the nerve density, nerve length, and total number of nerves were assessed by a masked examiner. The groups were compared using a t-test. No significant differences were identified between the *Muc4* knockout and wildtype mice at 4 months of age. However, a significant increase in the number of nerves (P=0.0196) and occupancy (P=0.0325) were identified in the 10-month-old *Muc4* knockout mice compared to the wildtype mice. We hypothesize that this increase in basal nerve number and density indicate that neuronal regeneration is occurring due to a decrease in apical nerve health which we will investigate in future studies.

Microwave Assisted Synthesis of Lead Chevrel Phases

Rose Lam
Sponsor: Jesus Velazquez Mojica, Ph.D.
Chemistry

Demand for sustainable energy solutions calls for development of transformative energy conversion and storage materials. Chevrel phases (MyMo6X8, M = alkali, alkaline, transition, post-transition, and lanthanide metals; X = S, Se, and Te) show promise as electrocatalysts for hydrogen evolution reactions (HER) and CO2 reduction (CO2R). While studies have been performed on binary and transition metal intercalated CPs, few are on post-transition metal intercalated phases. CPs with large cations can be difficult to access due to their metastability. An alternative route is intercalating the cation into pre-synthesized binary CPs, allowing for pure phase metastable material. In literature, CPs are synthesized utilizing tube furnaces, however, this is time intensive and energy inefficient. Microwave synthesis offers an alternative, utilizing microwave radiation to intercalate the cation into existing binary phases in a quick manner. Within non-aqueous chemistry, lead is a material of interest due to its ability to selectively convert carbon dioxide to oxalate. Using Pb as an intercalant in multinary materials can lead to diminished heavy metal content while still accessing high oxalate yields. This work aims to report microwave-assisted synthesis of PbMo6X8. As well as full characterization of the materials, highlighting x-ray diffraction (XRD), scanning electron microscopy (SEM), and energy-dispersive x-ray spectroscopy (EDX).

Development of Breath Test for Respiratory Virus Diagnostics

Tiffany Lam
Sponsor: Cristina Davis, Ph.D.
Mechanical & Aerospace Engr

To increase the capacity to test for respiratory viruses worldwide, such as COVID-19, the development of a new type of test is needed. Due to health complications, many patients may not be able to partake in the widely available nasopharyngeal swab test or blood test, so an alternative noninvasive test is highly desired. The purpose of our study is to distinguish unique breath VOC (volatile organic compounds) biomarkers of respiratory viral infection, and then use these biomarkers to develop a portable breath analysis device that could be used by clinicians to noninvasively diagnose patients. This breath analysis device would use our miniature differential mobility spectrometry (DMS) detector, coupled with chip-based gas chromatography. The device will include a custom chip-based preconcentrator, which will be concentrated with chemical sorbent to allow extraction of VOCs from breath. We currently recruit subjects from the UC Davis Medical Center and collect exhaled breath through Tenax Sorbent Tubes that capture VOC biomarkers and collect nasopharyngeal swabs along with demographic information. Our findings so far indicate that there is variation in the VOCs found between different respiratory viruses, including the distinct strands of COVID-19.

Myocardial Infarctions on Systemic Bone Loss through C5a Protein

Selena Lam
Sponsor: Blaine Christiansen, Ph.D.
MED: Orthopaedic Surgery

Heart attacks, or myocardial infarctions (MI), and acute osteoporotic fractures are two of the leading causes of illness in the United States. Heart attacks are caused by a cessation of blood flow to the muscular tissue of the heart. Osteoporotic fractures are caused by the reduction in bone density and strength. MI has a direct relationship in inducing osteoporotic fracture with systemic bone loss. However, no studies have investigated one of the main mediators, the complement system and its primary protein (C5a), which incites multiple organ dysfunctions. In this study, MI was surgically induced in 12-week old C57BL/6 male mice (n = 12-16), C5aR1-/- mice (n = 6-13), C5a deficient B10.D2 (n = 13) mice. Mice from each group served as control (n = 7-13). Initial results display MI leading to peak bone loss at day 7 after injury in the L5 vertebra and day 28 in the femur. To further investigate this, TRAP staining was performed to count the number of osteoclasts in the L5 vertebra and femur to quantify bone resorption on day 7 post-MI. These results exemplify that MI lead to systemic bone loss with the C5aR1 being a modulator for this response: bone loss and increased fractured risks.

Subthalamic Deep Brain Stimulation Parameters for Gait Impairment in Parkinson's Disease Patients

Desiree Lano
Sponsor: Sarah Faye, M.A.
University Writing Program

Parkinson's disease (PD) is a devastating neurodegenerative disease that affects about 572/100,000 North Americans ages 45 and older. Progression of the disease can be crushing for both patients and their loved ones, with no permanent cure in our current medical arsenal. Gait impairment, a particularly disabling feature of PD, can range from arm swing asymmetry to freezing of gait and difficulties with balance—this often contributes to a decline in functioning as the disease progresses. Typical treatment of symptoms includes dopaminergic medications such as Levodopa; however, in some patients the side effects are either intolerable or the medication is not effective enough. In these cases, more invasive treatments must be considered by treating clinicians. This review aims to evaluate the current scientific literature on proper treatment parameters for gait impairment, with a particular focus on subthalamic deep brain stimulation—an invasive yet effective treatment for the motor symptoms of PD.

Using Genetic Screenings to Identify Novel Genes Associated with NAD+ Metabolism and its Regulation in the Model System *Saccharomyces cerevisiae*

Gordon Lao
Sponsor: Su-ju Lin, Ph.D.
Microbiology & Molec Genetics

Nicotinamide adenine dinucleotide (NAD^+) is an essential metabolic cofactor involved in redox reactions and cellular signaling. NAD^+ is synthesized from tryptophan leading to quinolinic acid production (QA) via the *de novo* pathway or by salvaging precursors such as nicotinic acid/nicotinamide (NA/NAM) and nicotinamide riboside (NR) via their respective pathways. Abnormal NAD^+ levels are associated with age-related human disorders, but NAD^+ regulation is not completely understood due to its complexity. Using *Saccharomyces cerevisiae* and NAD^+ intermediate specific cell-based assay, we identified ~350 genes that may impact NAD^+ intermediate homeostasis. We validated ~100 clones, including known NAD^+ metabolic and novel genes such as transcription factors, signaling pathway components, and autophagy trafficking components. We will be focusing on several targets that show strong phenotypes including QDR2, AFT1, NPY1, and FPY1. These studies will help elucidate the interconnections within NAD^+ metabolism and its regulation as well as aid in developing therapeutic strategies for metabolic disorders related to abnormal NAD^+ levels.

Examining Baseline Cortisol and Autonomic Activity in Children with Internalizing Symptoms

Mary Lawlor
Sponsor: Camelia Hostinar, Ph.D.
Psychology

Childhood anxiety rates have been increasing over time and are linked to dysregulation of the stress-response system. The hypothalamic-pituitary-adrenal (HPA) axis and autonomic nervous system (ANS) are activated during stress, but findings examining links between anxiety and the activity of these systems have been inconsistent. Previous research has mainly focused on the systems individually, rather than looking at both. To better understand how anxiety relates to children's HPA and ANS physiology, the current study examines links between internalizing behaviors and baseline cortisol and ANS activity. 180 children (ages 9–11 years old, M = 9.9 years, SD = .58) completed the State-Trait Anxiety Inventory for Children (STAIC) and their parents completed the Child Behavior Checklist (CBCL). Children's saliva samples were collected 10 minutes after arrival and ANS activity was collected during a five-minute resting baseline period. Saliva samples were assayed for cortisol, and ANS recordings captured both pre-ejection period (PEP), a marker of sympathetic nervous system activity, and respiratory sinus arrhythmia (RSA), an index of parasympathetic activity. We expect to find that children who have higher scores of internalizing symptoms on the CBCL and greater reported trait anxiety will have higher baseline cortisol levels, higher PEP, and lower RSA.

Overcoming Barriers: Exploring Deterrents to Naturalization and Potential Solutions

Jules Lazarus
Sponsor: Jeannette Money, Ph.D.
Political Science

Our research aims to investigate the factors contributing to the relatively low naturalization rate among the millions of Legal Permanent Residents (LPRs) in the United States who are eligible for citizenship. After conducting thorough analyses of various data sources, academic literature, and research studies on this topic, we have identified economic reasons as a significant deterrent. This encompasses the financial expenses associated with the naturalization process and the broader implications of monetary challenges, such as limited access to adult education and lower wages. Our objective is to find the economic and social circumstances of those who do naturalize as citizens in the United States and the perceived benefits of American citizenship. We want to not only uncover any correlation between naturalization and socioeconomic background , and whether the benefits of naturalization can motivate individuals to pursue it, but also to identify the necessary steps that can be taken to address the obstacles to naturalization for those who qualify.

The Stress Profiles Questionnaire: A Pilot Study of A Novel Assessment of the Multidimensional Responses to Acute Stress

Jasmine Le
Sponsor: Camelia Hostinar, Ph.D.
Psychology

Traumatic stress and early adversity have been well-studied as having negative impacts on affective, behavioral, cognitive, and somatic wellbeing. Available research on acute stress evidences the vast multifinality of stress across and within these domains, highlighting the complex developmental pathways for psychopathology and negative physiological outcomes (Hostinar et al., 2023). With the elevated prevalence of psychopathology following the COVID-19 pandemic (Kessler, 2022), it is increasingly necessary to develop means of stress assessment that capture the many impacted domains of individuals' responses to stress. Doing so would allow for improved prediction of mental and general health trajectories, as well as interdisciplinary comprehension of stress profiles and their diagnostic correlates. The current study pilots a novel measurement tool, the Stress Profiles Questionnaire (SPQ), that seeks to inventory various possible responses to stress, and provides an exploratory analysis of collected responses. Data on stress responses was collected as a part of a larger study examining food insecurity and perceived stress among undergraduate students. The pilot questionnaire consists of qualitative and quantitative measures to catalog cognitive, behavioral, affective, and somatic responses to acute stress. This study presents the initial findings of the pilot SPQ's efficacy in capturing self-identified stress response symptoms and perceived severity.

Spontaneous Seizures and Altered Cognitive Outcomes in Adult Rats Following Acute Intoxication with DFP

Bao Ngoc Le
Sponsor: Gene Gurkoff, Ph.D.
MED: Neurological Surgery

Acute organophosphate (OP) intoxication is experienced in suicides, unintentional agro-industrial poisoning and chemical weapon exposure, resulting in hundreds of thousands of deaths globally each year. Acute OP-intoxication can lead to status epilepticus (SE), spontaneously recurring seizures (SRS) and long-term cognitive dysfunctions in survivors.

We hypothesize that SE triggered by acute intoxication with the OP-threat agent diisopropylfluorophosphate (DFP) will result in the development of SRS and concurrent persistent learning and memory dysfunction. Local field potentials (LFP) were recorded from depth electrodes of multiple brain regions and electroencephalogram (EEG) from a cortical screw in both male and female rats. Continuous video-EEG seizure monitoring occurred between days 1-21, 52-61 and 90-99. Cognitive assessments included Y-maze (48d), Novel Object Recognition (51d) and Barnes maze (85-88d).

In both male and female rats, intoxication with DFP resulted in an increase in seizures and spikes, with the frequency and duration of seizures increasing over time. While spontaneous alternation on Y-maze remain unchanged, deficits were significant in the NOR task. In Barnes maze, both males and females with SRS had significant deficits ($p<0.05$), whereas non-epileptic animals performed similarly to controls. Overall, acute DFP intoxication leads to similar sequela in male and female rats, as observed in humans.

Ineffective Policies: Examining the Lack of Impact of State Minimum Wage Changes on Poverty

Kristen Le
Sponsor: Colin Cameron, Ph.D.
Economics

This paper seeks to investigate the causal effects of changes in state minimum wage on the likelihood of an individual being beneath the poverty threshold. This paper contributes to existing research by exploring the impact of minimum wage at a state level on poverty through a narrower scope. By comparing the outcomes of all industries with industries that have the largest ratios of minimum wage workers, we are able to see the impact in both a broad and targeted context. Our investigation into the relationship between the probability of being below the poverty threshold and key regressors — real state minimum wage, state fixed effects, year fixed effects, and industry fixed effects — employs causal methods, specifically a fixed effects regression model and logistic model. We leveraged data from the American Community Survey and Federal Reserve Economic Data from 2012 through 2019, and through our analysis, the results indicate that real minimum wage does not have a large nor significant impact on the probability of an individual being below the poverty threshold across the industries included in the dataset. The findings indicate that the minimum wage is ineffective as the only policy tool to combat poverty.

In Vitro Generation of Alzheimer's Disease Tau Aggregates and Their Effects on Tau-Microtubule Interactions

Tianna Le
Sponsor: Richard Mckenney, Ph.D.
Molecular & Cellular Bio

Alzheimer's disease (AD) results in neurodegeneration, leading to loss of memory and cognition impairment. The molecular mechanisms of this neurodegeneration are unclear, but it is known that neurofibrillary tangles (NFTs) are central to the pathology. NFTs are large, insoluble aggregations of proteins and among their chief components is tau - a microtubule associated protein (MAP) that exists in healthy neurons in a soluble form bound to microtubules. Our lab has shown that when bound to microtubules, tau forms selectively permeable protein 'envelopes' that regulate the association of various other MAPs and alter the underlying microtubule lattice. Unlike NFTs, tau envelopes represent reversible self-association of the tau molecule. This project aims to elucidate the relationship between tau NFTs (irreversible self-association of tau) and tau envelopes (reversible self-association tau) on microtubules through assembly of NFTs and dynamic fluorescence imaging. These results may shed new light on the role of tau self-association in physiology and disease.

Improving the Efficiency of Electroporating CRISPR-Cas9 in Bovine Embryonic Stem Cells

Heesoo Lee
Sponsor: Elizabeth Maga, Ph.D.
Animal Science

Gene editing in livestock is a valuable tool to advance desirable traits that benefit the agricultural and biomedical fields. Using gene edited livestock embryonic stem cells (ESCs) and nuclear cloning to generate transgenic animals has advantages over microinjecting embryos such as reducing mosaicism, costs, and animals used for crossbreeding. Although clustered regularly interspaced palindromic repeats (CRISPR)/Cas9 is a widely used gene editing tool due to its cost effectiveness and efficiency, there are limited reports of its use in bovine ESCs. Electroporation is one of the various ways to deliver CRISPR-Cas9 reagents into ESCs. With the establishment of new livestock ESC lines, electroporation parameters must be optimized for that specific cell line as they vary depending on cell type. While lower voltages may result in greater cell viability after transfection, higher voltages make the cell membrane more permeable for uptake of gene editing reagents. The objective of this project is to compare the transfection efficiency of electroporation at different voltages to determine the most optimal conditions for transfecting bovine ESCs.

Design to Data for mutants of β-glucosidase B from *Paenibacillus polymyxa*: N404M, N404Q, T212E, T116S, T296S, T321S

Jennifer Lee
Sponsor: Justin Siegel, Ph.D.
MED: Biochem & Molecular Med

Leveraging computational tools to uncover protein structure-to-function relationships is growing rapidly in applications to enzyme engineering. Though there are numerous examples of computational tools enabling the design of novel protein functions, the current limitations in dataset size and quality hinder the development of accurate predictive algorithms. This study addresses this challenge by expanding the current dataset with the characterization of six novel variants N404M, N404Q, T212E, T116S, T296S, and T321S in β-glucosidase B (BglB) from *Paenibacillus polymyxa*. Variants were designed and modeled in Rosetta GUI Foldit Standalone, purified in *Escherichia coli*, and characterized with colorimetric kinetic assay and thermal stability fluorescence-based protein unfolding assay. Functional parameters, Michaelis-Menten constants (k_{cat}, K_M, and k_{cat}/K_M) and thermal stability (T_M), were added to the publicly accessible Design2Data database. Examining a small set of mutations as a case study reveals trends in mutational effects that align with and diverge from conclusions drawn from larger-scale studies of the entire dataset.

Promoting Engagement with College Campus Food Access Resources through Culturally-Inclusive Recipes

Ellie Lee
Sponsor: Debbie Fetter, Ph.D.
Nutrition

College students make up a diverse subpopulation of emerging adults who are at risk of facing food insecurity due to the high costs of living, tuition, and additional competing financial obligations. Food insecurity is linked to health concerns, including nutritional inadequacy, overweight/obesity, decreased growth potential, and mental health concerns. Although efforts have been made by campuses to publicize food access resources, these sites remain underutilized. To improve UC Davis students' cooking confidence and motivation to use campus food access resources, culturally-inclusive recipes were designed from foods available at the student-run pantry, The Pantry. Food preferences and perceived cooking self-efficacy were identified from a convenience sample of 272 enrolled UC Davis students. Six recipes were selected based on students' cuisine preferences (American, Chinese, Mexican, Japanese, Italian, Korean). To investigate recipe acceptability, samples will be provided to students at The Pantry and participants will be asked to complete a modified sensory evaluation. These results will be used to guide the development of future recipes that tailor to student needs and encourage use of items from food access resources.

Eliminating Monitor Overuse

Julia Lee
Sponsor: Michelle Hamline, M.D.,Ph.D.
MED: Pediatrics

Continuous pulse oximetry is a prevalent method to surveil oxygen saturation (SpO_2) of hospitalized pediatric patients with bronchiolitis. However, for the subset of patients who have bronchiolitis but are not receiving supplemental oxygen, it is ineffective and can lead to difficult hospital experiences for both patients and their healthcare team. Due to inconsistent readings even as a patient's condition improves, length of hospital stay becomes prolonged, escalating the possibility of adverse events and complications. Additionally, false alarms may distract nursing staff from attending to emergencies. This large-scale study aims to track de-implementation of pulse oximetry use and assess patient outcomes across 35 hospitals. First, a Baseline Data Collection phase tracking pulse oximetry use and an Active De-implementation phase involving education on misconceptions of continuous monitoring were carried out. Currently, a Sustainment phase is underway to gauge the effectiveness of education programs and whether patients who are not monitored truly have better outcomes. REDCap is being utilized to collect respiratory support methods, SpO_2 monitoring status, and length of hospital stay for eligible patients with a bronchiolitis diagnosis. Data from the study will help re-evaluate the best de-implementation methods for continuous pulse oximetry.

Eyes on Growth: Investigating Eye Lens Diameter with Juvenile Salmon Age and Growth rates

Sung-A Lee
Sponsor: Carson Jeffres, Ph.D.
Center For Watershed Sciences

Fish eye lenses are archival tissues that allow valuable insights into life history and dietary patterns through stable isotope analysis. Analogous to growth rings in trees, eye lenses grow in sequential layers over the lifetime of the fish. The current scientific literature suggests that juvenile salmonid lens growth is linearly proportional to fork length, but the extent to which fish age and growth rates influence this relationship remains untested. We investigated the relationship between eye lens diameter and fork length in juvenile Chinook Salmon (*O. tshawytscha*) across 12 weeks, with treatment groups exposed to varying temperature conditions (11^oC, 16^oC, 20^oC) and food rations (35%, 65%,100%). Every 3-weeks, a subset of fish per treatment group were sacrificed and their eye lens diameters and fork lengths were measured. The insights gained from observing differences in both fish growth rates and eye lens diameter among treatment groups established increasingly specific and reliable confidence intervals for predicting fork length based on eye lens diameter. The results of this study not only enhance our comprehension of the interplay between lens diameter, laminae configuration, and fork length but also pave the way for increasingly accurate back-calculations of fish life history.

Using $^{15}N_2$ to Determine the Impacts of Location in the North and South Side of a Rice Field on the Nitrogen Fixation Rates in Paddy Algae

Cami Lee
Sponsor: Bruce Linquist, Ph.D.
Anr Plant Sciences

Algae grows along with rice in rice fields and has some benefits, but can become a problem when it grows in abundance. Algae acts as a biofertilizer, by providing nutrients to the soil and rice, and helping in the process of nitrogen fixation. However, algae can become a nuisance for rice farmers because it can crowd the rice crops and decrease the oxygen supply for the rice. Studies have looked into algae growth in different fields, but not much has been researched regarding different locations within the same field. This research project looks at how varying locations in a rice field affect paddy algae by analyzing nitrogen fixation rates from $^{15}N_2$ amounts. $^{15}N_2$ is used because it is a trace element that allows for exact measurements to be accounted for. This study was performed by collecting algae from a rice field, placing them in mini chambers in the greenhouse, incubating them with $^{15}N_2$, and then prepping the algae, weed, and soil samples for analysis.

Investigating the Effect of Somatostatin Receptors on Downstream Signaling in Alpha and Beta Cells of the Pancreatic Islet

Jordan Lee
Sponsor: Mark Huising, Ph.D.
Neuro Physio & Behavior

In the pancreatic islet of Langerhans, alpha, beta, and delta cells secrete the hormones glucagon, insulin, and somatostatin respectively. These hormones function to regulate circulating blood glucose levels in the body. Dysregulation of these processes results in metabolic disorders such as diabetes, which affects 30 million Americans. On the alpha and beta cells, an increase in Gαs coupled GPCR activation leads to an increase in cAMP which aids in moving secretory vesicles to the membrane while calcium triggers the exocytosis of these vesicles. Somatostatin binds to somatostatin receptors (SSTRs) on these cells, and lowers the concentrations of calcium and cAMP resulting in a decrease in hormone secretion. It has been observed that alpha cells are more inhibited by SST than beta cells. I hypothesize that this is due to the presence of SSTR2 and SSTR3 on alpha cells and only SSTR3 on beta cells. I visualized the presence and function of SSTR2 and SSTR3 receptors through immunofluorescence and live imaging confocal microscopy. Discerning whether the presence of different receptors contributes to this variation in inhibition will allow us to better understand delta cells' contribution to hormone regulation. Furthermore, this will aid in understanding islet associated metabolic disorders as a whole.

Aberrant Mitochondrial Morphology in Age-Related Macular Degeneration

Zoe Lee Greenblatt
Sponsor: Cecilia Giulivi, Ph.D.
VM: Molecular Bio Sciences

Age-Related Macular Degeneration (AMD) is a retinal disease that leads to central vision loss. The disease manifests as an accumulation of lipid and proteins plaque in the form of extracellular lipid deposition known as drusen or intracellular lipid accumulation presenting as punctate lesions, culminating in macular degeneration. Primates are the only mammals to possess maculae essential for sharp central vision, making them crucial models for AMD research. The macula, rich in mitochondria, is susceptible to environmental influences (such as sunlight exposure and dietary habits) and genetic factors that may contribute to mitochondrial damage, influencing the onset and progression of degeneration. To investigate, we analyzed mitochondrial morphology in retinal pigment epithelial cells of healthy rhesus macaques versus those with drusen or punctate lesions. Our findings revealed disrupted mitochondrial morphology in AMD samples, particularly those with drusen or punctuated deposits, exhibiting blunted fusion, a more circular shape, and diminished content compared to normal animals. These observations shed light on the potential role of mitochondrial dysfunction in AMD. Understanding this mechanism could guide the development of future treatments and preventive strategies targeting mitochondrial aspects of AMD.

History of Anthropological Research on the Sami of Norway

Katharina Lenz
Sponsor: Christyann Darwent, Ph.D.
Anthropology

My research takes a historical approach to understanding Indigenous Sami in the *Sápmi* region of Norway. My project aims to identify changes in anthropological research topics, and how Norway's governmental policies, increased resource extraction, Sami self-determination, climate change, and tourism have influenced the type of research undertaken by anthropologists. Initial data was generated through issue-by-issue culling of articles published in anthropology's flagship journal, *American Anthropologist*, founded in 1888, and from the only anthropology journal focused on the circumpolar north, *Arctic Anthropology*, founded in 1962. *American Anthropologist* published 29 articles about the Sami in the following decades: 1910s (n=1), 1920s (n=2), 1940s (n=1), 1950s (n=3), 1960s (n=7), 1970s (n=3), 1980s (n=2), 1990s (n=6), 2000s (n=4). There is a near even split between the number of publications prior to 1970 and those published after 1970. Although started in 1962, *Arctic Anthropology*, has more publications overall than *American Anthropologist* given its geographic focus: 1970s (n=6), 1980s (n=3), 1990s (n=3), 2000s (n=5), 2010s (n=21). Using key search terms identified in this initial analysis, I will undertake a Google Scholar search of published articles over the past century (1920-2020) to explore the history of Sami research in Norway.

Using Genetic Screenings to Identify Novel Genes Associated with NAD^+ Metabolism and its Regulation in the Model System *Saccharomyces cerevisiae*

Althea Leones
Sponsor: Su-ju Lin, Ph.D.
Microbiology & Molec Genetics

Nicotinamide adenine dinucleotide (NAD^+) is an essential metabolic cofactor involved in redox reactions and cellular signaling. NAD^+ is synthesized from tryptophan leading to quinolinic acid production (QA) via the de novo pathway or by salvaging precursors such as nicotinic acid/nicotinamide (NA/NAM) and nicotinamide riboside (NR) via their respective pathways. Abnormal NAD^+ levels are associated with age-related human disorders, but NAD^+ regulation is not completely understood due to its complexity. Using Saccharomyces cerevisiae and NAD^+ intermediate specific cell-based assay, we identified ~350 genes that may impact NAD^+ intermediate homeostasis. We validated ~100 clones, including known NAD^+ metabolic and novel genes such as transcription factors, signaling pathway components, and autophagy trafficking components. We will be focusing on several targets that show strong phenotypes including QDR2, AFT1, NPY1, and FPY1. These studies will help elucidate the interconnections within NAD^+ metabolism and its regulation as well as aid in developing therapeutic strategies for metabolic disorders related to abnormal NAD^+ levels.

Control of Tiltwing Hover via Trailing Edge Slipstream Deflection and Prop-Rotor Cyclic Pitching

Jaryd Leong
Sponsor: Camli Badrya, Ph.D.
Mechanical & Aerospace Engr

Tiltwing is a type of VTOL (vertical take-off and landing) aircraft configuration that achieves thrust vectoring by rotating the propulsion-wing element. Such configuration features lower noise and drag in hover, along with shorter transition time compared to other vectored thrust methods. Historically, experimental tiltwings like CL-84 and Vertol VZ-2 had achieved stability in hover by incorporating thrust at the tail to control pitch, but a tailrotor adds complexity and weight. It is also known that tiltwing has limited yaw control, as it is susceptible to gusts and in hover. The implementation of trailing edge flaps and cyclic articulation of the rotors can be a simpler system that provides control in hover. The stability of a tiltwing scale model in hover will be studied by coupling these two mechanisms; the extent to which this system can provide control will be explored by modeling of the flight mechanics and demonstrated with a scaled flight test vehicle.

What makes the UC Davis Student Farm's Ecological Garden "ecological"?

Anika Levy-Groth
Sponsor: Cameron Pittelkow, Ph.D.
Plant Sciences

Small-scale farming systems that incorporate agroecological principles can help build soil fertility, promote beneficial insects, and increase resilience to weather shocks and climate change. However, holistic assessment frameworks are lacking in identifying the strengths and weaknesses of different agricultural systems in meeting social and ecological sustainability goals. This study focuses on the UC Davis Student Farm's Ecological Garden, and how "ecological" it is. To do so, we studied the 10 principles of Agroecology, which were created by the Food and Agriculture Organization of the United Nations as a framework for farms to determine their resilience to and mitigation of climate change, along with their social and economic sustainability. The principles were then assessed using the Tool for Agroecology Performance Evaluation. The poster will show the findings on the performance of the Ecological Garden in each agroecological principle. We conclude that more research is needed to make tools that apply to a wider range of agricultural methods and goals and that more funding is needed to evaluate the social and economic aspects of the Ecological Garden.

Comparing the Relationship Between Complex Speech Sounds and Auditory Scenes in Recollection and Familiarity

Sharon Li
Sponsor: Andrew Yonelinas, Ph.D.
Psychology

Prior research has established that visual forms of working memory are supported by recollection and familiarity, however, whether these processes also contribute to auditory working memory remains unclear. In this study, we examine auditory working memory for pure tones, complex speech (i.e., pitch, syllable, and location), and auditory scenes. For each paradigm, 24 young adults were given an auditory change-detection task where sounds were presented one after another. Participants were tasked with making confidence judgments indicating whether the sounds were the same or different, and Receiver Operating Characteristics (ROCs) were used to analyze performance. The results indicated that in each paradigm we examined both recollection and familiarity contributed to auditory working memory. Future studies will utilize these paradigms to examine the effects of aging and neurological disorders such as medial temporal lobe amnesia on the neural processes supporting auditory working memory. Additionally, future studies will examine differences in change detection performances between confidence judgments and binary responses (i.e., "perceive" or "sense").

AI-Enhanced Precision in Identifying Sentinel Lymph Node Metastases in Breast Cancer Patients

Zihan (Tom) Li
Sponsor: Mohsen Mesgaran, Ph.D.
Plant Sciences

The prognosis of breast cancer is critically dependent on the presence of metastases in sentinel lymph nodes (SLN). Traditional histopathological examination of these nodes, while standard, is labor-intensive and may miss small metastatic occurrences. Recent advances in pathology have seen the rise of convolutional neural networks (CNNs) as a transformative tool, particularly in automating the analysis of whole-slide images (WSIs). This study focuses on assessing the effectiveness of a CNN-based model in identifying lymph node metastases in breast cancer patients. The study utilized a public dataset from the PatchCamelyon (PCam), and a total of 80,000 patches of healthy tissue and 80,000 patches of metastatic tissue were assessed in the training set, while 57,458 patches of pathological tissue were evaluated in the test dataset. Considering the classification by board certified pathologists as a reference, the trained deep net showed high accuracy (0.937), precision (0.971), validation AUC (0.979), and a low validation loss of 0.016. Our data show that a deep learning system can be trained to recognize metastatic cancer, outperforming pathologists under time constraints (mean AUC of 0.810), showcasing its potential for clinical application.

U.S. - China Trade War: A Global Value Chain Perspective

Rebecca Li
Sponsor: Janine Wilson, Ph.D.
Economics

In March 2018, former U.S. President Donald Trump implemented punitive tariffs on Chinese imports. In response, China imposed retaliatory tariffs on U.S. goods in April, leading to tariff escalations and counter-tariffs within a short time between the two largest economies in the world, which eventually turned into the U.S.-China trade war. This conflict, rooted in a deep-seated trade imbalance, has raised crucial questions about the global trade architecture and the role of national policies in shaping international economic relations. This research delves into the underlying causes of the trade war, particularly focusing on the significant trade imbalance between the U.S. and China. By employing the Global Value Chain (GVC) model to analyze the participation and position indices of both nations within global trade networks, this study offers a nuanced understanding of how and why this imbalance has contributed to the onset of the trade war. By calculating the global value chain participation and position indices of both countries, we will examine how the huge trade imbalance between the U.S. and China was created and how tariffs being used as a “weapon” in the trade war.

Traffic Related Air Pollution, Stress and Lung Pathology

Diane Li
Sponsor: Laura Van Winkle, Ph.D.
VM: Anat Physio & Cell Biology

Cardiovascular disease (CVD) is the leading cause of death in the United States, disproportionately affecting those with lower socioeconomic status. Exposure to traffic-related air pollution (TRAP) and chronic stressors prevalent in economically disadvantaged communities can increase this disparity and aggravate lung inflammation and mucus production. However, research on the combined effects of TRAP and chronic stress on cardiopulmonary health is lacking. To address this gap, this study utilizes a tunnel system to capture light-duty vehicle (LDV) and heavy-duty vehicle (HDV) exhaust to simulate TRAP exposures while also inducing chronic unpredictable stress (CUS) and acute restraint stress (ARS) on Sprague-Dawley rats. Following exposure, cardiovascular function and stress-related markers were assessed by another lab, while lung-specific outcomes were studied by our group. We conducted bronchoalveolar lavage and collected lavage fluid (BALF) to measure infiltration of inflammatory cells. The left lung lobe was fixed in 1% paraformaldehyde for histology. We used Hematoxylin and Eosin to localize immune cells as well as Alcian Blue to define mucus cell distribution and abundance. Preliminary data indicates an abundance of these cells in the lungs of rats exposed to combined TRAP and chronic stress, suggesting a possible link between these environmental factors and pulmonary health outcomes.

Electrophysiological Study of Haptic Stimulation: Implication for Cross-Modal Plasticity

Ruoyu Li
Sponsor: David Corina, Ph.D.
Linguistics

The neurophysiological theory of cross-modal plasticity (CMP) predicts the reallocation of unused brain structures to aid in the processing of active structures. In the case of congenitally deaf children, CMP has been shown to occur between the active visual cortex and inactive auditory cortex. Specifically, responses to visual stimuli were reported in the auditory cortex. The extent to which CMP is maladaptive and negatively affects future speech perception in developing children is controversial. Here we extend the investigation of CMP to the less-well studied somatosensory domain. Our pilot program explores somatosensory evoked potentials in adults in response to vibratory stimulation. Using an odd-ball paradigm we evaluate the mismatch-negativity response (MMN). The MMN is an electrophysiological brain potential that registers the occurrence of a wide class of stimuli (visual, auditory, haptic). We use an Arduino and vibratory coin motor setup to deliver haptic stimuli to the index and pinky finger of subjects and measure the magnitude of the MMN. Here we report preliminary results in typically hearing adults. Our long term plan is to use this paradigm to examine CMP in CI using children.

Computational Modeling to Investigate Cardiovascular Responses During Spacecraft Aerodynamic Re-Entry

Toby Li
Sponsor: Rich Whittle, Ph.D.
Mechanical & Aerospace Engr

Re-entry from Low-Earth Orbit presents a unique set of hypergravity conditions that act as stressors on the cardiovascular system. There is a risk that this orthostatic challenge may cause issues in injured/ill crewmembers. This research aims to simulate cardiovascular responses during the re-entry of the UC Davis Space Ambulance concept, based on a X-37B to incorporate a pressurized crew volume, selected for its flight heritage and entry, descent, and landing capabilities. Using an optimized re-entry trajectory based on lifted-body aerodynamics, the resultant force is derived on supine subjects over re-entry. Subsequently, the gravitational profile is applied to a model of the cardiovascular system in simulated subjects to determine the effect of re-entry on cardiovascular function. Results will inform the ergonomics and performance of the vehicle that could be used to extract injured/ill crewmembers. These results act as a baseline against which to compare the response in injured/ill crewmembers in order to determine critical medical constraints. Currently, no spacecraft cater to medical evacuation from the International Space Station or elsewhere. With the broadening demographic and risk profile of commercial spaceflight, there will be a requirement to evacuate patients from space in a more deliberate fashion than existing capabilities.

Macroautophagy and Selective Autophagy Work in Parallel Pathways to Regulate the Accumulation of Alpha-Synuclein

Trina Lim
Sponsor: Kenneth Kaplan, Ph.D.
Ag Molecular & Cellular Bio

A hallmark of neurodegenerative disease (ND) are deposits of toxic protein aggregates, e.g., alpha-synuclein forms inclusions in Parkinson's patients' brain samples. Autophagy, the process that targets damaged organelles and protein aggregates for degradation, has been proposed to be protective for ND progression. However, it is unclear if this protection involves bulk macroautophagy, or selective autophagy of specific organelles. Evidence in PD patients suggest that alpha-synuclein causes ER stress and may specifically affect the nuclear ER (nER). We hypothesize that proteotoxic stress caused by alpha-synuclein damages the ER and is specifically targeted by nER autophagy pathways. To test this hypothesis we expressed human alpha-synuclein in budding yeast with mutations that block either macroautophagy or selective autophagy at the nER. Specifically, we tested macroautophagy mutants that are essential for the formation of the autophagosome, the structure that transports alpha-synuclein for degradation. We also examined a mutant that selectively inhibits autophagy at the nER, a nuclear-vacuole junction protein. We monitored for the appearance of inclusions and clearance after shutting off alpha-synuclein expression. We observed that autophagy at the nER is critical for suppressing alpha-synuclein toxicity, which suggests that these autophagy pathways work in parallel, with selective autophagy exhibiting a more robust response.

LupBook: An Open Source Interactive Textbook Framework

Angelina Lim
Sponsor: Joel Porquet-Lupine, Ph.D.
Engr Computer Science

LupBook is an open source interactive textbook framework designed to enhance the teaching of programming languages through enabling readers to experiment with concepts in real-time as they learn them. Unlike existing platforms that rely on server-based code execution, LupBook operates entirely on the client's side, enabling offline usage. The project introduces a virtual machine, emulating a minimal RISC-V based system with a full but minimal Linux-based software stack. This approach allows code components within the interactive textbook to be executed locally, fostering a continuous learning experience. In this poster, our student team will present our contributions to the project which include: a set of new interactive components and navigational features. We've worked on various interactive components that improve the learning experience available for users. The development of multiple-choice questions, matching exercises and parsons exercises, ensure that book authors have flexibility in choosing question types for their specific needs. We've also added an improved user experience, created through the development of seamless navigation, integrating features such as a table of contents and settings bar, facilitating font adjustments and dark mode for enhanced readability. LupBook represents a significant advancement in interactive textbook technology, empowering educators to create engaging and customized learning experiences.

Investigating the Effects of Insulin-like Peptide 6 on Temperature Rhythms Induced Longevity

Katherine Lim
Sponsor: Fumika Hamada, Ph.D.
Neuro Physio & Behavior

Human body temperatures fluctuate throughout the day, playing a role in overall homeostatic regulation. This body temperature rhythm (BTR) is controlled by circadian clocks. We previously demonstrated that Drosophila (fruit flies) show similar BTR and regulatory mechanisms to mammals. The purpose of our research is to determine how BTR impacts longevity and which genes are involved in its regulation. We conducted a lifespan assay under several different temperature cycles and found that the wild-type flies housed in the incubator mimicking BTR (increase during the day and decrease during the night) lived longer than those in incubators with an inverse BTR (decrease during the day and increase during the night) or at a constant 25°C. Next, we performed lifespan experiments on insulin-like peptide 6 (*ilp6*) mutants and circadian clock mutants (*tim01*) to assess the importance of these genes on the lifespan of Drosophila. We discovered that *tim01* mutants showed similar life spans to the wild-type flies while all of the *ilp6* mutants lost their BTR-dependent longevity. These results suggest that BTR has an important role in longevity and that insulin signals help regulate BTR-dependent longevity, while circadian clocks may not.

Low-Cost Microfluidic Device for Single-Cell Isolation and Cloning

Kylie Lin
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

The Microfluidics Research Team in the BioInnovation Group is developing a low-cost microfluidic chip, known as a single-cell capture (SCC) device, to study heterogeneous cellular populations. We expect this device and methodology to enable the capture, cloning, and analysis of single cells from heterogeneous populations without the use of cell surface markers. Monoclonal cell lines cultured *on-chip* can then be extracted and studied in applications such as tissue regeneration. We based our initial device design on examples from literature that used photolithography to create masks for PDMS casting. However, the cost of photolithography limits access to these tools. We propose that common and affordable 3D printing technologies can be used as an alternative to photolithography to create SCC devices that will perform nearly as effectively. Our current device achieves a SCC rate of 35%, comparable to devices created using photolithography (60% capture rate) at 1% of the upfront cost. Our current focus is optimizing cell culturing and proliferation of various mammalian cell types to perform functional assays *on-chip*. Here we report the development of surface treatment techniques to promote growth and the design and testing of a 3D-printed container for environmental control.

Meeting Patients Where They Are: Improving Smoking Cessation Services for Patients Experiencing Homelessness at the Willow Clinic

Claire Lin
Sponsor: Loralyn Taylor, Ph.D.
MED: Public Health Sciences

People experiencing homelessness face many barriers that prevent them from successfully quitting or reducing smoking despite showing strong initial motivation. The Smoking Cessation program at the Willow Clinic, a UC Davis student-run free clinic, utilizes motivational interviewing and one-on-one consultations for unhoused patients in Sacramento to help them develop a smoke-free lifestyle catered to their values and needs. To guide this Quality Improvement study, the Plan-Do-Study-Act (PDSA) framework is utilized to identify gaps and determine the best course of action to improve the services we provide to our unhoused patients who smoke. In May 2023, a preliminary needs assessment (N=264) was performed to understand our patient demographics and evaluate patients who have been seen by our developing Smoking Cessation program. The study revealed that 56.8% (146) of our unhoused patients were active smokers, and 29.5% (28) of those surveyed indicated interest in the program. However, only 5 patients were able to be seen, indicating gaps in our services. Since then, clinical interventions such as tracking patients' progress and increasing awareness about our program during our outreach efforts have been implemented. Currently, the program is in the 'Study' phase to assess the effectiveness of the new interventions.

Examining the Effect of *MOS4-associated complex 3B* Nuclear Condensate Formation on Plant Circadian Rhythms

Abigail Lin
Sponsor: Stacey Harmer, Ph.D.
Ag Plant Biology

The circadian clock is a complex mechanism that regulates an organism's response to environmental cues, promoting adaptability and energy conservation. In plants, biological timing relies on many genes including *MOS4-associated complex 3B*(*MAC3B*)—one of the two homologs of human-derived *PRP19*—an evolutionarily conserved U-box E3 ubiquitin ligase. *MAC3B* is also involved in various other pathways including nuclear condensation, plant immunity, pre-RNA splicing, and DNA damage response. However, the links between these pathways remain unclear. Recent research showed a gain-of-function mutant *MAC3B*(Q77A/D81A) formed nuclear condensates in response to pathogen infection, activating defense gene expression in an immune activation response. In contrast, another mutant *MAC3B*(H31A/D34A) showed no gain-of-function phenotype. These results suggest that formation of nuclear condensates by *MAC3B* ligase affects immunity responses in Arabidopsis. Therefore, by comparing the circadian rhythms in Arabidopsis plants expressing wild-type *MAC3B*, *MAC3B* (Q77A/D81A), and *MAC3B* (H31A/D34A), we aim to determine whether nuclear condensation of *MAC3B* affects circadian rhythm. Understanding the significance of nuclear condensation in regulating circadian clock function will provide insight into the complex pathways that link plant immunity and rhythmicity.

Investigating Suppressed Colonial Growth of Tunicate *Botryllus schlosseri* in a Recirculating Aquaculture System (RAS)

Mandy Lin
Sponsor: Dietmar Kueltz, Ph.D.
Animal Science

Botryllus schlosseri is a species of colonial marine tunicate that can grow through asexual reproduction. Each week, adult individuals synchronously regress, and the next generation of zooids develop into place. The number of developed zooids is dependent on the health of the whole colony. Our lab currently uses two methods of *Botryllus* culture. One uses a recirculating aquaculture system (RAS) with constant flow between the animal housing tanks and the filtration system. The other method uses individual tanks in which the entire volume is replaced with fresh artificial seawater weekly. Colonies in the RAS experience lower rates of zooid growth compared to colonies reared in individual water tanks. To investigate whether water composition was causing this difference, twelve individual colonies were placed in separate jars to compare the two water sources. The water is replaced weekly, with six jars receiving fresh artificial seawater and the others receiving water from the RAS system. Water quality parameters are measured three times per week including temperature, salinity, pH, ammonia, nitrite, and nitrate. The extent of asexual budding and overall colony size will be quantified at the end of the experiment to determine which water source best supports *Botryllus* growth in a landlocked laboratory.

Social Media Empowerment for Small Businesses

Winnie Lin
Sponsor: Martin Hilbert, Ph.D.
Communication

In an increasingly digital world, specific demographics, particularly those unfamiliar with technology or non-native English speakers, face barriers in adapting to technological advancements and media integration in America. This project focuses on empowering small businesses within local communities, particularly those facing such challenges, by providing them with the knowledge, tools, and resources needed to employ social media for business growth effectively. Through surveys, interviews, and community engagement, the project identifies the preferred educational medium for these communities: video, pamphlet, or online module. The educational resource will offer easily digestible, concise information on each step of social media marketing, from content creation to optimizing posting schedules. A key objective is to ensure accessibility by translating the information into various languages and distributing it in a large variety of channels. By engaging in this initiative, small business owners will gain valuable strategies for enhancing their marketing efforts, increasing customer engagement, and boosting sales through social media platforms.

What's for Dinner? The Diet and Ecological Role of the Marine Dove Snail, *Alia carinata*

Sophia Lindemuth
Sponsor: Eric Sanford, Ph.D.
Evolution & Ecology

Seagrass beds are inhabited by many small gastropods and crustaceans, but the diet and ecological role of these consumers is often poorly known. The dove snail *Alia carinata* is a common marine gastropod occurring in low-intertidal surfgrass and eelgrass beds along the West Coast of Northern America. Prior literature suggests that this species is either a grazer on diatoms or a scavenger on decomposing material. However, recent observations at Bodega Marine Laboratory indicate that *Alia carinata* is capable of predation on egg capsules deposited on seagrass blades by other gastropod species. In this study, dove snails and their putative food sources were collected from two field sites in the Bodega Bay region and a controlled feeding experiment conducted to determine the extent to which this species may be preying on gastropod embryos. We used both bulk and amino acid compound-specific stable isotope analysis of carbon and nitrogen from dove snails and their food sources to elucidate whether *Alia carinata* may be an important and unrecognized predator on gastropod egg capsules. The results of this study will help advance our understanding of the ecological role of small gastropods in seagrass ecosystems.

Restoration of Choline Acetyltransferase in Mice via AAV9-mediated Gene Therapy

Kyley Linn
Sponsor: Ricardo Maselli, M.D.
MED: Neurology

Congenital myasthenic syndromes (CMS) are disorders characterized by muscle weakness and fatigability. One CMS variant results from deficiency of the enzyme choline acetyltransferase (ChAT), which catalyzes the synthesis of acetylcholine at cholinergic synapses and at the neuromuscular junction. We used a conditional knock out model consisting of LoxP sites flanking Chat exons 4 and 5, and Cre-recombination activated by the estrogen agonist Tamoxifen (Tx). Mutant mice injected with Tx at P11 developed progressive weakness and with rare exceptions all died. We hypothesized that injecting an adeno-associated virus type 9 (AAV9) carrying human CHAT (AAV9-CHAT) at P28 would rescue this lethal phenotype. This was experimentally confirmed as 5 out of 5 mice injected with AAV9-CHAT survived while 13 out of 14 mice not injected mice died. Immunohistochemistry showed severe reduction of Chat expression in spinal motor neurons of mutants but almost complete restoration of expression in AAV9-injected mice. RT-qPCR demonstrated only mild reduction of Chat RNA in mutant mice, consistent with the interpretation that the impaired protein expression resulted primarily from an early termination codon induced by the LoxP recombination. Histopathological analysis showed no adverse effects. Thus, AAV9-mediated gene therapy may be effective and safe for treating humans affected with ChAT-CMS.

The Impact of Maternal ACE Scores and Positive Parenting on Child Behavioral Problems

Brooke Linow
Sponsor: Daniel Choe, Ph.D.
Human Ecology

Greater adverse childhood experiences (ACE) relate to greater dysregulation in adulthood. This dysregulation can impact individuals' parenting and increase the risk of behavior problems in their children. This study examines the relationships between mothers' self-reported ACE scores, their parenting, and their young children's behavior problems. Mothers (N = 149; M_{age} = 32.12 years) with an annual household income of less than $50,000 and children between ages 1.5 and 5 years old and were recruited nationwide via Amazon Mechanical Turk (MTurk) and administered an online survey that included a demographics questionnaire, Child Behavior Checklist (CBCL), Parent Behavior Checklist (PBC), and a mothers' ACE questionnaire. We hypothesized that greater maternal ACE scores would relate to greater children's behavior problems and greater positive parenting scores would relate to lower children's behavior problems. Preliminary analyses found a significant positive correlation between mothers' ACE score (α = .83) and children's total behavior problems, $r(149) = .21$, $p < 0.05$. Additionally, positive parenting (alpha = .85) was negatively correlated with children's total behavior problems, $r(149) = -.21$, $p < 0.05$. For future analyses, we will examine whether mothers' ACE scores predict children's total behavior problems and if this relationship depends on mother's positive parenting practices.

Comparison of Abdominal Pigmentation in *Drosophila* Species Reveals Thermal Plasticity of Dominance Relationship Between Phenotypes

Jingqi Liu
Sponsor: Artyom Kopp, Ph.D.
Ag Evolution & Ecology

Abdominal pigmentation in *Drosophila* evolves very fast and can be a model trait for studying the genetic basis of phenotypic evolution. The abdominal color scheme consists of a mixture of light and dark pigments. The environmental factors such as temperature change theproportion of dark-to-light pigments in their abdomen sections. Therefore, comparing thermal plasticity of abdominal pigmentation patterns between multiple species contributes to understanding the developmental mechanisms for evolution of patterns. In our study, we used 4 species: *D. burlai*, *D. bocqueti*, *D. jambulina*, and *D. serrata*. These species show color dimorphisms in abdomens (“Dark” and “Light” phenotypes). We reared homozygotes and heterozygotes of those species under temperatures of 17, 20, 23, and 26 degrees Celsius. We then scored the ratio of dark to light pigments in their abdominal sections based on the criteria in David et. al. 1990. By comparing the scores, we are able to conclude that some species show thermal-dependent dominance and recessiveness of the phenotypes of "Dark” and "Light”abdominal pigmentation.

Machine Learning Pipeline for Gene Biomarkers in Stroke Diagnosis

Joanne Liu
Sponsor: Paulina Carmona-Mora, Ph.D.
MED: Neurology

Stroke diagnosis has long been a challenging process, most evident in highly time-sensitive settings like the emergency department. To support accurate diagnosis, this project will develop a machine learning model that leverages patient blood samples to identify relationships between patterns in gene expression and diagnosis. We studied 121 patients with stroke mimics (i.e., migraine), 145 stroke patients, and 133 controls with no acute brain event. Using the R package MatchIt, we balanced the three diagnosis groups by matching patients across the following covariates: age, sex, diabetes, hypertension, and hypercholesterolemia. To assess similarity between the three groups, we ran t-tests and Fisher’s tests and found no significant differences in age or relationships between diagnosis and all of the covariates of interest. Afterward, we split the patients into derivation and validation cohorts that will be used to conduct differential expression analyses that will highlight the most prominent genes in these cohorts. These genes will then be fed into a machine learning model that will identify the genes that best predict diagnosis. These genes represent an important diagnostic tool, particularly in the case of stroke mimics, where a differential diagnosis is critical for patient discharge.

Evaluation of morphological variation across deep genetic breaks in the California turret spider (Mygalomorphae, Antrodiaetidae, *Atypoides riversi*)

Kaitai Liu
Sponsor: Jason Bond, Ph.D.
Entomology/Nematology

California is a biodiversity hot spot with high endemicity and diversity, reflecting its complex geography and climate. Species delimitation is an important first step to understanding California's biodiversity and documenting species for conservation purposes. Developments in evolutionary genetics and its application in systematics have revealed that many species are divided into multiple genetic groups or even multiple cryptic species. *Atypoides riversi*, commonly known as the California turret spider, is a mygalomorph spider in the family Antrodiaetidae that is endemic to northern and central California. Phylogeographic studies show *A. riversi* are separated into multiple parapatric and allopatrically distributed populations. The deep genetically divergent groups indicate that *Atypoides riversi* is a species complex. However, morphological divergence within this group needs re-evaluation. In this study, we generate new somatic morphological data from female specimens from different populations. We apply multivariate analyses to a continuous variable dataset to evaluate morphological divergence in light of the species tree. We also compare male secondary-sex characters, which evolve more rapidly than somatic characters in spiders, for possible diagnostic features. We use these data to delimit species and reveal possible mechanisms of speciation.

Flow Management: How Sacramento-San Joaquin Delta Outflow Influence Non-Native Submersed Aquatic Vegetation Abundance and Distribution

Yuexuan Liu
Sponsor: John Durand, Ph.D.
Center For Watershed Sciences

Submersed aquatic vegetation (SAV) is substantial component of the Sacramento-San Joaquin Delta ecosystem. Non-native SAV negatively affects the Delta ecosystem by competing with native plants and phytoplankton, providing habitat for non-native invertebrates and fishes, reducing turbidity, and clogging waterways. To conserve ecosystem services and native aquatic assemblages of the Delta, it is important to study factors that could influence the spread of non-native weeds for future management. Sacramento-San Joaquin Delta outflow is expected to influence the abundance and distribution of non-native SAV by washing plants downstream during high flows, but this effect has not been observed in past studies. I will analyze the effect of outflow on weed distribution using monthly weed volume data collected from trawls in the North Delta over the past 10 years and comparing them with average monthly Delta outflows. We predict that months with high average outflows will decrease non-native SAV abundance. Our findings could inform environmental flow management decisions that aim to control non-native SAV.

Does XAP5 CIRCADIAN TIMEKEEPER Control the Plant Circadian Clock Via Regulation of Evening Complex Activity?

Zhe Liu
Sponsor: Stacey Harmer, Ph.D.
Ag Plant Biology

The circadian clock synchronizes physiological processes with diurnal cycles, allowing plants to anticipate and optimize their responses to environmental changes. The Arabidopsis circadian clock comprises multiple transcriptional-translational feedback loops (TTFLs). One key transcriptional regulator is the Evening Complex (EC), which suppresses the transcription of the morning-expressed clock gene *PSEUDO-RESPONSE REGULATOR 9 (PRR9)* by binding to its promoter. Our lab previously identified XAP5 CIRCADIAN TIMEKEEPER (XCT) as another regulator of the circadian clock, but how it acts within the TTFLs is unclear. Interestingly, we observed a prominent increase in *PRR9* expression and a reduction in EC binding to *PRR9* promoter region in an *xct-2* mutant. Therefore, we hypothesized that XCT may normally inhibit *PRR9* expression by promoting the inhibitory effect of the EC on *PRR9* transcription. We plan to test this by suppressing EC activity by subjecting plants to a short light pulse at night and then comparing *PRR9* expression levels. If the treatment does not significantly increase the *PRR9* expression in *xct* mutants, this would suggest that the EC activity in *xct* is already suppressed before the light pulse. The result of this study will provide a better understanding of the roles of *xct-2* within the circadian system.

TRIM37 is a Genetic Determinant of TNBC-associated Racial Disparity

Kammi Liu
Sponsor: Sanchita Bhatnagar, Ph.D.
MED: Medical Microbiology & Imm

The incidence of Triple Negative Breast Cancer (TNBC) is disproportionately higher in African American women compared to other races, signifying the existence of a racial disparity. In both early and advanced stages of TNBC diagnosis in AA women, an aggressive tumor phenotype is a characteristic feature. Consequently, a 5-year survival rate for TNBC in AA patients is only 14% compared to 36% in non-African American women. Although racial disparities in treatment, comorbidity, and access to health care contribute to this poor prognosis, a race-specific biological component to TNBC disparity cannot be ruled out. Our lab has previously identified and characterized TRIM37, a tripartite containing motif protein 37, as a breast cancer oncoprotein and metastatic driver. Further preliminary genomic investigations in our research suggest a genetic link between TRIM37 and AA ethnicity. Through *in vitro* assays, we find that high levels of TRIM37 in AA cellular models accelerates the tumorigenesis trajectory.

Electrophysiological Study of Haptic Stimulation: Implication for Cross-Modal Plasticity

Timothy Liu
Sponsor: David Corina, Ph.D.
Linguistics

The neurophysiological theory of cross-modal plasticity (CMP) predicts the reallocation of unused brain structures to aid in the processing of active structures. In the case of congenitally deaf children, CMP has been shown to occur between the active visual cortex and inactive auditory cortex. Specifically, responses to visual stimuli were reported in the auditory cortex. The extent to which CMP is maladaptive and negatively affects future speech perception in developing children is controversial. Here we extend the investigation of CMP to the less-well studied somatosensory domain. Our pilot program explores somatosensory evoked potentials in adults in response to vibratory stimulation. Using an odd-ball paradigm we evaluate the mismatch-negativity response (MMN). The MMN is an electrophysiological brain potential that registers the occurrence of a wide class of stimuli (visual, auditory, haptic). We use an Arduino and vibratory coin motor setup to deliver haptic stimuli to the index and pinky finger of subjects and measure the magnitude of the MMN. Here we report preliminary results in typically hearing adults. Our long term plan is to use this paradigm to examine CMP in CI using children.

Investigation on BET Inhibition Enhancing Autophagic Flux and Autophagy-dependent Cell Death in *Atm*-deficient Pancreatic Cancer

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

Pancreatic ductal adenocarcinoma (PDAC) is the third leading cause of cancer-related death in the U.S. and has a 13% five-year survival rate. Among total cases, 10% of PDAC are hereditary and categorized as familial pancreatic cancer (FPC). Some FPC patients carry germline mutations of genes involved in DNA repair pathways (e.g., *BRCA2*, *ATM, BUB1B*). *Brca2*-deficient pancreatic cancer has been shown to be more sensitive to Bromodomain and Extraterminal Motif inhibitors (BETi) (e.g., JQ1) through enhanced autophagic flux. This study raises a possibility that other FPC-gene deficient PDAC (e.g., *ATM*) can be sensitive to BETi through autophagy-dependent cell death. Indeed, *Atm*-deficient PDAC cells are more sensitive to BETi compared to the control cells. Immunofluorescence staining of the autophagy marker LC3 has revealed that *Atm*-deficient PDAC cells display higher expression of LC3, which is further augmented by JQ1. In the future, the autophagy-dependency of the cell death will be verified by knocking down ATG proteins which are responsible for autophagosome formation. This may suggest that other FPC-gene-deficient cancer cell lines also render this unique sensitivity to BETi, and BET inhibition can be a personalized therapeutic strategy for FPC-gene-deficient PDAC.

Web-Accessible Life-Threatening Diagnostic Test Results for Urgent Clinician Notification

Janet Yue Liu
Sponsor: Gerald Kost, M.D.,Ph.D.
MED: Pathology & Lab Medicine

This research aimed to examine critical limits and values available on the World Wide Web, assess drift in quantitative low/high thresholds since 1990-93, streamline urgent notification practices, and promote global accessibility. We identified Web-posted lists of critical limits/values at university hospitals. We compared 2023 to 1990-93 archived notification thresholds. We found critical notification lists for 26 university hospitals. The median number of tests was 62 (range 21-116). The breadth of listings increased. Statistically significant differences in 2023 versus 1990 critical limits were observed for blood gas (pO_2, pCO_2), chemistry (glucose, calcium, magnesium), and hematology (hemoglobin, platelets, PTT, WBC) tests, and for newborn glucose, potassium, pO_2, and hematocrit. Fourteen hospitals listed troponin measurements. Qualitative critical values expanded across disciplines. Bioterrorism agents, contagious pathogens, and pathology were listed frequently, although only three hospitals listed COVID-19. Only one notification lists detailed point-of-care tests. Urgent notifications should prioritize life-threatening conditions. We recommend that hospital staff evaluate drift over the past three decades for clinical impact. Notification lists expanded, especially qualitative tests, suggesting that automation might improve efficiency. Sharing notification lists and policies on the Web will improve accessibility and harmonization of urgent notification and critical care practices in the 21st Century.

Effects of Diet on Body Shape Evolution in Reef Fishes

Shih-Na Liu
Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

Disentangling the determinants of phenotypic diversity and their respective contributions is key to understanding the mechanisms that shape patterns of diversity across the tree of life. Among reef fishes, diet influences lineage diversification, as it underpins numerous crucial biotic interactions. We build on these insights by exploring the impact of diet on the evolution of body shape. Using phylogenetic methods, we compared average body shape, morphological disparity, rates of evolution, and patterns of dietary transitions across 1,706 species of reef fishes grouped into 7 diet categories. We found that long and slender forms are unique to generalized carnivores, mobile invertivores, and planktivores, while groups that feed by biting, including herbivores, sessile invertivores, and durophagous invertivores tend to have laterally compressed, deep bodies. Diet groups also differ in evolutionary rates, but the variation in body shape disparity is mainly driven by evolutionary time. Interestingly, planktivores exhibited the highest disparity despite not being exceptional in evolutionary time or rate, alluding to the effect of frequent transitions from diverse lineages. These findings highlight the complex interplay between transitions between diets, morphological adaptation to those diets, and time in shaping patterns of body shape diversity in reef fishes.

Analysis of Previous Cardiopulmonary Clinic Data to Improve Patient Cardiopulmonary Healthcare Services

Alexandria Long
Sponsor: Ronald Jan, M.D.
MED: Surgery

Cardiovascular and pulmonary diseases are prominent health problems in underserved communities due to limited access to proper healthcare, language barriers, financial difficulties, and being uninsured. The Cardiopulmonary Committee of Paul Hom Asian Clinic was founded in 2015 to provide free cardiopulmonary assessments to those in the underserved community. This project aims to improve the health monitoring progress and treatments of patients enrolled in Cardiopulmonary Specialty Clinic through use of an established database. Data was gathered from patients' lab tests between 2015 and 2022 and averages were generated from patients entering our specialty clinic per year. Patient entries (n=102) consist of ages ranging from 17 to 77 years old. 68 patients were male and 34 were female. Findings indicate slightly elevated mean LDL and above-normal mean HDL among patients. Additionally, higher-than-normal fasting glucose and elevated BMI values in Asian patients raise concerns about potential cardiovascular and pulmonary risks. The database will permit improved patient follow-ups, monitoring of health progress, and potential interventions to address recognized health indicators; furthermore, the demographic and vitals data can be used to identify future cardiopulmonary patients at the clinic.

Learning Algorithms in Basic Neuroscience: Decoding the Contents of Attention.

Sebastian Lopez
Sponsor: Steven Luck, Ph.D.
Psychology

Electroencephalogram (EEG) recordings provide neuroscience with essential information about perceptual and cognitive processes. Previous studies explored decoding of neural activity during the delay periods of working memory tasks, using the pattern of EEG voltage on the scalp to "decode" which orientations are actively held in working memory. The present study uses a similar decoding approach to ask how attention influences the information about simple letters when the visual system is overloaded by fast rates of presentation. We hypothesize that the brain will extract more information from attended sensory inputs than unattended sensory inputs. This should make it possible to decode which letter the participant is perceiving more accurately when the letter is attended to rather than ignored. Subjects were asked to pay attention to letters drawn in their target color and to press a button when the current target letter had the same shape as the previous target letter. Decoding analyses used support vector machines with error-correcting-output codes. Results show that the average decoding accuracy of the letter identity was greater when the letter was drawn in the attended color than the unattended color, consistent with our hypothesis. These results indicate that attention strengthened the representation of shape information.

Visualizing Illegality and Deportation: Affect in The New York Times

Christopher Lopez
Sponsor: Alan Pelaez Lopez, Ph.D.
Chicano Studies

In 2011, a record-breaking 400,000 undocumented individuals were deported from the U.S. under President Barack Obama's administration. Numerous news outlets reported on Obama's immigration policies and Homeland Security's enforcement of "civil immigration guidelines." This research presentation focuses on the New York Times' (NYT) depiction of migrant illegality. The research collects and analyzes photographs published in the print-edition of the NYT in 2011 to understand how illegality and deportation are visually represented. In centering an analysis of the visual aspect of illegality in the NYT, I hope to answer how visuals influence the way readers understand, perceive, and/or relate to (or push back against) "illegal immigrants." This research argues that visuals have been under-studied in migration studies and that every visual printed by the NYT has a story to tell that informs how we (citizens and noncitizens) perceive both "national security" and the racialized bodies inside the nation.

Identifying Potential Genetic Loci Associated with Phenology in Pistacia

Megan Lorenc
Sponsor: John Monroe, Ph.D.
Plant Sciences

Nuts are one of the most climate efficient sources of protein, contributing over 150 times less greenhouse gas emissions than the same amount of beef protein. Pistachio is positioned as a promising protein alternative for future climate scenarios as it is drought and salt tolerant and a complete protein. While pistachio is an encouraging crop for protein production, it must meet a chill requirement to flower and produce fruit. Amidst the challenges of a changing climate, a continued decline in chill hours has been observed. While one species of pistachio (Pistacia vera) dominates commercial cultivation, there is variation in required chill hours amongcultivars. Additionally, species within Pistacia are readily hybridized, and the genus displays large variation in chillingrequirement. By utilizing a diversity panel consisting of eleven species and various interspecific hybrids maintained at the Wolfskill Experimental Orchards we aim to identify regions of the genome associated with phenology. We have performed Illumina whole genome sequencing on 155 individuals and are currently using phenotypic data on phenology to identifygenomic regions associated with chilling requirement. This work will inform future research into the genetic control of chilling requirement in Pistacia.

Regional Differences in Tight Junction Proteins and Gliosis in the Transgenic TgF344-AD Rat Model of Alzheimer's Disease

Marielle Lorenzo
Sponsor: Pamela Lein, Ph.D.
VM: Molecular Bio Sciences

Tight junctions (TJ) are integral components of the blood-brain barrier (BBB) that regulate the movement of molecules between the blood and brain parenchyma. BBB dysfunction is thought to be involved in the pathogenesis of Alzheimer's disease (AD) by promoting neuroinflammation and neurodegeneration. The TgF344-AD rat, which expresses two human genes that confer AD risk, recapitulates the progression of AD-related neuropathology observed in humans. However, BBB changes have not been rigorously characterized in this model. To address this data gap, we analyzed regional differences in TJ proteins in the TgF344-AD rat versus sex- and age-matched wild-type (WT) rats. Key TJ proteins, claudin-5 and occludin, were assessed in the entorhinal cortex and hippocampus using quantitative immunohistochemistry. In addition, we measured amyloid deposition and astrogliosis as detected using OC and glial fibrillary acidic protein (GFAP) immunoreactivity, respectively. Decreased expression of claudin-5 and occludin, increased amyloid deposition and increased astrogliosis were observed in TgF344-AD compared to WT animals (n=5) at 10 and 15 months. This is consistent with observations of human AD.

Presence of Glial Scars in a Rat Model of Acute Organophosphate Intoxication

Melody Lou
Sponsor: Pamela Lein, Ph.D.
VM: Molecular Bio Sciences

Acute organophosphate (OP) intoxication leads to a cholinergic toxidrome that can progress to life-threatening status epilepticus and respiratory failure. While glial scars are often associated with acute brain injury and create an unfavorable milieu for neuronal function and axonal regeneration, they have not been well characterized following acute OP intoxication. Our goal was to identify the spatial and temporal patterns of glial scars in a rat model of acute intoxication with the OP, diisopropylfluorophosphate (DFP). Adult Sprague-Dawley rats were dosed with DFP followed by standard-of-care procedures. The brain was collected at 1, 3, 7, 14, and 28 days post-DFP exposure, and glial scars were detected using immunohistochemical staining for astrocytes. Of 83 rats exposed to DFP, 43 (51.8%) presented glial scar formation, 26 being males and 17 females. Seven males and eight females (18.1%) showed inconclusive signs of glial scarring. No significant difference in glial scar frequency was detected between sexes ($P>0.05$). Despite higher counts of rats with glial scars at 3, 7, and 14 DPE, there was also no statistical difference among time-points ($P>0.05$). Further analyses including other histological markers will assist with a better structural and temporal characterization of glial scar formation following acute OP intoxication.

The role of Kif26 unconventional kinesin family in neurodevelopment and neurological disorders

Kayla Louie
Sponsor: Henry Ho, Ph.D.
MED: Cell Biology & Human Anat

Brain development is a complex process involving the coordinated actions of many molecules and cellular processes. The Kif26a and Kif26b genes encode a family of unconventional kinesin with a growing role in neurodevelopment. Mutations in Kif26a and Kif26b were recently identified in human patients affected by a wide variety of brain malformation phenotypes. However, the mechanisms by which the Kif26 family regulates neurodevelopment remains enigmatic. To explore this further, our lab generated knockout mice lacking both Kif26a and Kif26b, and my project concerns the analysis of brain phenotypes in these mice. By sectioning embryonic day 18.5 mutant brains and L1-CAM immunostaining, we observed a reduction or loss of major axon tracts such as the anterior commissure and internal capsule, suggesting that the Kif26 family plays an important role in axonal outgrowth and guidance. Additional neurodevelopmental phenotypes included cortical layer thinning indicative of neuronal migration defects; however, more in-depth analysis is required. Future experiments will include neurofilament staining to observe axon tracts, in utero electroporation for mosaic mutant analysis, and LacZ reporter stains to determine spatiotemporal expression of Kif26a/b during nervous system development, delineating the specific neuronal processes and behaviors affected by the loss of the Kif26 family.

Reinforcing High-Effort Task Selection Through Reward Intervention

Zoya Low
Sponsor: Yuko Munakata, Ph.D.
Psychology

In school, children are presented with challenging tasks and easier tasks. Although easier tasks may lead to better performance and challenging tasks may lead to worse performance, challenging tasks present more learning outcomes and can strengthen mental fortitude. The current study investigates whether children's preferences for high- versus low-effort cognitive tasks can be influenced by rewards contingent upon their performance and task choices. 60 9- to 12-year-old children were presented with a series of computer games in which they were given the choice of a high- or low-effort cognitive task. Participants were rewarded for either better performance, selecting the high-effort task, or a randomly as a control. We predict that children will initially select the low-effort task associated with better performance more frequently; however, we predict that the introduction of reward for picking the high-effort task will alter the aversiveness of lower performance, resulting in more selection of high-effort tasks even when reward is not offered. This outcome would suggest that children's choices can be intervened with to encourage the habit of selecting high-effort tasks, regardless of performance. Findings will have implications for curriculum development and academic reward strategies of middle school aged children.

Using *Kluyveromyces lactis* To Express bovine Casein Protein for Vegan Cheese Production

Emily Lowe
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

Dairy cows are the third-largest producers of greenhouse gases in the food industry. In response to these environmental concerns, interest in milk alternatives has increased in recent years. While plant-based milks have been commercially successful, vegan cheeses have gained a somewhat poor reputation among consumers. Many plant-based cheeses have a low protein content, and lack the characteristic stretch and mouthfeel that consumers expect with traditional dairy-based cheeses. While there are cheeses that utilize plant-based proteins and have a more cheese-like texture, they often fail to replicate the taste of the cheese they are attempting to emulate. Our research focuses on using the yeast *Kluyveromyces lactis* to synthesize four different bovine casein proteins which, when combined with other components, can be used to make a vegan cheese that resembles real cheese in both texture and taste. We are currently investigating modes of protein expression and several purification methods, and their impact on cost and yield. Additionally, we are also evaluating the manufacturing costs for an eventual product, which involves sourcing the other components for our vegan cheese and researching different cheese varieties in order to select a cost-effective product to make.

Developing a Measurement Algorithm to Characterize Meiotic Prophase-I Chromosomes

Tianhong Lu
Sponsor: Fushing Hsieh, Ph.D.
Statistics

Accurate measurement of chromosome length and quantification of immunostaining foci of recombination factors are standard tools for understanding chromosome metabolism during meiotic prophase-I. Traditional manual measurements are labor intensive, and prone to subjective interpretation, variability, and bias among researchers. In this study, we developed a Python-based algorithm to obtain more precise, unbiased measurements. We used images from mouse prophase I spermatocytes, particularly focusing on the pachytene stage. Images of mouse spermatocyte nuclei immunostained for a chromosome axis marker, SYCP3, and a crossover recombination marker, MLH1, were employed to develop our algorithm with the goals of enhanced precision and automated analysis, thereby minimizing human error and bias. We employed major machine learning algorithms including color histogram, K-means clustering, principle component and Gaussian mixture model. Preliminary results demonstrate that measurements derived using our algorithm closely align with those obtained using ImageJ, and indicate high accuracy and reliability for quantifying chromosome axis length and focal counts. This study not only highlights the potential of advanced Python-based algorithms to refine analysis of meiotic chromosomes by reducing human error and bias, but also opens up avenues for more precise and automated analysis of chromosome dynamics in general, setting new standards for the field.

Domestication in Maize and its Wild Progenitor Analyzed in Genome-Wide Selection Scan

Hana Lubin
Sponsor: Jeffrey Ross Ibarra, Ph.D.
Ag Evolution & Ecology

Domestication is a transformative process that has dramatically increased the prevalence of particular traits in organisms by cultivation. Identifying signals of selection is important to understanding how domestication shaped the maize genome. Other studies have done selection scans with maize, but by using newly updated genomic data of 240 Mexican traditional varieties (*Zea mays* subsp. *mays*) in comparison to 70 of its wild relative, *Zea mays* subsp. *parviglumis*, we can explore more sites of selection that are indicative of domestication traits. I used the software *selscan* to analyze genomic data for signatures of selection. The software detects patterns of variation as a signal of selection. The signals are sites with low genetic diversity along with the frequency of alleles and their linkage. I anticipate this approach will provide a more comprehensive analysis of the genetic data by comparing multiple statistics with a larger sample size. The results from this study will be added to the MaizeGBD, a community database for Maize Genetics and Genomics. The updated track will allow researchers to see if a specific gene has gone through selection during domestication.

Influence of Auxin and Cytokinin on Growth in Dryland Moss *Syntrichia caninervis* Brid

Ivan Lujan
Sponsor: Siobhan Brady, Ph.D.
Plant Biology

Hormones play a crucial role as signaling molecules that regulate various aspects of a plant's life—reproduction, life expectancy, and growth development. While the use and effect of these regulators on plant development is well-known in seed plants, little research has been conducted on mosses. The moss *S. caninervis* is a crucial element of biocrust in the world's driest ecosystems providing soil stability, preventing soil desiccation, and erosion. Unique morphological traits of this moss explain partly its influence on the dynamics of hydrological properties in deserts, yet it's unknown how these traits form in a moss lifespan. This project aims to study the effects of hormones Auxin (NAA:0-2500nM) and Cytokinin (BAP:0-250nM) on the development of water-related traits in *S. caninervis*. Use of traditional anatomical and morphological measurements (i.e., laminar cell size and hairpoint length) of the leaf as well as novel microscopic techniques will be utilized to understand the role of auxin and cytokinin in the development of critical traits that allow *S. caninervis* to thrive in the desert. This research will provide insight on how this little organism develops throughout its lifespan and contributes essential ecological services in desert ecosystems.

A Systematic Comparison of the Use of Neighborhood-Level Indices in Place-Based Policies in the United States

Kayla Lujan
Sponsor: Noli Brazil, Ph.D.
Human Ecology

In response to growing evidence that neighborhood conditions influence individual well-being, researchers, policymakers, and practitioners have developed an assortment of neighborhood-level indices measuring opportunity and disadvantage. As new indices continue to be developed and released, the question becomes whether these indices differ in meaningful ways that would elicit their continued creation. In particular, how these indices are being used in policy and intervention has yet to be examined. This is important to understand considering that a primary motivation underlying the creation of these indices is to help practitioners target areas for funding and program intervention. This project fills this gap by examining how policy, funding, and program interventions in the United States develop, select, and use neighborhood-level indices. Employing a systematic scoping review, we identified 22 neighborhood-level indices that have been used for specific policy, funding, or support program initiatives. We compare the type of intervention covered by each program, including COVID-19 support, financial assistance, and educational or individual-level wellness programs, how agencies developed or selected an index, and how it is used to deploy interventions. We plan on conducting spatial analyses to understand the degree to which the indices geographically overlap in their identification of neighborhoods high in disadvantage.

Rat Primary Cortical Cell Tri-Culture to Study Microglial Motility Under Amyloid-Beta Exposure

Luis Luna
Sponsor: Erkin Seker, Ph.D.
Elect & Comp Engr

The aim of this research project is to investigate the potential effects of FITC-tagged amyloid-beta (FITC-Aβ) on microglia motility using a tri-culture of rat cortical neurons, astrocytes, and microglia. Microglia are the resident macrophages in the brain that clear debris and participate in synaptic pruning. It is hypothesized that misfolded Aβ peptides play a role in the etiology of Alzheimer's Disease (AD). The aggregation and accumulation of Aβ peptides may modulate microglia motility and impact its phagocytic clearance effectiveness. The reduction in microglia motility can be attributed to soluble factors and cell contact-mediated cues that guide microglia to regions with higher Aβ content and promote phagocytic clearance of the particles. Here, we used live cell imaging of microglia with and without Aβ exposure, and conducted image analysis to extract microglia motility parameters. The results from this research project are expected to be a path towards creating a microglia motility-based model of AD for further mechanistic studies and screening applications.

Comparison of Asexual Growth Rate in *Botryllus schlosseri* Fed Live Feed Versus Commercial Feed

Brenda Luu
Sponsor: Dietmar Kueltz, Ph.D.
Animal Science

Botryllus schlosseri, a colonial marine tunicate, is an emerging model organism for studying aging, self-recognition, and stem cell regeneration. Maintaining healthy tunicate colonies in a controlled lab setting is essential to support research such as the development of an immortal cell line. To optimize the rearing conditions for maximum colonial growth, this experiment focuses on the comparison of two different diets: commercially available feed versus a live diet consisting of four marine microalgae strains (*Nannochloropsis*, *Tetraselmis*, *Isochrysis*, and *Dunaliella* species) and rotifers (*Brachionus plicatilis*). To normalize the difference between the two diets in nutritional quantities, I performed a BCA assay to quantify each diet's protein density and determined the volume necessary to provide an equal amount of protein for each diet. Three clonal lines of tunicates were selected for the experiment. Individuals from each clone were randomly assigned to be fed either live feed or commercial feed. Variables measured were asexual growth rate, sexual reproduction potential, ampullae health, and contamination. Results show that live-feed tunicates had a significantly higher asexual reproduction rate compared to commercial-fed tunicates. There was no difference in ampullae health or contamination.

Examining the Interaction Between Sensory Proprioceptive Signaling and Muscle Fiber Composition

Yanki Ma
Sponsor: Theanne Griffith, Ph.D.
MED: Physiology & Membrane Biol

Proprioception is a critical sensation involved in detecting muscle movement to provide sensory feedback during voluntary motor tasks and motor reflexes. Proprioceptors are a subpopulation of peripheral sensory neurons that encode muscle movement and force to initiate proprioceptive signaling. Like all neurons, proprioceptor electrical activity is mediated by voltage-gated sodium channels (Na_Vs). Our lab has discovered loss of either the $Na_V1.1$ or $Na_V1.6$ isoforms selectively in sensory neurons results in moderately and severely impaired proprioception, respectively, at both the cellular and behavioral levels. Ongoing collaborative experiments show that intrinsic muscle properties are altered in mice lacking $Na_V1.6$ in proprioceptors, while remaining unaltered in mice lacking $Na_V1.1$ in these cells. Thus, we are testing the hypothesis that this is due to changes in the proportion of slow-twitch (Type I) and fast-twitch (Type II) fibers. To accomplish this, we are performing muscle fiber typing experiments using immunohistochemistry and confocal imaging in our two models of impaired proprioception. Results from these experiments will enhance our understanding of how impaired proprioception affects muscle fiber composition and therefore will provide critical insight as to how sensory feedback shapes muscle development and function.

Contaminant Concentrations and Detections as a Function of Delta Outflow

Cecilia Ma Li
Sponsor: Bruce Hammock, Ph.D.
VM: Anat Physio & Cell Biology

The Sacramento-San Joaquin River Delta, part of California's largest watershed, converges with the Pacific Ocean in the San Francisco Estuary. Pelagic fish populations in the Delta crashed from the late 1960s to 1990, with a subsequent decline to about 1/90th of their late 1960s levels by 2015, a trend that persists. Multiple factors, including food limitation, collapsing pelagic food webs, decreasing turbidity, and contaminants, are attributed to the decline, forming the Multiple Stressor Hypothesis. This project focuses on the contaminant aspect, examining its relationship with outflow. Data spanning the past decade from the Sacramento-San Joaquin River Delta, sourced from the USGS and CEDEN, will be analyzed alongside Dayflow information, combined into a relational database. Through this, we aim to model contaminant classes' response to outflow to address four main questions: 1) How does outflow affect concentrations and detections of each contaminant class?; 2) Do different contaminant classes respond differently to outflow?; 3) What is the functional relationship between flow and contaminant concentrations?; and 4) How do antecedent conditions influence contaminant concentrations and detections (e.g., 'first flush')? The outcomes of this research will guide conservation and restoration strategies to protect and revitalize the habitats of endemic fishes.

Muscle Stem Cell Population in Cerebral Palsy

Lizbeth Macias De La Torre
Sponsor: Lucas Smith, Ph.D.
MED: Physical Medicine & Rehab

Cerebral palsy (CP) is a neurological condition affecting movement and muscle tone, often characterized by contractures, or shortened and rigid muscles. Muscle satellite cells (MuSCs) are stem cells that are vital for muscle tissue growth and repair. Fibro-adipogenic progenitors (FAPs) are stem cells that deposit the extracellular matrix (ECM) and facilitate the regeneration of muscle tissue, though an excess accumulation of ECM results in fibrosis and the stiffening of muscle. The contractures present in CP may affect the quantities of MuSCs and FAPs compared to typically developing (TD) muscle. In this study, our focus lies on examining and comparing the populations of MuSCs and FAPs in CP and TD muscle. We hypothesized that there would be a decrease in MuSCs and an increase in FAPs in CP muscle compared to TD muscle. To explore this, we stained cryosections of CP and TD muscle with Pax7 and PDGFRα, which are markers that help locate and identify the MuSCs and FAPs on muscle, respectively. This study could provide insight into possible stem cell targets for treatment of the contractures present in individuals with CP.

The Clavibacter Code: Deciphering Pathogen Host Range Dynamics

Melanie Madrigal
Sponsor: Gitta Coaker, Ph.D.
Plant Pathology

Pathogenic members of the Gram-positive *Clavibacter* genus cause significant yield losses in tomato, potato, and maize. Despite infecting a broad range of plants, *Clavibacter* pathogens are thought to be host-specific. Recent research has shown the tomato pathogen *C. michiganensis* can grow in *Solanaceous* hosts, such as eggplant, without resulting in disease. To limit disease development, plants encode surface-localized receptors that enable recognition of pathogen threats and initiate immune responses including hypersensitive response (HR), characterized by localized cell death around the infection site. However, whether immune recognition drives pathogen host range has been unexplored across the genus. We utilized HR assays to assess seven previously described hosts species responses to each pathogenic species using a panel of 17 *Clavibacter* isolates. While plant species exhibited distinct responses to different *Clavibacter* pathogens, the potato pathogen *C. sepedonicus* elicited an immune response in pepper. By comparing *C. sepedonicus* genomes, we uncovered a serine protease, Chp8, that is recognized by the pepper host. Here, we report our broad screen to understand the host range of the *Clavibacter* genus and the role of *C. sepedonicus chp8* in limiting potential disease development in pepper. These findings can help us better understand *Clavibacter* pathogen biology.

YAP Signaling Is an Upstream Activator of En1 Expression in Metastatic Pancreatic Cancer Cells

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

Engrailed-1 (EN1) encodes for homeodomain containing proteins that function to control morphogenesis of the central nervous system during development. We found that EN1 is aberrantly expressed in metastatic pancreatic cancer and responsible for aggressive characteristics. YAP inhibitors have previously been shown to reduce En1 expression in fibroblasts during wound regeneration, suggesting that EN1 can be directly regulated by YAP. We hypothesize that YAP signaling is an upstream activator of En1 expression in metastatic pancreatic cancer cells. We set out to observe this effect by treating cell lines with a YAP activator, GA-017 (LATS1/2 inhibitor). This is predicted to increase En1 expression by permitting YAP to remain unphosphorylated and form a transcription complex in the nucleus. We observe the effects of GA-017 on En1 expression by utilizing qPCR techniques on our cell lines. This study provides a new mechanistic insight on how EN1 is regulated in metastatic pancreatic cancer.

Determining the Mechanisms That Prevent the Paternal Genome From Interacting With the Meiotic Spindle in *C. elegans* Zygotes

Meghana Mahantesh Magadum
Sponsor: Francis Mcnally, Ph.D.
Ag Molecular & Cellular Bio

Fertilization occurs before the completion of oocyte meiosis in the majority of animal species. Sperm chromatin is thus present in the same cytoplasm as the female meiotic spindle as it segregates maternal chromosomes into a polar body. If sperm chromatin were incorporated into the female meiotic spindle, paternal chromosomes could be expelled with maternal chromosomes into a polar body, thus generating lethal monosomy or haploidy. In both C. elegans and mouse, sperm DNA moves significant distances within the zygote before completion of anaphase II, thus increasing the risk of premature interactions. We found that paternal mitochondria were scattered throughout the zygote when maternal ataxin-2 was depleted, suggesting that maternal factors hold the sperm contents together into a cohesive unit that might shield the sperm DNA from interaction with the meiotic spindle. Double depletion of kinesin-13 and ataxin-2 resulted in close encounters in which the maternal ER shell around the paternal DNA was transiently stretched toward the meiotic spindle but then recoiled to a spherical shape as it moved away. These results suggest that premature interaction of paternal DNA with the meiotic spindle is prevented by kinesin-13-dependent suppression of long-range movement and maternal ataxin-2-dependent cohesion of sperm contents in the zygote.

The Relationship Between Childhood Trauma, Disclosure of Childhood Trauma, and Sleep in Mexican-Origin Mothers

Mariam Mahmodi
Sponsor: Leah Hibel, Ph.D.
Human Ecology

Trauma describes a disturbing event that can cause a long-lasting negative effect on a person's attitudes, behavior, and other aspects of functioning. Trauma during childhood can lead to decreased sleep quality, potentially due to circadian dysregulation, elevated cortisol, and social mechanisms, contributing to future mental and physical health challenges. Disclosure of such experiences may have an impact on these health outcomes in adulthood. This study establishes whether childhood trauma, as well as non-disclosure of this trauma, is related to sleep quality indicators among Mexican-origin (MO) mothers, a group in which this association may be greater due to racialized and gendered disparities. Data will come from the California Babies Project, a longitudinal study of the development of self-regulation in low-income, MO children. Data from MO mothers were also collected, including actigraph data from 8 nights of sleep, and a battery of questionnaires, including the Childhood Trauma Questionnaire, which assesses mothers' traumatic experiences during childhood, and if they confided in others about these events. Using Linear Regression models, we will test the association between childhood traumatic experiences, non-disclosure of these experiences, and maternal sleep quality. We hypothesize that both childhood trauma and non-disclosure will be associated with decreased sleep quality.

Using Vesicle Isolation and Co-Immunoprecipitation for the Investigation of Callose Synthase GSL8 Interactors During Cytokinesis in *Arabidopsis thaliana*

Hoang Tuan Mai
Sponsor: Georgia Drakakaki, Ph.D.
Plant Sciences

Cytokinesis is the fundamental process of cell division in plants. During this process, the cell plate forms and divides the parent cell into two identical daughter cells, facilitating plant development. The cell plate formation, expansion, and maturation are through the actions of vesicle delivery, fusion, and membrane transformation stages. In our lab, we investigate callose – a polysaccharide that is considered a major player during cell plate formation. The callose accumulation during cytokinesis is regulated by GSL8, one of the twelve members of glucan synthase-like proteins in Arabidopsis thaliana. The homozygous gls8 mutant plants show abnormal growth phenotypes including dwarfism, small cotyledons, and seedling lethality. Moving on from the function of GSL8, vesicle isolation and co-immunoprecipitation techniques were applied to investigate the protein interaction of GLS8 with or without Endosidin 7 treatment. Endosidin 7 (ES7) is the specific inhibitor of callose deposition that has shown the essential role of the polysaccharide in cell plate maturation. The proteomic analysis and hypothesis based on the data will be presented in understanding the molecular mechanism of the role of GSL8 during cell plate formation of plant cytokinesis.

Determining the Role of SOX10 in Gliogenesis using Chick Embryos

Aashwin Makhija
Sponsor: Crystal Rogers, Ph.D.
VM: Anat Physio & Cell Biology

Neural crest (NC) cells are embryonic stem cells that exhibit the remarkable capacity to differentiate into over 30 cell and tissue types. NC cells originate in the neural tube and undergo an epithelial-to-mesenchymal transition (EMT), delaminate from the neural tube, migrate throughout the embryo and differentiate. The mechanisms regulating this process are detailed in a neural crest gene regulatory network (GRN), which includes proteins that control the molecular changes NC cells undergo during EMT. SOX10 is an important transcription factor within the GRN that promotes cell migration and glial cell formation. Using the avian species, Gallus gallus (chick), my lab has identified the timing and localization of SOX10 gene and protein expression during EMT. Preliminary experiments showed that SOX10 overexpression may induce premature NC differentiation and inhibit migration in chick. I *hypothesize* that SOX10 overexpression drives premature NC differentiation into glial cell derivatives. To test this hypothesis, I will overexpress SOX10 and will perform immunohistochemistry using glial cell markers. I will also incubate injected embryos to late stages to determine the developmental implications of premature NC differentiation on chick development. These experiments will shed light on the specific mechanisms driving NC cell migration and differentiation during embryonic development.

From Stress to Smoke: Unraveling the Connection Between Anxiety and Smoking Among Sacramento's Unhoused at the Willow Clinic

Ashika Maniam
Sponsor: Kate Richards, M.D.
MED: Family & Community Med

Past literature showcases that the disproportionate prevalence of anxiety disorder among unhoused individuals increases their risk of developing substance use disorders. One such abused substance includes tobacco products, especially cigarettes. This quality improvement study explores the relationship between anxiety disorder and smoking habits within the patient population of Willow Clinic, a student-run clinic serving the unhoused population of Sacramento via medical and social services. A retrospective chart review was conducted of past patient medical history, namely to collect information on the GAD-7 metric (a metric for screening anxiety disorder) and smoking history. Results revealed a significant association ($p = 0.004 < 0.05$) between current smoking status and GAD-7 scores when comparing active smokers to former/non-smokers. Among the 158 active smokers, 111 had screened positive for an anxiety disorder diagnosis. These findings further highlight how closely intertwined mental health and substance abuse disorders are, suggesting the importance of screening other commonly abused substances like fentanyl, alcohol, methamphetamine and more. By identifying risks early, Willow Clinic can offer more tailored and holistic healthcare to this vulnerable and transient patient population.

Identifying ADAM and ADAMTS Metalloproteases Expression in *Hydra* Regeneration

Kamille Maningding
Sponsor: Celina Juliano, Ph.D.
Molecular & Cellular Bio

Hydra vulgaris is a freshwater cnidarian capable of whole-body regeneration from significant injuries, including those that leave only a tissue fragment. The simple body plan consists of endoderm and ectoderm epithelia separated by an extracellular matrix (ECM). During regeneration and homeostasis, interstitial stem cells (ISCs), dispersed within the ectodermal epithelia, migrate through the ECM to differentiate in the endoderm layer. Our preliminary lab data indicate metalloproteases, like α disintegrin and metalloprotease (ADAM) and ADAM with thrombospondin motifs (ADAMTS) family genes, may be necessary for ECM digestion and degradation to enable ISCs migration. During many developmental and morphogenetic events, ADAM/TS is crucial for migration and tissue remodeling. ADAM/TS expression from nearby cells modifies ECM structure and function. Using RNAseq, we found some upregulated ADAM/TS genes during head and foot regeneration, but the specific cell types upregulating them are unknown. The *Hydra* genome contains 26 ADAM/TS genes. This study identified ADAM/TS expression patterns in *Hydra vulgaris* during head regeneration via in situ hybridization. Different ADAM/TS gene expressions were observed in both endodermal epithelial and ISC lineages. With *Hydra*'s regeneration and necessity of metalloproteases, this serves as a great model to understand the ECM role during regeneration.

Identifying Gender Based Biomarkers and Pathways in Idiopathic Pulmonary Fibrosis

Nathan Mann
Sponsor: Ching-hsien Chen, Ph.D.
MED: Int Med Nephrology (sac)

Idiopathic pulmonary fibrosis (IPF) is a chronic, incurable lung disease that causes breathing difficulties due to scarring in the lungs. Early diagnosis and intervention are critical for mitigating IPF progression. IPF arises from unknown causes but is characterized by its predominance in males. To identify gender-specific biomarkers, whole blood samples of IPF patients were used for RNAseq analysis and gender-specific differential expressed genes (DEGs) were identified using the DEseq2 R package. Several DEGs may be the potential biomarkers including, CXCR3, CCL2, CCR5, and IL7R for female, as well as IL10, S100A9, CA1, and CTSG for male. The DAVID pathway enrichment results indicated that females had enriched Bicarbonate transporters, Platelet homeostasis, Chemokine receptors bind chemokines (CXCR3, CCL2, CXCR6, CCR5, CCR4), GPCR ligand binding pathways, Wnt signaling pathway, and PI3K-AKT signaling pathway. These pathways are linked to cell differentiation, profibrotic fibroblast proliferation, and platelet hyperactivity. Males had enriched Alpha-defensins, O2/CO2 exchange in erythrocytes, and neutrophil activation pathways. These pathways are known to cause inflammation, fibrogenesis, and respiratory distress. These findings may be able to increase our understanding of the IPF mechanism and lead to earlier diagnosis or therapeutic targets for the disease.

Circadian Phenotypes of *Arabidopsis elf3* Mutants Complemented with Sunflower *ELF3*

Nicholas Mao
Sponsor: Stacey Harmer, Ph.D.
Ag Plant Biology

In plants, the circadian clock coordinates physiological processes with daily environmental changes. Environmental stimuli, such as changes in temperature, can reset circadian genes; in turn, circadian clock components can affect plant responses to the environment. In *Arabidopsis thaliana, EARLY FLOWERING 3* (*ELF3)* is a transcription factor that acts as a master regulator in the evening complex of *Arabidopsis thaliana's* circadian system. *ELF3* has been shown to integrate temperature response to the clock through differential protein activity caused by a predicted prion domain (PrD). However, *ELF3* protein activity and its thermosensitivity in *Helianthus annuus* (domesticated sunflower) is still unknown. We sought to compare how different alleles of a sunflower ELF3 homolog complement *Arabidopsis elf3-1*'s circadian phenotypes at different temperatures. To do this, a luciferase assay was performed on *elf3-1 Arabidopsis* lines expressing mutant and wildtype Sunflower *ELF3_3* transgenes under different promoters. Transgenic lines with a firefly luciferase reporter under a circadian promoter (*CCR2*) were imaged for 6 days at two different temperatures. Preliminary studies suggest sunflower *ELF3* alleles can rescue circadian phenotypes in mutant *Arabidopsis elf3-1*. We hypothesize that the *HaELF3* alleles will complement the mutant *Arabidopsis* circadian phenotypes but have differing levels of complementation across low and high temperatures.

Role of the P-Rex2 DEP1 Domain in Autoinhibition

Rohan Marde
Sponsor: Jennifer Cash, Ph.D.
Molecular & Cellular Bio

P-Rex2 is a Rho guanine nucleotide exchange factor (RhoGEF) which promotes the exchange of GDP for GTP on small GTPases like Rac1. P-Rex2 is naturally autoinhibited, and gain-of-function mutations in P-Rex2 that increase GEF activity have been associated with various cancers. The DH/PH tandem is responsible for catalytic activity in P-Rex2, and the DEP1 domain has been linked to autoinhibition in P-Rex1, a closely related protein that also contains the DH/PH tandem. Accessory domains outside of the catalytic core have also been shown to play a role in autoinhibition in other RhoGEFs, but the role of the DEP1 domain in P-Rex2 autoinhibition remains unknown. To investigate this, we are expressing and purifying two protein constructs: one with the P-Rex2 DH/PH tandem, and one with the DH/PH tandem plus the DEP1 domain. Using a FRET-based GEF activity assay, we are assessing the impact of DEP1 on DH/PH GEF activity. We anticipate the DH/PH-DEP1 construct to have reduced GEF activity compared to the isolated DH/PH tandem, elucidating the role of DEP1 in P-Rex2 autoinhibition. Results from this experiment will create a deeper understanding of P-Rex2 autoinhibition and inform the development of future cancer therapeutics.

Tomato Trichomes Expression with Modular Cloning System

Ho Ching (Natalie) Mark
Sponsor: Yann-ru Lou, Ph.D.
Plant Biology

Plants in the Solanaceae (Nightshade) family, such as tomatoes and potatoes, are among the most produced crops in the USA. Type I/IV trichomes on wild tomato relatives produce specialized metabolites, such as acylsugars, which serve as native defenses against herbivores and pathogens. However, acylsugars are often lost in cultivated crop plants. Introducing different genetic combinations to acylsugar biosynthetic genes can be used to create pest-resilient tomato plants. Trichome-expressed acylsugar acyltransferases (ASATs) are enzymes that are required for acylsugar production. The sticky features of trichomes play a crucial role in protecting plants. However, the upstream regulatory regions for driving trichome expression remain unknown. My project aims to utilize native ASAT promoters to create a promoter library in a modular cloning system to introduce new genes in trichomes. I am focusing on wild tomato (*Solanum pennellii*) and cultivated tomato (*Solanum lycopersicum*). After the promoter is cloned, it will be used with a reporter to verify the drive of gene expression in trichomes. With this successful cloning of native promoters, I aim to generate a cloning system that allows the introduction of new genetic material to trichomes to establish sustainable, low pesticide-usage tomato production.

The Effect of Speed Stress on Timelines of Visual Word Processing

Annabel Marshall
Sponsor: Steven Luck, Ph.D.
Psychology

Given the essential nature of reading and its role in various aspects of daily life, including education, a thorough understanding of how reading is performed is crucial. This study aims to establish whether the brain's recognition of words occurs with an inherently fixed timeline or can be expedited under heightened time pressure. The start of a lexicality effect is evidence of the brain processing words and nonwords differently, potentially giving insight into the timeline of word processing. Using electroencephalogram (EEG), the study addresses the apparent disjunction between the natural reading speed (approximately 200-250 words per minute) and the delayed onset of the lexicality effect observed at 200-250 ms in existing EEG evidence. The experiment presents 5-letter strings at two rates, one simulating typical EEG experimental conditions and another faster rate more closely resembling skilled reading. If the prevailing understanding is true and the timeline of word recognition is rigid, the ERPs should show an identical lexicality effect occurring at approximately 200 - 250 ms for both presentation rates. If, however, lexical processing time can be decreased under time pressure, we predict that a lexicality effect begins significantly earlier (before 200 ms) for only the faster presentation rate.

Microcosm Methods for *Zostera m.* Microbiome Studies

Andrew Matayoshi
Sponsor: John Stachowicz, Ph.D.
Coastal & Marine Science Inst

The goal of this project was to determine which methods of lab cultivation of eelgrass, *Zostera marina*, were most effective and reflective of natural conditions for subsequent microbiome studies. Seeds were numbered and randomly assigned as sterile (seeds with only the interior microbiome intact) or unsterile (seeds with exterior and interior microbiome present) and then assigned either light or dark conditions to germinate. Once seeds germinated, they were randomly transferred into one of three environments: petri dishes, test tubes, and EcoFabs 2.0 (in collaboration with LBNL). For all three environments, seed growth stage, seed color, cotyledon color, number of leaves, disease, algae growth, and death were recorded over the course of the experiment. Results were analyzed with R to determine efficacy and will be used to inform our subsequent experiments looking at the seedling microbiome. We hope the results from this experiment increase germination success of eelgrass in the lab to propel research on this ecologically important and threatened species. Ultimately, the goal is to improve seagrass germination success in natural populations as they face increasing challenges with time.

Retrospective Chart Review: Prevalent Characteristics of Hmong Patients Seen at the Hmong Lifting Underserved Barriers Clinic, a Free Student-Run Clinic in Sacramento, California

Noora Mathur
Sponsor: Christian Bohringer, M.D.
MED: Anesth & Pain Medicine

The Hmong community in the greater Sacramento area faces significant health disparities, necessitating culturally sensitive healthcare. Hmong Lifting Underserved Barriers (HLUB) Clinic aims to address these challenges by understanding their health needs. Data (n=8) was collected from patients of Hmong descent seen at the HLUB Clinic from 2014 to 2023 for several parameters. Patients' BMI results were 25% normal, 25% overweight, and 50% obese. Hepatitis screenings showed 3 naive, 3 immune from vaccination, 1 dormant, 1 immune from past exposure, and none with active chronic hepatitis B. Patients' initial diabetes results were: 6 normal, 1 pre-diabetic, and 1 diabetic. Other parameters showed only 1 patient actively receiving care at the clinic, an average travel distance of 41.65 miles, 75% insured, and an average age of 33.5 years. Our preliminary data indicates a prevalence of high BMI patients, patients naive to hepatitis with no record of vaccination, and others who are positive for the core antibody. The enrollment in insurance and access to a clinic closer to home could explain a decrease in active Hmong patients. We suggest the clinic consider expansion of outreach, screening, and education efforts.

A Comparison of Invertebrate Facilitation Between *Pelvetiopsis limitata* and *Fucus distichus* in the Harbor vs. Open Coast

Cohen Maxwell
Sponsor: John Stachowicz, Ph.D.
Coastal & Marine Science Inst

Prior studies have identified functional redundancy among intertidal rockweed species in invertebrate facilitation in Northern California. However, there is a notable gap in research exploring whether these redundancies persist within exposure gradients. To address this, we conducted a comprehensive study comparing Dwarf rockweed (*Pelvetiopsis limitata*) and Bladderrack (*Fucus distichus*) under varying wave actions, surveying sites in Horseshoe Cove and Campbell Cove in Bodega Bay during negative king tide conditions. We utilized chalk blocks as proxies for wave action, laid transects, and employed quadrats to measure percent cover, species richness, snail abundance, and plant height. We expect variations in species richness and abundance between *Pelvetiopsis* and *Fucus* based on their percent cover and overall height dynamics. Our hypothesis extends to *Pelvetiopsis* displaying heightened facilitation on the open coast, while *Fucus* is expected to be a more robust facilitator in the harbor environment. Anticipating these distinctions in species richness and abundance between *Pelvetiopsis* and *Fucus*, our study aims to provide valuable insights into their facilitation dynamics under different exposure conditions, aiding informed conservation decisions in the context of climate change and other anthropogenic causes for species loss.

Word Learning in the Second Year of Life

Claire Mayew Sherman
Sponsor: Simona Ghetti, Ph.D.
Psychology

The goal of this project is to investigate word learning in 18- to 23-month old toddlers. We administered a task in which infants *(N*= 48) were presented with three unique 3D printed objects that did not reflect common objects: the target object, was given a monosyllabic name (e.g., “stip”, “croy”); the unnamed object, was played with equally to the target object but was not named; and the novel object, which was not named nor given special attention. After learning the label for the target toy, participants were asked to identify which of the three toys corresponded to the target (i.e., “Can you give me the stip?”). Participants were tested immediately after one-week, and evaluated again after an additional opportunity to learn at the end of the one-week test. We expect toddlers to remember the word labels across all testing occasions, but we will examine factors such as age, duration of sleep, and SES which may be associated with individual differences in episodic memory. We also plan to evaluate whether there are age differences in the type of errors toddlers make (i.e., choosing the novel toy versus choosing the unnamed toy).

Over the Rainbow: Utilizing Chromoproteins for Gene Reporting

Zoey Mayo
Sponsor: Richard Michelmore, Ph.D.
MED: Medical Microbiology & Imm

Reporter genes are an important tool for molecular biology research, allowing researchers to understand when and where genes are being expressed in organisms. GFP is the most well-known and used reporter gene, which fluoresces green under UV light. Fluorescent and non-fluorescent proteins that come in all colors of the rainbow were generated for bacterial expression by biologists, and some of them can be viewed with the naked eye under ambient light (chromoproteins). To aid research on promoters for transgene expression in lettuce, I used Golden Gate cloning to make plant expression constructs for the rainbow of chromoprotein genes and assessed their use as reporter genes in lettuce. I made constructs using the LjUBI promoter for all six chromoprotein constructs and also made red, blue, and purple chromoprotein constructs using the LsUBI promoter. In transient assays, the red, orange, yellow, and green chromoproteins displayed fluorescent expression in lettuce with the purple-red reporter RUBY being used as a control due to its high visibility in lettuce and transient assays. Non-fluorescent blue and purple chromoproteins were visible to the naked eye in certain tissues of stably transgenic lettuce, with the LjUBI promoter showing greater expression than the LsUBI promoter.

Investigating the Role of Amyloid Beta Agonism of Beta-2 Adrenergic Receptors on Amyloid Precursor Protein Processing in the Brain

Carly Mccurry
Sponsor: Yang Xiang, Ph.D.
MED: Pharmacology

Adrenergic neurons, originating from the locus coeruleus, are the first neurons to show neurodegeneration in Alzheimer’s Disease (AD). Norepinephrine binds to a variety of postsynaptic receptors, including beta-2 adrenergic receptors (β2AR). B2AR is highly expressed in the brain and can directly interact with soluble Aβ, a main player in AD development. Previous work from the lab found that Aβ binding to β2AR, followed by GRK phosphorylation, can trigger endocytosis and receptor degradation, causing a net decrease in β2AR in neuron membranes. Additionally, studies have shown that β2AR internalization can facilitate endocytosis of two transmembrane proteins involved in Aβ production: amyloid precursor protein (APP) and γ-secretase. When internalized, the acidic environment facilitates γ-secretase activation in an endosome, which increases APP processing and Aβ production. We propose a positive feedback mechanism whereby β2AR degradation, via Aβ binding, promotes APP cleavage and further Aβ production. This leads to further accumulation of Aβ and pathogenesis of AD. To test our hypothesis, we used a genetic approach to interfere with this pathway in a mouse model of AD and quantified proteins of interest. By disrupting this cycle, we expect a decrease in Aβ accumulation, neuron loss, neuroinflammation, and alleviation of symptoms in AD model mice.

From Authenticity to Appropriation: Examining the Impact of AAVE Misappropriation on Professional Spheres

Nadia McGhee
Sponsor: Angela Morris, Ph.D.
University Writing Program

This conference presentation applies an archival study of the social media platform, X (formerly known as Twitter) to analyze how the demotion of African American Vernacular English (AAVE) to internet slang and the subsequent misuse by nonblack demographics harms native Black speakers in business, academic, and professional spheres. The presentation highlights three words from the dialect and tweets pulled from the media platform that showcase the correct usage of the word followed by the incorrect usage. Using this research, this presentation discusses how the wrongful appropriation of AAVE by the majority can damage the validity of Black Englishes in professional spaces. I also include my mental processing of this subject as an African American woman who is aware of how important code-switching is between “professional” and AAVE. My experience provides an important perspective on the subject when speaking to broader audiences at this research conference. In conclusion, as with any cultural appropriation, the appropriation of AAVE only serves to harm African Americans while subsequently profiting those who have appropriated the language and culture in terms of social popularity or gain.

Analyzing the Potential of IMU Motion Capture to Advance ASL Research

Jillian Mckie
Sponsor: David Corina, M.D.,Ph.D.
Linguistics

The exploration of American Sign Language and other visual languages presents unique challenges in research primarily due to their visual medium. Inertial Measurement Unit (IMU) motion capture shows promise in gaining a more holistic understanding of visual language processing, and our project's goal is to explain the benefits and potential applications of this technology in the future. By making use of acceleration and time data recorded by the motion capture technology, we can correlate the movements of a signer to EEG activity, and gain insight into the exact moment a movement conveys meaning to the viewer. Similarly, because the IMU motion capture data is recorded in a 3D space, we avoid limitations that are associated with 2D recordings, such as image occlusion. We can also manipulate the space to show different frames of reference and see how this influences EEG activity and learning in children. The final major benefit of IMU motion capture is that 3D creation software like Blender enables the manipulation of natural human movements into impossible movements and inhuman avatars. By using IMU motion capture, we will be able to explore the potential for a more holistic approach to capturing the intricacies of visual language processing.

Supramodal Selective Attention to Speech Modulates Neural Processing in the Thalamo-Cortical System: an EEG investigation

Zach McNaughton
Sponsor: Lee Miller, Ph.D.
MED: Otolaryngology

While many studies have demonstrated attentional effects on higher-order cortical speech-language processing, little is known about how it impacts auditory processing as signals first reach the cortex via the thalamus. Furthermore, selective auditory attention ability is rarely related to attentional ability more generally. This study aims to examine the relationship between supramodal selective attention ability and neural activity while listening to speech-in-noise. Participants' supramodal selective attention was measured with a visual flanker paradigm. EEG data was then collected while 25 participants with normal hearing performed a continuous multi-talker speech spatial attention task. Neural activity was assessed using the middle latency responses (MLR), a type of event related potential (ERPs) elicited by the speech, which reflects processing in the thalamus and primary auditory cortex. Preliminary results show a correlation between supramodal selective attention ability and the MLR Pa component peak latency when participants attend to continuous speech, but only in the presence of a distractor talker. This possibly demonstrates top down attentional modulation along the thalamocortical tract in the auditory nervous system.

Impact of Biocontrol Agent *Paraburkholderia phytofirmans* PsJN on Fusarium Wilt of Strawberry

Davis McWilliams
Sponsor: Johan Leveau, Ph.D.
Plant Pathology

To mitigate environmental risks from pesticide use, novel, sustainable, and effective biocontrol methods to protect our crops and environment are crucial. The plant growth-promoting bacterium *Paraburkholderia phytofirmans* strain (PsJN) has been shown to protect various plant species against fungal pathogens, including the fungus that causes Fusarium wilt of tomato. A closely related fungal pathogen, *Fusarium oxysporum* f. sp. *fragariae* (*Fof*), causes Fusarium wilt in strawberry plants. This pathogen is difficult to manage, even with conventional fungicides. Whereas PsJN did not inhibit *Fof* growth *in vitro*, we hypothesize that PsJN can help *Fof*-challenged strawberry plants by triggering an immune defense. This project sought to determine whether and how PsJN inoculation impacts the development of Fusarium wilt disease symptoms. Strawberry plants were inoculated with PsJN 7 days before, 1 day before, or 7 days after challenge with *Fof*. As controls, plants were inoculated with *Fof* only or with water only. We measured and compared foliar symptoms and plant biomass. The results from this study will help inform the potential of PsJN to offer effective protection against Fusarium wilt of strawberry.

Effects of Wildfire ash on *Ixodes Pacificus* Respiration, Cuticle Health, and Survival

Ryan Meadows
Sponsor: Janet Foley, D.V.M.,Ph.D.
VM: Medicine & Epidemiology

The purpose of this research project is to study the effects of ash from wildfires on *Ixodes pacificus*, the western black-legged tick. This medically-significant arthropod is a vector of zoonotic diseases such as Lyme disease and anaplasmosis. With controlled burns increasingly being used to manage California forests, the effects of wildfire ash on ticks survival are worth researching. The abrasive and absorptive effects of ash and dust are known to lethally affect arthropods. In ticks though, the lethal mechanisms of wildfire ash are not entirely understood. Ash used in this project will be produced from several common sources of vegetation in California: Redwood (*Sequoia sempervirens*), Eucalyptus (*Eucalyptus sp.*), and California Bay (*Umbellularia californica*). Experimentation will involve exposing ticks to different wildfire ashes in a way that simulates "dust-bathing:" a practice animals are thought to use to cleanse themselves of ticks. Adult male and female ticks will be tested in this way. The morphological focus of this project is on tick spiracles (breathing holes), mouthparts, and cuticles (protective outer layers). Observations will be made regarding spiracle obstruction, cuticular abrasion, mouthpart obstruction, water loss, and acuteness of mortality: all with the goal of revealing potential mechanisms of lethality.

Biofilm Formation by Piscine Pathogenic *Lactococcus* spp. Impacts Resistance to Common Antimicrobials and Disinfectants in Aquaculture

Isabella Medina Silva
Sponsor: Taylor Heckman, Ph.D.
VM: Medicine & Epidemiology

Piscine lactococcosis, caused by gram-positive bacteria in the genus *Lactococcus*, is a prevalent disease in aquaculture worldwide. Currently, there are limited options for the treatment and prevention of this disease, and consequently, it causes significant losses in the aquaculture industry. Outbreaks often do not respond to antimicrobial intervention, and recurrent outbreaks are common. We hypothesize that piscine pathogenic *Lactococcus* spp. form biofilms that increase their resistance to antimicrobials and disinfectants, with potential species-specific differences. Following initial growth kinetic studies, biofilm formation by representative strains (n=10) of *Lactococcus petauri, L. garvieae* and *L. formosensis* were investigated using the minimum biofilm eradication concentration (MBEC) Assay® system. Biofilm and planktonic bacterial survival after exposure to common disinfectants and antimicrobials will be compared using hydrogen peroxide (H2O2), bleach, providone-iodine, Virkon® Aquatic, and the Sensititre™ Avian plate system. All tested strains formed appreciable biofilms by 24h at 30°C and biofilm associated bacteria showed increased resistance to H2O2. Planktonic *L. garvieae, L. petauri,* and *L. formosensis* showed differences in minimal inhibitory concentrations for important drugs in aquaculture, and investigation of MBECs is ongoing. However, preliminary results suggest biofilm formation is conserved among piscine pathogenic *Lactococcus* spp. and should be considered in disease management.

Parent-Child Touch and Its Impact on Infants' Word Recognition

Jai Mehta
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Parental responsiveness is crucial for infants' language learning. Infants whose parents are attentive to their interests tend to know more words than infants whose parents are not. However, it is not well understood how touch in parent-child interaction benefits infants' word recognition. To fill this gap, we conducted a study of forty-eight 11- to 15-month-old infants engaged in book reading and toy-play activities with their caregivers. Both the books and toys included animals (e.g., cow, horse). Subsequently, infants participated in a looking-while-listening word recognition task for sets of animal items with 4 levels of familiarity: items that appeared in the book and toys, book only, toys only, or no prior exposure. Infants' performance on word recognition tasks is evaluated by measuring the proportion of correct looking time to a named animal (e.g., "Look at the cow."). We predict that the more frequent parent-child touch occurrences during the play and book sessions, the better the infant's performance at the word recognition test. These findings will shed light on the benefit of parent-child touch interaction on infants' lexical learning.

Changes in Genetic Makeup of Walnut Propagated by Continuous Somatic Embryogenesis

Li Meinhold
Sponsor: John Monroe, Ph.D.
Plant Sciences

Plant tissue culture is an *in vitro* method allowing for the rapid expansion of clonal tissue. Somatic embryogenesis is a tissue culture technique that allows for the generation embryo tissue from somatic cells. These somatic embryo cultures are useful for plant genome engineering in highly heterozygous crops as they are clonal embryos of the somatic cells they are generated from. This technique can also lead to the avoidance of chimeric transformations. The Walnut Improvement Program at UC Davis has maintained a line of walnut cv. Chandler somatic embryos in tissue culture for over thirty years, providing a unique opportunity to study mutation accumulation in a repetitively embryogenic cell line. While this lineage derives from a single somatic embryogenesis event, multiplication has led to 12 intermixing lines. We have identified massive SNP accumulation, large structural variation, and two independent trisomies in some randomly selected individuals from this lineage using short read sequencing and PacBio HiFi. We have now sequenced individuals from each of the 12 lines with Illumina WGS and aim to identify relatedness and determine the extent to which these aneuploidies are shared. This research will help inform culturalists on mutation occurring in somatic embryogenic tissue.

The Role of Cytochrome P450 Monooxygenases in Environmental Smoke Induced Lung Tumorigenesis

Robin Jordan Merluza
Sponsor: Laura Van Winkle, Ph.D.
VM: Anat Physio & Cell Biology

Extensive research shows a significant correlation between exposure to environmental tobacco smoke(ETS) and tumor formation, but it is unclear which enzymes cause smoke-related lung tumor progression. Cytochrome P450 monooxygenases(CYPs) are substrate inducible microsomal enzymes vital for bioactivation of polycyclic aromatic hydrocarbons, subsequently forming harmful metabolites associated with tumorigenesis. We explore how modification of these enzymes affects ETS carcinogenicity. Three strains of A/J mice (both sexes) were observed, with group 1(G1) mice and group 2(G2) having null *Cyp2f2* and *Cyp2s1* mice genes and only G1 replaced with human *CYP2A13*+*CYP2F1*+*CYP2B6*. Our wildtype control group(G1), which exhibits heightened tumor incidence/multiplicity upon ETS exposure underscored the significance of CYPs in metabolizing ETS toxicants. Consequently, we hypothesize these CYP enzymes are important in tobacco smoke tumorigenesis, thus, we will witness a similar multiplicity and incidence in our humanized mice(G1), while simultaneously a decrease in our null group. Groups were exposed to ETS for 5 months, followed by a 4-month filtered air(FA) recovery period, or FA for the whole time. Samples were fixed and paraffin embedded, H&E stained, and sent to a certified pathologist for examination. Data collection is still ongoing, and results will help inform which enzymes are relevant for ETS initiated lung progression.

British Educational Policies during the Mandate of Palestine: Funding the Police Over Education

Esma Mesihovic
Sponsor: Angela Morris, Ph.D.
University Writing Program

This presentation features an archival and textual study that analyzes both British correspondence and British and Palestinian memoirs to investigate the establishment of education policies in the region before and during the British Mandate of Palestine. Current literature on the subject shows how the British gave Palestinians less autonomy in their education and purposively aimed to keep the Arab race in a lower class of society to make colonial resistance harder. The immigrating Jewish population, meanwhile, had a stronger and more autonomous educational system thanks to substantial funding through the World Zionist Organization. By reviewing this data collection. this presentation not only addresses the colonial motive but tracks a correlation between increased military and police spending and the poorer education quality of Palestinians. Ultimately, this presentation argues that while racialized and class ideas were a huge motive, it was also Britain's willingness to submit to Zionist pressure and direct more expenditure to the police that resulted in less funding and attention given towards an autonomous and strong Palestinian educational system. This deprived the indigenous Arabs economic and political power over the growing Jewish population.

The Impact of the COVID-19 on Consumer Behavior and E-Commerce in the United States

Yang Miao
Sponsor: Colin Carter, Ph.D.
Ag & Resource Economics

This study investigates how the COVID-19 pandemic reshaped consumer behavior in the United States. During the pandemic, consumers re-evaluated priorities, adapting spending and savings patterns. These changes showcase consumer resilience in crises, providing insights into recovery and potential lasting financial impacts. I examined pandemic-driven consumer changes across three dimensions: spending, savings, and online shopping. Facing uncertainty, consumers increasingly focused on savings over discretionary purchases and adjusted budgets to meet new constraints. The rise of e-commerce for safety and convenience also accelerated. Together these pandemic-spurred adaptations represent a major reconfiguration of consumer financial behavior, with possible long-term implications for retail and the broader economy. This study adopts a three-dimensional view: consumer spending, savings, and the shift in shopping habits toward online platforms. The pandemic has catalyzed significant changes, with consumers increasingly prioritizing savings amidst economic uncertainty, adjusting their spending in response to shifting needs and constraints, and embracing online shopping as a safer and more convenient alternative. These behavioral shifts reflect a comprehensive adaptation to the pandemic's challenges, highlighting a reconfiguration of financial habits that may have lasting implications for both the retail industry and broader economic patterns.

Movement Kinematics as Predictors for the Success of Reaching and Grasping Tasks in Selectively Sensory-Deprived Gray Short-Tailed Opossums

Madeleine Miller
Sponsor: Leah Krubitzer, Ph.D.
Psychology

Reaching and grasping is the primary means rodents, non-human primates, and humans interact with the world, specifically with food items. Reaching and grasping is a targeted sensory-dependent movement pattern that is well studied in rodents and non-human primates, but a detailed assessment of this behavior is lacking in non-eutherian animal models. Short-tailed opossums (*Mondelphis domestica*) are adept at single-arm reaching and grasping, but the reason for their success remains unknown. Here we characterize the kinematics of reaching and grasping while we vary available sensory input. We sequentially removed somatosensory and olfactory input before testing the animals' ability to reach and grasp. To quantify data, we used video recording analysis and pose estimation with DeepLabCut, an algorithm that extracts pose kinematics in three dimensions before and after the reaching and grasping event. Preliminary data suggests that reaching success rate covaries with reach speed, such that slower reaches are more successful. Somatosensory and olfactory deprivation impairs the success rate and the kinematic characteristics of the movements. These data will inform future studies of the impact of sensory deprivation on the kinematic movements of non-eutherian animals, and will expand our understanding of how different sensory systems contribute to complex ethologically relevant behaviors.

Analyzing the Effects of COVID-19 on Transit Ridership: A Multi-Year Perspective

Jackson Mills
Sponsor: Susan Cayar, Ph.D.
Environmental Science & Policy

This research project examines the main causes of the disparity between loss of ridership for public transit agencies across the United States during the COVID-19 pandemic and studies how each transit agencies' efforts to bring riders back have impacted their post-pandemic ridership recovery. Data points include ridership information from transit agencies, demographic data from the United States Census, agency reports, and interviews with transit agency officials. The study examines ridership trends from 2007 to 2023, painting a more complete picture of the state of American transit throughout the 21st century. This research is critical given the seemingly lasting impact of the pandemic on transit ridership, with many agencies staring down bleak financial projections and deep service cuts in the years ahead stemming from a drop in revenue from reduced rates of farebox recovery. The report discusses key findings related to the specific variables that are likely to influence transit ridership and the associated policy implications.

Aberrant Mitochondrial Morphology in Age-Related Macular Degeneration

Angela Min
Sponsor: Cecilia Giulivi, Ph.D.
VM: Molecular Bio Sciences

Age-Related Macular Degeneration (AMD) is a retinal disease that leads to central vision loss. The disease manifests as an accumulation of lipid and proteins plaque in the form of extracellular lipid deposition known as drusen or intracellular lipid accumulation presenting as punctate lesions, culminating in macular degeneration. Primates are the only mammals to possess maculae essential for sharp central vision, making them crucial models for AMD research. The macula, rich in mitochondria, is susceptible to environmental influences (such as sunlight exposure and dietary habits) and genetic factors that may contribute to mitochondrial damage, influencing the onset and progression of degeneration. To investigate, we analyzed mitochondrial morphology in retinal pigment epithelial cells of healthy rhesus macaques versus those with drusen or punctate lesions. Our findings revealed disrupted mitochondrial morphology in AMD samples, particularly those with drusen or punctuated deposits, exhibiting blunted fusion, a more circular shape, and diminished content compared to normal animals. These observations shed light on the potential role of mitochondrial dysfunction in AMD. Understanding this mechanism could guide the development of future treatments and preventive strategies targeting mitochondrial aspects of AMD.

Electrical Response to Chemically Injured Porcine Corneas: Stem Cell and Epithelial Cell Population and Wound Healing

Wen Min
Sponsor: Min Zhao, M.D.,Ph.D.
MED: Dermatology

Little is known about electric signaling in the cornea after chemical injuries. Chemical injuries to the cornea are prevalent occupational hazards in certain industries, which can often lead to severe outcomes such as impaired vision. Furthermore, understanding the wound healing mechanisms is critical for developing effective treatments. This project aims to better understand electrical signaling in corneal tissue post-chemical injury by measuring the electric response and determining the cellular dynamics of stem cells and epithelial cells. This study is designed to measure the transepithelial potential (TEP) in ex vivo porcine corneas following nitrogen mustard (NM) injury and to identify the changes in limbal stem cell (LESC) and corneal epithelial cell (CEC) populations. Immunohistochemistry (IHC) will be employed to identify LESC and CEC populations using specific markers—p63 and ABCG2 for LESC, and ck3 and ck12 for CEC—at intervals of 0 hours, 24 hours, and 48 hours post-injury. Concurrently, electrical signaling will be elucidated through TEP measurements using a glass microelectrode. The purpose of this research is to contribute to the development of novel treatments and therapies for corneal diseases and injuries caused by chemical agents, enhancing recovery processes and occupational safety in relevant industries.

Exploring The Role of Genetic Factors and Cannabis Use on Cognitive Control in Individuals with Psychosis

Anika Minoji
Sponsor: Tyler Lesh, Ph.D.
MED: Psychiatry & Behav Sci

Cannabis use increases schizophrenia onset risk and continued use correlates with higher psychosis relapse rates, positive symptom severity, and hospitalization rates. Despite these negative outcomes, patients who use cannabis tend to have higher cognitive performance than non-users. This finding could be explained by a genetic predisposition to psychosis and higher cognitive performance in individuals who developed schizophrenia and used cannabis compared to non-users who developed schizophrenia. We recruited individuals with schizophrenia, schizoaffective disorder, or schizophreniform disorder diagnoses from the greater Sacramento area. Participant blood samples underwent DNA genotyping to generate a polygenetic score (PGS) representing the genetic burden for schizophrenia. Participants' cognitive control was measured using the AX- Cognitive Performance Task (AX-CPT) performance during fMRI. Cannabis use was evaluated using a structured clinical interview. Analyses in ANCOVA will be used to investigate the relationship between cannabis use and PGS with cognitive control performance. These results could suggest that, while cannabis use is associated with higher psychosis risk, these individuals could be characterized by lower genetic burden and consequently, attenuated cognitive impairment. Accounting for how an individual's genetic predisposition to schizophrenia interacts with cannabis use to alter cognition will provide more targeted and personalized therapy for patients.

Reducing Nonspecific Binding on Western Blot: Effects of Combination Blocking and Temperature Variation in Blocking Solution

Ana Miranda
Sponsor: Aldrin Gomes, Ph.D.
MED: Physiology & Membrane Biol

Western blotting is a critical technique for the identification and analysis of individual proteins. As part of the western blot, we utilize blocking solutions to promote specific binding. This step allows the blocking reagent to bind to unbound regions on the membrane. In order to enhance the western blot, we conducted experiments to induce greater blocking efficiency. First, we compared if increasing the temperature of the blocking solution using 3% nonfat milk blocking solution would decrease the time needed to incubate the membrane for effective blocking. Second, we experimented with using a combination of blockers and observed how the solutions compared to the use of individual blockers. For this, we compared combinations of BSA, nonfat milk, and casein at three percent total concentrations. Overall, through increasing the efficiency of blocking, we aim to significantly reduce background and nonspecific binding signals on the membrane. Additionally, we seek to reduce the time taken for blocking so that the western blot experiment can be conducted at a faster rate. These would in turn allow for a more efficient and accurate analysis of the protein determination by western blotting.

How Type of Attachment Figures Can Vary the Strength of the Stress-Buffering Effect in Praire Voles (*Microtus ochrogaster*)

Benny Mis Diaz
Sponsor: Karen Bales, Ph.D.
Psychology

Stress buffering is a known phenomenon that is exhibited in pair bonding animals, such as prairie voles (Microtus ochrogaster). This is characterized by a reduction in stress responses to adverse experiences by an animal when an attachment figure is present. While this is well studied, what is less known is how the strength of the buffering can change depending on the type of attachment figure. This phenomenon is also exhibited by humans and more information can help us understand how different types of social experience aid in combating the effects of stress. This study compares behavioral stress responses to an unfamiliar environment when voles are alone, and when with their respective attachment figures. Voles could be male/ female pairs able to reproduce, pairs with vasectomized males, or same-sex sibling pairs. This study will give us more information on how the type of bond affects the potency of the stress buffering in prairie voles.

Differences in Self-Perception and Academic Performance of Computer Science Transfer and High-School-Admitted Students

Niharika Misal
Sponsor: Joel Porquet-Lupine, Ph.D.
Engr Computer Science

At UC Davis, students come from a diverse array of academic backgrounds, notably transfer students from other institutions, who arrive at the beginning of their 3rd year, and high-school-admitted students (HSAs), who start at the beginning of the 1st year. Transfer students bring prior coursework experiences, while HSAs transition directly from high school. When transfer students join UC Davis, they can often feel less prepared and capable than their HSAs counterparts, particularly in fields like Computer Science (CS) where disparities persist. Through a comparative analysis, this study focuses on uncovering the potential differences in self-perception and academic performance between Computer Science transfer students and HSAs. By utilizing student survey data and academic information, we can investigate whether a knowledge gap among transfer students is a genuine issue or merely a misconception. With insights into self-perception, we can determine whether students believe a gap exists and through data analysis, whether this gap actually diminishes. The outcome of this study can enhance orientation programs and strategies, benefiting the CS student community. With the field's growth, this research fosters inclusivity and effectiveness in education, catering to the expanding CS student population.

The Representation of Arabs During WWII in the New York Times

Ali Misleh
Sponsor: Suad Joseph, Ph.D.
Anthropology

I researched and analyzed the use of the term “Arab” in the New York Times on ProQuest from 1940-1949 by filtering for articles, editorials, and front-page articles and screened 815 articles with 24 of them being relevant. Little distinction was made among different Arab groups, cultures, and identities. Additionally, Arabs often had their history, culture, opinions, and political views described for them. I found patterns of Arabs being stereotyped, overgeneralized, and misrepresented as irrational, controllable, and stuck in the past. A close look into how Arab people were represented during this period is crucial because many Arab countries were controlled by Western powers. Therefore, their representation may have influenced how Arab lands were used as a battleground for World War II and how the rest of the world viewed Arab peoples after independence. The study of the usage of the term “Arab” in the media is vital in understanding how Arabs were represented in the context of Western interest in WWII. *This is a part of a long-term analysis from 1850 to the present of the NYT in the Suad Joseph Lab. The project analyzes the representation of Islam and Muslims over a 150-year period.*

Tower Debias: Eliminating the Effect of Sensitive Variables from Black-Box Machine Learning Models

Aditya Mittal
Sponsor: Norman Matloff, Ph.D.
Engr Computer Science

In recent years, the rapid development of machine learning models across diverse sectors, such as business, healthcare, and legal systems, have become increasingly evident. As these models play a pivotal role in critical decision-making processes with a broad range of consumer impact, a significant concern arises: the issue of social fairness in machine learning. With this, the primary objective of fair machine learning is to mitigate biases associated with sensitive attributes that may influence the predictive outcomes of algorithms. Introducing the towerDebias method, this novel approach aims to eliminate the impact of sensitive variables on predictions generated by black-box machine learning models. This approach is guided by the Tower Property of conditional expectation, with its primary goal of improving the fairness of predictions in the post-processing stage at some potential loss in accuracy. Notably, this approach is widely flexible and does not require intricate understanding of the underlying black-box algorithm itself. Empirical results from several fairML datasets demonstrate the efficacy of the towerDebias method in improving fairness at some expense of utility in both regression and classification settings. Our findings yields valuable insights into the fairness vs. utility tradeoff on application of towerDebias across various contexts.

From Stress to Smoke: Unraveling the Connection Between Anxiety and Smoking Among Sacramento's Unhoused at the Willow Clinic

Ravin Mogan
Sponsor: Kate Richards, M.D.
MED: Family & Community Med

Past literature showcases that the disproportionate prevalence of anxiety disorder among unhoused individuals increases their risk of developing substance use disorders. One such abused substance includes tobacco products, especially cigarettes. This quality improvement study explores the relationship between anxiety disorder and smoking habits within the patient population of Willow Clinic, a student-run clinic serving the unhoused population of Sacramento via medical and social services. A retrospective chart review was conducted of past patient medical history, namely to collect information on the GAD-7 metric (a metric for screening anxiety disorder) and smoking history. Results revealed a significant association ($p = 0.004 < 0.05$) between current smoking status and GAD-7 scores when comparing active smokers to former/non-smokers. Among the 158 active smokers, 111 had screened positive for an anxiety disorder diagnosis. These findings further highlight how closely intertwined mental health and substance abuse disorders are, suggesting the importance of screening other commonly abused substances like fentanyl, alcohol, methamphetamine and more. By identifying risks early, Willow Clinic can offer more tailored and holistic healthcare to this vulnerable and transient patient population.

The New York Times Representation of Egypt in the 1960s

Aaminah Mohammad
Sponsor: Suad Joseph, D.V.M.,Ph.D.
Anthropology

This study explores the depiction of Egypt and its people in articles published by the New York Times from 1960 to 1969. The New York Times consistently portrayed Egyptians as the "other," often labeling them as aggressors in their 1967 war against Israel. Moreover, there was a tendency to depict them as culturally backwards and barbaric. Given the New York Times' influential position in the United States and in the world, these representations had a significant impact in influencing public perceptions. During this era, significant events unfolded, including Egypt's conflict with Israel, the nationalization of the Suez Canal, the 1967 Arab-Israeli War, and the brief annexation of Gaza and Syria by Egypt into what became called the United Arab Republic. Additionally, under President Nasser's leadership, ideologies such as Pan-Arab nationalism, modernism, and socialism gained prominence in Egypt.This analysis screened 300 articles, with 150 of them being considered relevant to the research. This research is part of a broader project by the Suad Joseph lab, spanning from 1850 to the present. The project aims to analyze the portrayal of Islam and Muslims over a 150 time period through the lens of the New York Times.

Sustainable Therapeutic Protein Production in Microalgae

Fahim Mohammed
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

The production of therapeutic proteins is currently dominated by a few chassis organisms including *E. coli*, *S. cerevisiae*, CHO cells, and some plants. However, synthetic biologists have, of late, been working to develop alternative chassis organisms that may provide advantages over these traditional chassis. Microbial photosynthesizers, or microalgae, are currently one interesting alternative. By only requiring light, trace minerals, buffer, and a nitrogen source, microalgae provide a potentially low-cost platform for therapeutic protein production that is also ecologically sustainable due to fast growth and photosynthetic ability. The microalgae *Chlamydomonas reinhardtii*'s physiology is well-documented and has been shown to synthesize stable mammalian proteins, making it a prime research candidate as a photosynthetic chassis organism. One of the biggest barriers to using *C. reinhardtii* as a chassis organism is performing a high-efficiency transformation. Our research strives to develop a transformation protocol that can efficiently integrate transgenic DNA into the *C. reinhardtii* genome using exponential electroporation. This transformation protocol can then be applied to a synthetic biology context to produce different therapeutic proteins, reducing the cost both financially and environmentally. Here, we present our recent work to improve transformation protocols for *C. reinhardtii*.

Functional Morphology as Environmental Proxy: Do Sponge Fossil Morphologies Inform Late Ordovician Environmental Conditions?

Lena Molteni
Sponsor: David Gold, Ph.D.
Earth And Planetary Sciences

Sponge fossils have potential to act as effective proxies for environmental conditions. Sponges are valuable organisms for studying this concept because they change shape as they grow based on their dynamic environment. Studying their morphology through imagery allows for remote analysis of abiotic variables in their community. When a sponge becomes fossilized, its environmental adaptations are preserved in its morphology. This study uses a classification system containing four types and fourteen subtypes of sponge morphologies to inform an understanding of environmental conditions. Twelve environmental factors impact sponge morphologies in the local marine environment, particularly hydrodynamics and sedimentation. To analyze these factors in the paleoenvironment, we classify late Ordovician (472-460mya) sponge fossils from the Great Basin by morphology. Our novel use of this classification scheme, created for living sponges, is a promising environmental proxy for paleoenvironmental conditions. Preliminary findings cross referenced with extensive literature review suggest that the environmental implications of newly classified sponge fossils do correlate with the known paleoenvironment. We expect sponge morphologies through the late Ordovician to accurately inform paleoenvironmental conditions throughout the western coast of Laurentia, and that this work is important for ecological study of sponges and reconstruction of prehistoric environments lacking sedimentary or geochemical records.

Quantifying Diurnal Spring Movements of Neotropical Migrant Birds on Upper Mount Diablo

Ethan Monk
Sponsor: Andrew Engilis, M.S.
Wildlife & Fisheries Biology

Songbirds that overwinter in the neotropics and return to more northerly latitudes in North America to breed, primarily of the suborder *Passeri*, are known to migrate primarily by night despite being otherwise diurnal. However, under certain climactic conditions at rare and unique locations, these birds often continue migrating into the morning well after the sun has risen ("diurnal migration"). During the springs of 2023 and 2024 (research ongoing), diurnal migration and weather were monitored at a novel site for observing this phenomenon on the southern flank of Mount Diablo. While work is ongoing, preliminary results suggest warm overnight temperatures and strong northerly wind are key factors in creating or encouraging diurnal migration. Marine layer, a frequent phenomenon at this site absent or only rarely present at most other known sites where diurnal migration occurs, appears to influence the incidence of diurnal migration but in a less predictable manner. While proximal causes of these diurnal migration events are not yet well understood, understanding climatic factors that create and/or encourage this phenomenon should aid in the discovery of new sites and lend key insight into why normally nocturnally migrating birds will occasionally migrate diurnally.

Roll the Spice Dice: Sexual Novelty and Approach Motives Encourage Self-Expansion

Elina Moreno
Sponsor: Paul Eastwick, Ph.D.
Psychology

Approach motivation is intimately linked with self-expansion. Self-expansion predicts relationship satisfaction through sexual desire. Novelty is known to both incentivise approach through dopamine production and promote self-expansion. This study investigates whether sexual novelty encourages sexual approach motives and, thus, heightened self-expansion among monogamous and friends with benefits (FWB) relationship styles. Approximately 800 UC Davis students completed a 15 minute survey which measured sexual novelty, sexual approach and avoidance motives, and self-expansion. Preliminary analysis suggests that monogamous participants report significantly greater levels of self-expansion (M=5.29; SD=1.22) than FWB (M=4.50; SD=1.33) and sexual approach motives (M=5.50; SD=1.05) than FWB (M=4.91; SD=1.22). There were no significant differences between sexual avoidance motives or sexual novelty. Across the entire sample, sexual novelty is positively correlated with sexual approach motives (r=.399, p<.001) and self-expansion (r=.512, p<.001). Sexual approach motives are also positively correlated with self-expansion (r=.506, p<.001). This study aims to identify the relationship between sexual motivation and sexual novelty as they predict self-expansion among diverse relationship types.

Stable Isotope Analysis of Deer Remains from Alameda County

Brooke Morey
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

This project examines mule deer (Odocoileus hemionus) remains from CA-ALA-554, an ancestral Ohlone site in modern-day Pleasanton that yielded abundant deer remains across eighty-three burials. AMS radiocarbon dates indicate that people lived here and deposited the deer bones between 400 and 2000 years before present. We document shifts in deer ecology, especially diet and migratory behaviors, across this swath of time. Analysis of δ13C, δ15N, and δ34S in bone collagen help reconstruct the diet and movement patterns of individual deer. Results speak to larger population trends, allowing us to reconstruct the environmental landscape. Increased variation in δ13C and δ15N values between 800 and 1000 cal BP reflects ecological stress faced by both mule deer and people during the Medieval Climatic Anomaly (MCA) (650-1220 cal BP), which forced one or both to alter their respective foraging and hunting practices. Additionally, our δ34S data suggests that people contracted hunting ranges after 800 cal BP, likely in response to increasing population size and the consolidation of territories during the Late Period (685-180 cal BP). Together, isotopic data reveals ecological and social factors that precipitated changes in deer and human subsistence behaviors.

Purification and Structural Elucidation of an Unknown Enzyme Product from *PvCYP71Y1*

Ayna Muftic
Sponsor: Philipp Zerbe, Ph.D.
Plant Biology

Switchgrass (*Panicum virgatum*) is a bioenergy crop valued for its environmental resilience and bioenergy efficiency. Switchgrass has a broad habitat range across eastern North America with ecotypes adapted to different environmental conditions. Understanding switchgrass stress tolerance mechanisms is vital for enhancing crop resilience and productivity.

Monocot crops employ blends of diterpenoid metabolites to mediate chemical defenses against environmental stressors. The primary enzymes responsible for diterpenoid biosynthesis are diterpene synthases (diTPS) and cytochrome P450 monooxygenases (P450s). We identified a modular diterpenoid-biosynthetic network in switchgrass involving multiple diTPS and P450 enzymes, where the recently discovered diTPS, P. virgatum Kaurene Synthase-Like 2 (PvKSL1) forms four abietane diterpenoids that structurally resemble major defense compounds in conifers. To discover enzymes of this pathway, we used gene co-expression studies to identify a P450 of the CYP71Y family, PvCYP71Y1, that showed similar expression patterns as PvKSL1. Combinatorial biochemical analysis of PvKSL1 and PvCYP71Y1 yielded an unrecognized metabolite.

To structurally identify this compound, we enzymatically produced the PvCYP71Y1 product for purification via silica chromatography, followed by HPLC and NMR analysis. Characterizing the PvCYP71Y1 product will expand our knowledge of the P450 superfamily diversity and enhance switchgrass stress resilience against climate change.

Assessing Activity of Somatostatin Enhancers Using AAV-Based Reporter Assays

Amina Muhic
Sponsor: Alexander Nord, Ph.D.
Neuro Physio & Behavior

Enhancers are cis-regulatory elements that play major roles in gene regulation. Spatial and temporal activity of enhancers are thought to be critical for cell development and maturation in the brain. Though identifying and screening enhancers has improved, there is still a gap in understanding enhancer activity in-vivo. To investigate enhancer function in the developing brain, we adapted a reporter assay. We first selected candidate sequences identified in late maturation inhibitory cells derived from a human iPSC culture. Our candidates were selected around the Somatostatin (SST) locus, which is highly expressed in SST interneurons. Candidates were then cloned into reporter vectors and delivered into neonatal mouse brains via intracranial injections at postnatal day 0 using recombinant adeno-associated virus (rAAV). Two weeks later, brains were processed for immunohistochemistry (IHC) to assess activity. During IHC, EGFP and an interneuron specific marker, Lhx6, were stained. We saw strong overlap between our EGFP reporter and the Lhx6 marker, indicating strong enhancer activity in interneuron populations of the developing mouse brain. In future experiments we would like to characterize our selected candidate regions by running mutagenesis assays to identify sequence motifs within the enhancer that are critical for its cell type specific activity.

Using *Kluyveromyces lactis* to Express Bovine Casein Protein for Vegan Cheese Production.

Allison Muller
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

Dairy cows are the third-largest producers of greenhouse gases in the food industry. In response to these environmental concerns, interest in milk alternatives has increased in recent years. While plant-based milks have been commercially successful, vegan cheeses have gained a somewhat poor reputation among consumers. Many plant-based cheeses have a low protein content, and lack the characteristic stretch and mouthfeel that consumers expect with traditional dairy-based cheeses. While there are cheeses that utilize plant-based proteins and have a more cheese-like texture, they often fail to replicate the taste of the cheese they are attempting to emulate. Our research focuses on using the yeast *Kluyveromyces lactis* to synthesize four different bovine casein proteins which, when combined with other components, can be used to make a vegan cheese that resembles real cheese in both texture and taste. We are currently investigating modes of protein expression and several purification methods, and their impact on cost and yield. Additionally, we are also evaluating the manufacturing costs for an eventual product, which involves sourcing the other components for our vegan cheese and researching different cheese varieties in order to select a cost-effective product to make.

Muscle Spindle Development is Activity-Dependent

Akash Murali
Sponsor: Theanne Griffith, Ph.D.
MED: Physiology & Membrane Biol

Proprioception allows for the detection of body position and facilitates purposeful movement. Proprioceptors, somatosensory neurons that initiate proprioceptive signaling, rely on voltage-gated sodium channels (Na_Vs) for neuronal activity. Our data shows that the $Na_V1.6$ subtype is required in proprioceptors for action potential firing. Most proprioceptors innervate muscle where they form muscle spindles, end organ structures that detect changes in muscle length via stretch-sensitive coiled wrappings around specialized muscle fibers. Evidence suggests neuronal activity is required for the development of some somatosensory end organ structures, but it remains unclear whether this applies to proprioceptors. To test the hypothesis that muscle spindle development depends on proprioceptor activity, we harvested muscle tissue for immunohistochemistry and confocal imaging from mice lacking $Na_V1.6$ in proprioceptors and controls. Muscle spindles were identified by vesicular glutamate transporter 1 (VGLUT1) staining. The number of wrappings per spindle was normalized to spindle length and expressed as a wrapping efficiency index. We found a significant reduction in the wrapping efficiency index in mice lacking $Na_V1.6$ compared to controls, demonstrating that muscle spindle development is activity dependent. Ongoing analyses are investigating whether loss of $Na_V1.1$ in proprioceptors, which results in moderate deficits in proprioceptor activity, also impairs muscle spindle development.

Identification of Novel Marker for Differentiation-Committed Oligodendrocyte Precursor Cells

Rohini Murali
Sponsor: Fuzheng Guo, Ph.D.
MED: Neurology

Oligodendrocyte precursor cells (OPCs) play a crucial role in central nervous system development and function by giving rise to mature oligodendrocytes, which are essential for myelination. Differentiation committed OPCs (COPs) are intermediates between proliferating OPCs and newly formed oligodendrocytes (NFOLs) and play an important role in myelin repair. In this project, we aim to characterize Inositol 1,4,5-trisphosphate receptor, type 2 (ITPR2) for oligodendrocyte lineage cells, thus facilitating neuroscience research for cell population identification. Previous single-cell RNA-sequencing data indicates that ITPR2 is upregulated in both COPs and NFOLs. Markers currently used for identifying COPs and NFOLs rely on scRNA-sequencing, in addition to immunohistochemistry. ITPR2 would be a more efficient marker as it relies solely on immunohistochemistry methods to effectively label oligodendrocyte lineage cells. We will use different oligodendrocyte developmental stage-specific markers to show which cell subpopulation is enriched with ITPR2. This will refine our understanding of oligodendrocyte and myelin biology and can be applied to future research related to myelin-related disorders.

SNF2H Regulates Spermatogonial Differentiation by Ensuring DMRT1/6 Function

Shanmathi Murugesan
Sponsor: Satoshi Namekawa, Ph.D.
Microbiology & Molec Genetics

Spermatogenesis is the process regulated by a network of genes that are responsible for the maintenance and differentiation of male germline stem cells into spermatogonia which later mature into spermatozoa. SNF2H is an important chromatin-remodeling enzyme which is critical for activating transcription of differentiation-related genes. In our study, we observed a notable phenotype in *Snf2h* conditional knockout (cKO) mice, characterized by a reduced number of differentiating spermatogonia, suggesting an essential role of SNF2H in facilitating the transition from undifferentiated to differentiated spermatogonia. To better understand the molecular mechanisms, we performed ATAC-sequencing and found the binding sites for two important transcription factors, DMRT1/6, became closed in *Snf2h* cKO. This finding suggested a potential relationship between SNF2H and DMRT1/6 in chromatin remodeling during spermatogonial development. Given that DMRT6 is not expressed in undifferentiated spermatogonia, we aim to use immunostaining to delineate the stages of development at which DMRT1 and SNF2H are expressed. To validate the protein-protein interaction between DMRT1/6 and SNF2H, we are performing co-immunoprecipitation assays. Our research aims to shed light on the molecular mechanisms governing spermatogonial stem cell differentiation, particularly emphasizing the dynamic interplay between transcriptional regulation and chromatin architecture.

Isolation and Characterization of a Bacteriophage Targeting the Model Phyllosphere Colonizer *Pantoea agglomerans* 299R

Yousuf Mustafa
Sponsor: Johan Leveau, Ph.D.
Plant Pathology

Pantoea agglomerans 299R (*Pa*299R) is a model organism for the study of bacterial colonization of the phyllosphere (plant leaf surfaces). A unique feature of *Pa*299R is the ability to form multicellular clusters called symplasmata. We hypothesize that these symplasmata provide protection against bacteriophage infection. Testing this requires the isolation of a *Pa*299R-specific phage. To this end, foliage from a *Pistacia chinensis* tree on the UC Davis campus was collected as source material, submerged in distilled water, and filtered to remove plant matter and microbes but retain phages. These filtrates were incubated for 3-5 days in *Pa*299R liquid cultures to enrich for *Pa*299R-specific phages, filtered to remove bacteria, then spotted on lawns of *Pa*299R. Plaque formation was monitored over the next two days, and individual plaques were picked and suspended in LB liquid media, serially diluted and tested in a standard plaque assay. Through this, we obtained phage preparations with a concentration of $2x10^{10}$ plaque-forming-units per milliliter. The phage's genome is currently being sequenced and annotated and compared to that of known phages of other *Pantoea* species and strains.

Lipoprotein(a) and Sugar: Effect of Consuming Sugar-sweetened Beverages on Lipoprotein(a) levels among Overweight and Obese Individuals

Munkhtuya Myagmarsuren
Sponsor: Enkhmaa Byambaa, M.D.,Ph.D.
MED: Int Med - Endocrinology

An elevated level of lipoprotein(a) [Lp(a)] is a genetically-regulated risk factor for cardiovascular disease. A size polymorphism in the apolipoprotein(a) [apo(a)] gene is the major genetic regulator of Lp(a) levels. Beyond genetics, evidence suggests diet influences Lp(a) levels. In this randomized, parallel-arm study among 32 overweight/obese participants, we investigated the effects of consuming 25% of energy requirement for 10 weeks from glucose- or fructose-sweetened beverages on Lp(a) levels. The mean age was 54 years, 50% were women, and 75% were of European descent. The mean BMI was 29 kg/m^2; 28% had metabolic syndrome. At the end of the study, Lp(a) levels decreased by an average of -13%, with the glucose group showing -15% reduction and the fructose group -11% reduction. Notably, the mean percent changes in Lp(a) levels were similar in carriers (-15%) vs non-carriers (-13%) of an atherogenic small apo(a) size. In conclusion, overweight/obese adults who consumed sugar-sweetened beverages for 25% of their energy requirement for 10 weeks experienced a reduction of ~13% in Lp(a) levels, independent of apo(a) sizes. These findings add to the growing evidence that diets impact Lp(a) levels.

Aberrant Mitochondrial Morphology in Age-Related Macular Degeneration

Maya Nair
Sponsor: Cecilia Giulivi, Ph.D.
VM: Molecular Bio Sciences

Age-Related Macular Degeneration (AMD) is a retinal disease that leads to central vision loss. The disease manifests as an accumulation of lipid and proteins plaque in the form of extracellular lipid deposition known as drusen or intracellular lipid accumulation presenting as punctate lesions, culminating in macular degeneration. Primates are the only mammals to possess maculae essential for sharp central vision, making them crucial models for AMD research. The macula, rich in mitochondria, is susceptible to environmental influences (such as sunlight exposure and dietary habits) and genetic factors that may contribute to mitochondrial damage, influencing the onset and progression of degeneration. To investigate, we analyzed mitochondrial morphology in retinal pigment epithelial cells of healthy rhesus macaques versus those with drusen or punctate lesions. Our findings revealed disrupted mitochondrial morphology in AMD samples, particularly those with drusen or punctuated deposits, exhibiting blunted fusion, a more circular shape, and diminished content compared to normal animals. These observations shed light on the potential role of mitochondrial dysfunction in AMD. Understanding this mechanism could guide the development of future treatments and preventive strategies targeting mitochondrial aspects of AMD.

TANF Spending Overtime: Why Texas and Arizona Spend Their Block Grant on Child Welfare Instead of Cash Assistance

Nishita Nair
Sponsor: Drew Halfmann, Ph.D.
Sociology

I set out to explore how states vary in how they allocate money for TANF related programs and how state legislation reflects these variations. States have almost complete discretion in how they spend their block and are able to do so with little oversight. Welfare scholars have aimed to explain the variations in spending using blanket theories. Through my research I hope to reveal that the story is much more complicated by doing a case study on TANF in Arizona and Texas. I gathered quantitative TANF expenditure data from Texas and Arizona from 2005 t0 2019. I also reviewed all the relevant passed legislation regarding TANF spending from 1996 to 2019 in each of the states and at the federal level. Finally, I compiled news articles from local sources in Texas and Arizona from 2005 to 2019 to understand the local norms surrounding welfare. My preliminary analysis has revealed that Texas and Arizona spend a disproportionate amount of their TANF budgets on child welfare and exceedingly little on basic assistance. While Arizona's spending seems to be culturally driven, Texas' spending patterns look like a product of bureaucratic fragmentation. These results have implications for future TANF policy and research.

Somatic Variant Calling on High Depth Bulk and Single Cell RNA Sequencing Data From the Prefrontal Cortex

Aruna Nannapaneni
Sponsor: Gerald Quon, Ph.D.
Molecular & Cellular Bio

While germline mutations have been more thoroughly investigated, the role of somatic mutations particularly in brain tissue and neurodevelopment has been less pronounced.This project intends to compare somatic mutation patterns from the prefrontal cortex of both unaffected individuals and those diagnosed with schizophrenia to identify any differential patterns of somatic mosaicism. We apply a somatic variant calling pipeline developed by Stanford's Fraser Lab to analyze high-depth bulk RNA sequencing data; the pipeline aligns input reads to the reference genome and filters germline cells and artifacts to retrieve only somatic mutations. Additionally, we utilize a single nucleotide variant calling tool called Monopogen, created by the Chen Lab at MD Anderson to identify single-cell nucleotide somatic variants by utilizing allele cosegregating patterns at the cell population level. We intend to analyze patterns of somatic allele frequencies to reconstruct the developmental history of the prefrontal cortex, similar to how cancer genomics data can be leveraged to make inferences of tumor clonal evolution. Ultimately, these inferred developmental histories can be compared between cases and controls to test the hypothesis that there are differences in the developmental histories of the cases and controls and uncover the early developmental origins of disorders that emerge later in life.

Investigating the Localization of Pancreatic Polypeptide Cells Within Mouse and Human Pancreatic Tissue Sections

Pierre Napaa
Sponsor: Mark Huising, Ph.D.
Neuro Physio & Behavior

The pancreatic islets of Langerhans are clusters of endocrine cells that are essential in regulating blood glucose levels through the secretion of hormones that act locally in the islet and at peripheral tissues. Dysfunction of islet hormone secretion leads to metabolic disorders including diabetes, affecting more than 30 million individuals in the United States. Interestingly, when quantifying islet composition from immunostained human pancreatic tissue sections, we found a subpopulation of cells positive for a maturity marker called Urocortin-3 (Ucn3) but were not alpha or beta cells. Reviewing transcriptomic data, we found another cell type called pancreatic polypeptide (PP) cells that also express Ucn3. Relative to alpha and beta cells, very little is known about PP cells. Our hypothesis is that these unknown, Ucn3 positive only cells are PP cells. We use immunofluorescence to identify beta (insulin), PP (ppy), alpha (glucagon) and/or Ucn3 positive cells in both mouse and human pancreatic tissue. We imaged these immunostained tissues using confocal microscopy to qualitatively determine the location of PP cells in the pancreas and whether the unidentified, Ucn3 positive only cells are indeed PP cells. Understanding the location of PP cells will help reveal their potential role in helping regulate nutrient homeostasis.

Computational Design of $Na_V1.8$ Sodium Channel Inhibitors as Novel Non-Addictive Analgesics

Kush Narang
Sponsor: Vladimir Yarov-Yarovoy, Ph.D.
MED: Anesth & Pain Medicine

The management of acute and chronic pain is an important objective in healthcare. Opioids are the leading approach to managing chronic pain. However, widespread addiction and overdoses underscore the urgent need for new approaches to pain management. There are nine voltage-gated sodium (Na_V) channel subtypes involved in distinct physiological processes ranging from muscle contraction to heartbeat. The $Na_V1.8$ channel plays an important role in the action potential generation and transduction of both neuropathic and inflammatory pain signals. An effective analgesic must demonstrate high subtype-selectivity for $Na_V1.8$ to prevent side-effects. Analgesics that can potently and selectively inhibit $Na_V1.8$ channels have potential to be non-addictive, effective, and safe therapeutics. We hypothesize that de novo designed mini-proteins (binders) targeting $Na_V1.8$ will inhibit channel function and limit pain sensation. These binders are hypothesized to have a high potency and subtype selectivity for $Na_V1.8$. Here, we leverage cutting-edge deep-learning based computational protein design methods to generate novel binders to trap $Na_V1.8$ into a non-functional state. The most-promising binders will be experimentally characterized with electrophysiology to validate computational models. These results will help optimize the binder design process and motivate the development and optimization of clinically-relevant, non-addictive analgesics.

LDHA-Mediated Lactate Overproduction Promotes Smooth Muscle Remodeling and Pulmonary Arterial Hypertension

Sanjana Neeli
Sponsor: Elena Goncharova, Ph.D.
MED: Int Med Pulmonary (sac)

Pulmonary arterial hypertension (PAH) is a complex, progressive disease characterized by remodeling of small pulmonary arteries (PAs). Remodeling occurs due to abnormal proliferation and survival of PA smooth muscle cells (PASMCs), endothelial cells (PAECs), and adventitial fibroblasts (PAAFs). A metabolic shift to glycolysis in PASMCs from PAH lungs supports a hyper-proliferative, apoptosis-resistant phenotype and results in over-production of lactate, the role of which remains unclear in PAH. We report here that lactate dehydrogenase A (LDHA) was overexpressed in the smooth muscle (SM) of small PAs from lungs of patients with PAH and mice with SU5416/hypoxia (SuHx)-induced PH. Early-passage human PAH PASMCs, but not PAECs or PAAFs, had significantly higher LDHA protein levels compared to control cells, which was associated with the significant increase in intracellular lactate levels and unstimulated hyper-proliferation. *In vitro*, reduction of lactate production by siRNA-induced depletion of LDHA suppressed proliferation and induced apoptosis in human PAH PASMC. Importantly, lactate supplementation prevented these effects. *In vivo*, mice with SM-specific LDHA knockout were protected from SuHx-induced pulmonary vascular remodeling, PH, and right ventricular hypertrophy. Collectively, these data strongly suggest that the LDHA-lactate axis represents an attractive therapeutic target to treat PASMC hyper-proliferation, remodeling, and overall PAH.

Exhibiting the Erotic: Erotic Japanese Prints from the Edo Period (1700 to 1820) & How and Why Shunga Should Be Displayed

Isabel Nelson
Sponsor: Alexandra Sofroniew, Ph.D.
Classics

Shunga Japanese prints are typically pushed aside because of their initial onanistic purposes or lost within the broader label of 'art.' This project seeks to disrupt the erasure of Shunga and to put together a sensible and practical blueprint to display Shunga in museums. This project will contextualize the material for a museum audience by pairing Shunga works with non-shunga works by the same artist or in the same styles and techniques. Further contextualization will be offered by framing Shunga within narratives. By showcasing six pairs of prints, one Shunga and one non-Shunga in each pairing, I will demonstrate how Shunga was intimately integrated into the form of Japanese printmaking. Focusing on a sample of twelve prints, six Shunga and six non-Shunga works by the same artists, I argue that these prints should be displayed and valued not only for their onanistic purposes but also for their rightful place within the genre of Japanese prints. I will create an exhibition blueprint which will contain a section about the technique of printmaking, a section about responses to Shunga, and a section addressing how to display this sexually explicit material, and how to adapt it for different museum spaces.

Predictive Modeling Reveals a Concern for Zinc Deficiency in First-Year, Female Vegetarian UC Davis College Students

Claire Nelson-Torakawa
Sponsor: Andrew Hall, Ph.D.
Nutrition

Zinc is an essential micronutrient and is a common deficiency. US Dietary recommendations do not account for reduced zinc bioavailability of plant-based diets. Our objective was to estimate zinc absorption of a vegetarian, female UC Davis first-year college student living in student housing and explore the potential effects of reduced phytic acid on zinc bioavailability. We based our calculations of zinc absorption on a dietary pattern recommended by the UC Davis Dining Commons (DC), assuming an 18 year old female. We calculated the zinc, protein, and calcium content based on values from the USDA Database of Standard Reference and phytate based on World Health Organization values. We calculated zinc absorption using Miller's 2013 model with and without phytate reduction. We estimated risk for zinc deficiency in relation to the Institute of Medicine physiological requirement for absorbed zinc. We found phytate content decreases zinc bioavailability of the recommended UC Davis diet. Phytate reduction would decrease the risk for zinc deficiency of female vegetarians consuming the recommended DC diet. This predictive modeling indicates a concern for zinc deficiency and, given the importance of zinc in health, warrants further research on the potential for zinc deficiency in this population.

Using Video Games to Introduce College-Level Engineering Design

Adele Newcomb
Sponsor: Angelique Louie, Ph.D.
Biomedical Engineering

With many students leaving their engineering major in the first two years of their degree, disproportionately impacting students in underrepresented groups, we aimed to find a way to foster a more engaging introduction to the field for engineering students. Thus, we developed eGames - a virtual and accessible way to expose students to engineering design concepts. We surveyed 1,022 students and measured changes in their responses to questions relevant to their knowledge and comfort level as engineering students. Five different questions were asked before and after the game, posed to gauge understanding and responsiveness to the experience. The students responded to each prompt on a five point Likert scale. We wanted to identify the impact the game had on students, and if it was stronger in different demographic groups. My role was performing statistical analyses on the data; I found the average scores within each group before and after playing the game, measuring the overall difference in scores, and performing t-tests to confirm statistical significance. While each group displayed an increase in their agreement with each of the questions asked after the game, we found very statistically significant results in specific groups with certain questions, showing significant improvements in responses.

Glucosinolate Natural Variation

Tiffany Ng
Sponsor: Dan Kliebenstein, Ph.D.
Plant Sciences

Glucosinolates (GSL) are specialized metabolites involved in plant response systems for defense and signaling pathways. They alter plant resistance to many pests and other organisms, and they're typically found in arabidopsis, cruciferous plants, and brassica. The purpose of this study is to recreate the natural knockout variation of GSL genes in fully functional accessions and observe these genes and their influence on fitness. Using CRISPR CAS9, we created knockout mutants, and we then selected and planted a variety of the knockout genotypes. We removed the transgene by performing backcrosses and screened new T1 plants to run on high-performance liquid chromatography (HPLC). We then selected promising chemotypes from HPLC data and performed amplicon sequencing to obtain genotype information. We used accessions that have diverse genetic backgrounds (chemotypes) with different combinations of active GSL genes to create the knockouts. Although we know that specific genes affect fitness, we do not know the specific effects of the knockouts. Therefore, future research will measure the complex effects of each combination of GSL genes and individual components of fitness.

Integrin Signaling Pathway in Long-Lived Ames Mice

Ethan Ng
Sponsor: Aldrin Gomes, Ph.D.
MED: Physiology & Membrane Biol

Ames dwarf mice are commonly employed in laboratory settings to investigate the mechanisms behind extended longevity. These mice exhibit a prolonged lifespan compared to their wild-type counterparts within the same genetic background. Through proteomics analysis, researchers have identified alterations in the Integrin Signaling Pathway in Ames dwarf mice when compared to wild-type mice. Integrins are cell adhesion receptors that interact with the extracellular matrix. They help control the intracellular signaling caused by the extracellular matrix. This includes controlling cell shape, mobility, and the process of the cell cycle. In the context of this Integrin signaling pathway, Parva, Parvb, several collagens (1a1, 1a2, 5a1, 6a6), and several laminins (alpha 2, 4, beta 1, gamma 1), filamin A, integrin subunit beta 1 and vinculin were upregulated in Ames mouse hearts. Mutations in the laminin subunit alpha 2 gene result in the deletion of certain parts of the laminin-?2 protein, one of the most common causes of LAMA2-related congenital muscular dystrophy. A decrease in the laminin-?2 disrupts the basal lamina, which leads to an increased likelihood of mechanical stress and myofiber damage inside the muscle. The upregulation of the laminin-2 protein suggests that Integrin signaling may prolong longevity due to preventing disease progression.

Characterizing Human PAX6 C-Terminal Extension Mutations

Nathan Ng
Sponsor: Tom Glaser, M.D.,Ph.D.
MED: Cell Biology & Human Anat

PAX6 is an evolutionary conserved transcription factor that acts as a master controller for eye development. Heterozygous mutations in the PAX6 gene lead to various ocular defects, most notably aniridia, characterized by partial or complete loss of the iris. Although most PAX6 mutations are null alleles, some missense mutations in the PAX6 paired domain alter its DNA binding specificity leading to a more severe phenotype: microphthalmia (small eyes). Therefore these are considered to be dominant-negative alleles. Conversely, C-terminal extension (CTE) mutations extend the PAX6 polypeptide past the normal stop codon in a particular reading frame (0, +1, or +2), which determines the amino acid length, stability of the protein, and ultimately the severity of disease. Some CTE alleles may have dominant-negative effects. However, due to the homopolymeric tract that follows the stop codon, it has been difficult to determine the CTE reading frame for these mutations. Here we aim to characterize CTE mutants *in vitro* through molecular cloning, site-directed plasmid mutagenesis, *in vitro* transcription and translation, HEK293T cell transfection, Western blotting, and cycloheximide pulse-chase analysis, in comparison to wild-type PAX6. The results will be valuable in helping us gain a better mechanistic understanding of the phenotypic range in different patients.

CaMKIIdelta regulates the obese HFpEF phenotype in mice

Megan Ngim
Sponsor: Donald Bers, Ph.D.
MED: Pharmacology

Calcium/calmodulin-dependent protein kinase IIdelta (CaMKIIδ) regulates multiple cellular processes, including ion channel function and gene transcription. Upregulation of CaMKIIδ has been associated with heart failure (HF), hypertrophy, and arrhythmias. CaMKIIδ knockout (KO) and CaMKII inhibition were cardioprotective following myocardial infarction and in HF with reduced ejection fraction. CaMKIIδ has recently also been implicated in HF with preserved ejection fraction (HFpEF). We aimed to characterize the role of CaMKIIδ in HFpEF using a translational two-hit mouse model that combines metabolic and hemodynamic stress. This established model involves a 15-wk treatment with high-fat diet (HFD) and nitric oxide inhibitor L-NAME. We found that global CaMKIIδ-KO mice gained more weight and had higher blood glucose levels than wild-type (WT) mice. Mice in which CaMKIId lacks 2 critical regulatory methionine oxidation sites (a knock-in that mutates MM281/282VV) subjected to the HFD+L-NAME treatment gained much less weight than WT or KO and prevented cardiac hypertrophy seen in WT and KO mice. We will extend our studies to assess the heart function using echocardiography and will use cardiac-specific CaMKIIδ-KO mice to define extracardiac CaMKIIδ effects. These results highlight important unappreciated metabolic effects of CaMKIIδ and the potential therapeutic benefit of targeting the posttranslational regulation of CaMKIIδ.

Analysis of Previous Cardiopulmonary Clinic Data to Improve Patient Cardiopulmonary Healthcare Services

Hao Ngo
Sponsor: Ronald Jan, M.D.
MED: Surgery

Cardiovascular and pulmonary diseases are prominent health problems in underserved communities due to limited access to proper healthcare, language barriers, financial difficulties, and being uninsured. The Cardiopulmonary Committee of Paul Hom Asian Clinic was founded in 2015 to provide free cardiopulmonary assessments to those in the underserved community. This project aims to improve the health monitoring progress and treatments of patients enrolled in Cardiopulmonary Specialty Clinic through use of an established database. Data was gathered from patients' lab tests between 2015 and 2022 and averages were generated from patients entering our specialty clinic per year. Patient entries (n=102) consist of ages ranging from 17 to 77 years old. 68 patients were male and 34 were female. Findings indicate slightly elevated mean LDL and above-normal mean HDL among patients. Additionally, higher-than-normal fasting glucose and elevated BMI values in Asian patients raise concerns about potential cardiovascular and pulmonary risks. The database will permit improved patient follow-ups, monitoring of health progress, and potential interventions to address recognized health indicators; furthermore, the demographic and vitals data can be used to identify future cardiopulmonary patients at the clinic.

Integrating Biologically Inspired Solutions into Engineering Practices

Phuong Nguyen
Sponsor: Daisuke Sato, Ph.D.
MED: Pharmacology

To ensure the quality and reliability of engineering systems, traditional engineering principles have yielded precise results through meticulous measurements of product design and manufacturing. However, living systems, such as the human body, achieve incredible precision without using explicit measurements. This leads to exploring the merging of the design principles of biological systems into engineering applications. By drawing inspiration from the stochasticity and randomness inherent in nature, we aim to solve engineering challenges, leading to the development of more reliable and adaptable systems. This study considers the practical engineering challenge of gear backlash, which is the loss of movement when the gear changes direction. By incorporating numerous projections with random sizes and locations, we demonstrate the elimination of backlash by adding desirable and probabilistic noise to the system. The potential impact extends beyond gear systems, as this approach may also pave the way to solve other engineering problems in a similar fashion.

Calmodulin-Dependent Kinase II Regulation by Methylation

Brian Nguyen
Sponsor: Julie Bossuyt, D.V.M.,Ph.D.
MED: Pharmacology

In animal models, increased activity of Calmodulin dependent protein kinase II (CaMKII) has been linked to several cardiovascular diseases such as arrhythmia and heart failure. Several post-translational modifications including autophosphorylation, S-nitrosylation and O-GlcNAcylation have been shown to autonomously activate CaMKII. A recent study suggests that PRMT1 ablation leads to heart failure via autophosphorylation of CaMKIId from alanine substitutions at sites R9 and R275 resulting in CAMKII hyperactivity. The exact molecular mechanism of CaMKIId regulation by methylation is unclear. Here we used RG-Camui, a FRET-based biosensor, to measure CaMKII activation state in cardiomyocytes using donor GFP fluorescence lifetime (FLT). We found that in both HEK and adult rabbit cardiomyocytes (ARCM) cells, PRMT1-specific inhibitor furamidine and type I PRMT inhibitor MS023, lowered lifetimes, indicative of a less active CaMKIId conformation. Our results so far suggest that CaMKII demethylation limits CaMKIId activation, which differs from the previous study. We also found that methylation mimetic variants R275F and R275K and Adomet, a methyl donating drug, show no change in activation from the Wild-Type at baseline, suggesting the residue 275 might already be methylated at baseline. Additional studies are needed to better understand the role of CaMKII methylation in physiological and pathological conditions.

Communication in Healthcare: The Missing Pieces

Theresa Nguyen
Sponsor: Angela Morris, Ph.D.
University Writing Program

This conference presentation utilizes a data collection set of 1-Star Google reviews from Kaiser Permanente, Dignity Health, and Sutter Health facilities in the Sacramento area to discuss inequitable health care practices for patients. This data was binary-coded using grounded theory to investigate causes of the poor reviews. The data was coded based on the following established categories: Structure/Organization, Financial, Uncleanliness, Poor Communication, and Other. With communication breakdowns being the primary reason individuals have unpleasant experiences with healthcare, this presentation addresses inequitable communication practices in the healthcare system. This presentation highlights the impact of health and medicine rhetorics in patient care and ultimately argues that the role of "providers" spans beyond physicians, and encompasses all medical care staff who interact with patients. This argument for a collective responsibility seeks to prompt further discussions of employee training standards and communication responsibilities in order to foster a more inclusive environment for patients.

Investigating the Role of Adenylyl Cyclase 6 in Regulating Insulin Secretion in Pancreatic Beta Cells

Jace Nguyen
Sponsor: Mark Huising, Ph.D.
Neuro Physio & Behavior

Type 2 Diabetes (T2D) affects 462 million individuals globally and is the eighth leading cause of death in America. It is characterized by improper insulin secretion from beta cells and disrupts glucose homeostasis. Incretins are hormones released by intestinal endocrine cells that then activate receptors on beta cells and increase insulin secretion threefold. Downstream of incretin receptor activation, adenylyl cyclases (AC) are activated and produce the secondary messenger cAMP to recruit insulin to the membrane for secretion. Limited knowledge exists on the main adenylyl cyclase isoform that drives incretin-mediated insulin secretion. Our lab's RNA sequencing data reveals adenylyl cyclase 6 (AC6) as the most highly expressed out of ten isoforms in beta cells. I hypothesize that adenylyl cyclase 6 is the main AC isoform important for incretin-mediated insulin secretion. To test this, I will isolate beta cells from AC6 knockout and wildtype mice and perform an ex vivo insulin secretion assay. After collecting the supernatant, I will conduct a Lumit immunoassay to quantify insulin levels from AC6KO and WT beta cells. Understanding the mechanisms of insulin secretion is crucial for advancing our knowledge of diabetes and developing treatments that are effective but also adaptable to diverse patient scenarios.

Suction Boundary Layer Effect on Flow Separation through Laminar Separation Bubble Dynamics for Enhanced Wind Turbine and Airfoil Design

Tien Lam Nguyen
Sponsor: Camli Badrya, Ph.D.
Mechanical & Aerospace Engr

The utilization of wind energy has gained significant momentum in recent years, driving advancements in wind turbine technology, particularly in the design of wind turbine blades. These blades are subject to a flow regime where the aerodynamic efficiency is governed by the laminar separation bubble, which can lead to flow separation. Flow separation poses a significant challenge in airfoil design, leading to increased drag, reduced lift, and decreased overall efficiency. While the shape of wind turbine blades have been well optimized to combat flow separation, active flow control seeks to further increase the efficiency of wind turbines, particularly through the use of boundary layer suction. This study dives into understanding the physics of laminar separation bubbles and how active flow control can help alleviate its negative effects and improve aerodynamic efficiency. Moreover, practical implications for the design and optimization of airfoils in wind turbine and general aviation can be utilized through the insights the research provided. Through the use of low fidelity model, computational and numerical methods, characteristics of laminar separation bubble and its impact can be explored, further study on flow control optimization and aviation applications can be progressed.

Thermal Dynamics of Aggression: Analyzing Temperature-Driven Patterns in Common Tern (*Sterna hirundo)* Behavior

Joey Nguyen
Sponsor: Elisha Hull, Ph.D.
Animal Science

Seabirds are important members of both marine and shoreline ecosystems, and understanding the abiotic factors that influence them can prove vital towards conservation efforts. As global temperatures rise and become increasingly variable, it is crucial to uncover relationships between temperature and avian welfare. Previous studies have examined the impact of temperature on various avian health factors, but the relationship between temperature and behavior is under-researched. Behavioral cues are important towards colonial lifestyles that Common Terns have, as they facilitate predatory defense, family-rearing, and other factors of colony cohesion. I coded aggressive displays from a colony of Common Terns and analyzed them against temperatures on Stratton Island, Maine, where the colony is located, using a linear mixed models approach. I hypothesized that aggression will vary with temperature, depending on the time of day. Specifically, I predicted that in the mornings, hotter temperatures would yield increased aggression per nest. At noon and evening, hotter temperatures would yield less aggression per nest. This would result from a potential “thermal optimum”, which is an ideal temperature range where the frequency of behavior would be at its highest due to lack of abiotic stress factors such as heat or chill.

Creatures and Confidentiality in Charles Brockden Brown’s *Edgar Huntly*

Cindy Nguyen
Sponsor: Michael Ziser, Ph.D.
English

Written shortly after America’s founding, Charles Brockden Brown’s 1799 novel *Edgar Huntly* uses animals and animalistic humans to determine the boundaries between property and wilderness on the American frontier. Its bizarre, hallucination-like story is told through the perspective of Edgar Huntly, who becomes both more animalistic as a character and less reliable as a narrator as the story progresses. At the narrative climax, nearly naked after sleepwalking into the woods, Edgar Huntly brutally kills and devours a panther. I argue that this battle represents not only a fight for survival but also symbolizes a battle for property and privacy. The struggle between animalistic humans like Clithero and Edgar Huntly and the panther and Old Deb’s dogs mirrors the struggle for belonging between Native Americans, new immigrants, and settlers. Brockden’s novel uses land struggles to expose the social hierarchy of the time, revealing which groups were deemed more deserving of privacy and property rights.

Myoglobin as a Cytochrome: An Exploration into the Electron-Transfer Capabilities of Myoglobin

Katelyn Nielsen
Sponsor: Thomas Jue, Ph.D.
MED: Biochem & Molecular Med

Biochemistry textbooks assert myoglobin (Mb) provides O_2 during hypoxia or ischemia, facilitates O_2 transfer from sarcolemma to mitochondria, and does not behave as a cytochrome to transfer electrons. However, Mb makes no significant contribution as an O_2 reservoir or facilitator of O_2 transport. Mb enters mitochondria of skeletal muscle cells and interacts with cytochrome c oxidase (complex IV) subunit 4 (COX4). We hypothesize that Mb can transfer an electron to the respiratory chain. This study aims to determine whether Mb can transfer an electron to cytochrome c and whether the transfer mechanism is mediated by O_2. Three reduction-oxidation (redox) reactions were carried out spectrophotometrically: MbO_2^{2+} and cytochrome c^{3+}, $deoxyMb^{2+}$ and cytochrome c^{3+}, and $MbCO^{2+}$ and cytochrome c^{3+}. MbCO does not transfer an electron. However, MbO_2 does. It yields a kinetics time to half-completion ($t_{1/2}$) of 5 minutes. With no O_2, the deoxyMb reaction yields the fastest rate ($t_{1/2}$ = 0.9 minutes). Thus, Mb transfers an electron to cytochrome c. O_2 does not mediate the reaction. In the low O_2 environment of the mitochondria, Mb could transfer an electron and could function as a cytochrome.

Perception and Attitudes Towards Research Findings in Social Media Versus General News

Yuri Nishii
Sponsor: Alison Ledgerwood, Ph.D.
Psychology

Social media has increasingly been used to communicate scientific findings to a wider audience. Existing research suggests a higher percentage of viewership of news through social media, however there is a need for empirical research on the viewers' attitudes towards them. Our study aims to assess perceptions of scientific findings when they are viewed in a social media format versus a general news article. Participants will be asked to take a series of questionnaires through Qualtrics, assessing their trust and interest in scientific findings. Trust will be defined by the article's perceived credibility and a participant's likelihood of sharing the news, measured using Likert-type scales. Interest will be assessed by a participant's time spent on a post or article, how well they understood the research, and their likelihood of doing further research. Utilizing graphic design elements to feign the presentation of social media and news articles, this study aims to measure trust and interest in scientific research when it is communicated over different platforms. We hypothesize that research findings presented on news platforms will gain more trust while those presented on social media will gain more interest. Our results may provide insight into more effective scientific communication.

The Characterization of *Juniperus scopulorum* Karrikin Insensitive 2

Caytlyn Noble
Sponsor: Nitzan Shabek, Ph.D.
Plant Biology

Wildfires on the west coast are happening more frequently, therefore destroying a large percentage of trees and bushes. However, some environments benefit from wildfires and can cause more trees to grow. Karrikins, produced from the combustion of cellulose, are able to initiate seed germination. Karrikins bind to Karrikin Insensitive Protein 2 (Kai2) and cause a protein named SMAX 1 to be degraded. The discovery of Karrikins and KAI2 proteins is very recent, therefore KAI2 is mainly studied in *Arabidopsis Thaliana*. The aim of the study is to show whether the structure of Juniperus Scopulorum Karrikin Insensitive 2 (JsKAI2) is similar to *Arabidopsis thaliana* Karrikin Insensitive Protein 2 (AtKAI2). This information can be used to help fight deforestation by increasing the rate of seed germination. To show how similar JsKAI2 is with ATKAI2, biochemical assays can be done to analyze the difference in catalytic activity between the two proteins. Crystallization will determine the three- dimensional structure of JsKAI2, allowing analysis of the active site.

Nectar Microbes Are Differentially Affected by Early Arriving Competitors

Helen Noroian
Sponsor: Rachel Vannette, Ph.D.
Entomology/Nematology

Priority effects occur when an early-arriving pioneer species modifies an environment and subsequently impacts the growth of later arriving species. Microbes that live in floral nectar are an interesting system to study priority effects because they often arrive sequentially and the nectar environment is physiologically harsh. To investigate whether priority effects occur in a nectar microbe model system, two known floral bacteria, *Acinetobacter pollinis* and *Lactobacillus kunkeei,* and one yeast, *Metschnikowia reukaufii,* were grown separately in cups of artificial nectar solution. Immediately after inoculation, the nectar was plated on three types of microbe-specific growth media to get an initial count of the pioneer species. After one day of incubation to allow pioneers to establish, the two other later arriving microbes were added to each nectar cup, plated on growth media immediately and two days after inoculation, incubated, and counted. We observed priority effects for both *L. kunkeei* and *A. pollinis*, with differences in growth depending on the initial pioneer species. However, *M. reukaufii* did not experience differences in growth, which suggests it can withstand changes introduced by the pioneer species. Ultimately, elucidating priority effects at the microbial level will increase our understanding of community dynamics in other ecological contexts.

Assessing whether the absence of the synaptonemal complex results in aneuploid offspring in zebrafish

Kasally Nour
Sponsor: Sean Burgess, Ph.D.
Molecular & Cellular Bio

The synaptonemal complex is a meiosis-specific proteinaceous structure that forms between homologous chromosomes to facilitate chromosome segregation for the production of sperm and eggs with the correct number of chromosomes. We have created mutant zebrafish strains in two genes that encode components of the synaptonemal complex, sycp1and syce2. sycp1 mutants fail to form a synaptonemal complex, while syce2 mutants only form short stretches of this structure. sycp1 mutant males are infertile, while sycp1 mutant females produce malformed offspring that rarely survive. Surprisingly, syce2 mutants produce predominantly healthy offspring. Our research aims to explore whether embryonic lethality in the offspring from sycp1 mutant females is due to aneuploidy, a condition characterized by an abnormal number of chromosomes. Additionally, we seek to confirm whether the healthy offspring from syce2 mutants possess the correct number of chromosomes. We will examine chromosome content by conducting metaphase chromosome spreads on 1-day old offspring. These experiments will shed light on the role of these genes in ensuring chromosome stability and embryonic viability.

Manipulation of Syllable Perception for Highly Variable Liquid Rime Words via Synthesized Acoustic Beat Stimuli

Josius Novak
Sponsor: Georgia Zellou, Ph.D.
Linguistics

Cohn and Tilsen (2015) previously established the English sesquisyllable, a class of words with variable syllable count judgments (monosyllable or greater than one syllable), is affected by English speakers' self-production. In the present study, we aim to further investigate effects on speakers' perception of the English sesquisyllable by priming via nonspeech 1-beat and 2-beat stimuli. We predicted that participants who receive a 1-beat stimulus prime would more commonly respond that the sesquisyllable is monosyllabic, while participants who receive a 2-beat stimulus prime would more commonly respond that the sesquisyllable is greater than one syllable. Our predictions were confirmed, but only in one set of participants (n=26) who tended to answer 'shorter' on sesquisyllable prompts, close to monosyllabic, on average as they showed statistical significance in how they were influenced by the prime. The participants (n=37) who responded 'longer' on sesquisyllable prompts, closer to disyllabic, tended to not be affected by the priming technique and no influence was indicated. The implications of these results suggests possible reasons for inconsistency in prior syllable priming research and holds importance in future research regarding syllabic segmentation's malleability.

Sequence, Expression & Evolutionary Analysis of ADP-Glucose Pyrophosphorylase (AGPase) in Horticultural Crops

Robert Nykodym
Sponsor: Diane Beckles, Ph.D.
Plant Sciences

ADP-glucose pyrophosphorylase (AGPase) is the important rate-limiting enzyme for starch biosynthesis in plants. Starch provides 50-60% of the calories consumed by humans, and besides its nutritional value, determines postharvest quality of horticultural crops as a primary metabolite. Cereals and tubers accumulate up to 90% of their weight as starch, while in unripen fruits and vegetables, such as tomatoes, apples, bananas, and mangoes, starch accumulates (40-60%) and is broken down to sugars contributing to quality. Therefore, fundamental knowledge of AGPase is pivotal for crop production. Early work identified functionally critical residues of potato AGPase, followed by in-vitro site-directed mutagenesis studies, created an enzyme with reduced sensitivity to feedback inhibition and enhanced heat-stability in E.coli expression systems. This knowledge serves as a foundation of subsequent crop improvement using biotechnological approaches like CRISPR-Cas9 base editing. However, the knowledge of the enzyme's structure-function relationship, the isoforms and their differential expression, or key residues that are conserved or diverged across species are still limited in horticultural crops. Here, we will perform a comprehensive bioinformatic analysis of AGPase in starch-storing horticultural crops as a starting point for modifying the enzyme's key residues.

Exploring Parental Stress Through the Lens of Acculturation: Family Social Support as Moderator

Brianna Ochoa Zavalza
Sponsor: Leah Hibel, Ph.D.
Human Ecology

Ethnic minority individuals living within the United States are influenced by both the dominant US culture and their own heritage culture, a process called acculturation. Many of these individuals struggle to reconcile the dominant US culture and their native culture which can cause stress in other areas of life, including parenting. However, emotional support from family members can buffer the effects of acculturation on parental stress. This research examines the impact of acculturation on parental stress, focusing on how family support among Mexican-American parents can be a moderating factor. Data are drawn from a longitudinal study of the development of self-regulation in roughly 200 young Mexican American children. As part of the study, mothers completed a battery of questionnaires, including the Acculturation Rating Scale for Mexican Americans, the Parenting Stress Index, and the Post-Partum Social Support Scale. We hypothesize that mainstream or native Mexican orientation will be associated with parental stress. Further, familial social support will have a buffering effect.

The Sublime and Climate Crisis

Shane O'Connell
Sponsor: Matthew Stratton, Ph.D.
English

The sublime as an aesthetic category is concerned with the vast power and scale of the natural world. It deals with that which is insurmountable or incomprehensible relative to humanity. However, as humankind's relationship to the natural world changes, so too does our relationship to the insurmountable and incomprehensible. The sublime takes its form around this historical and individual dependency. The climate crisis, in its modern instantiation, possesses inherently sublime qualities in that it far exceeds the individual in scale and temporality. The sublime thus acts, I argue, as a progenitor of the climate crisis: obscuring its effects and furthering catastrophe by making the crisis appear beyond human intervention. The climate crisis can be thought of as a synthetic sublime that is culturally produced and obscured. Understanding the sublime's role in climate change elucidates this obscurity. To make sense of this sublime influence I turn both to modern theoretical work and the Romantics' conception of sublimity.

Diverse Chinese Masculinity: Examining the Party-State's impact on Domestic Chinese Films

Olivia Olsen
Sponsor: Eddy U, Ph.D.
Sociology

In the past decade, the subject of masculinity has been widely debated in Chinese media and government, reignited through portrayals of Chinese men on screen deemed effeminate. In response to the moral panic of soft masculinity, termed as 'little fresh meat' (*xiaoxianrou*) Chinese officials seek to control popular films by censorship and controlling discourse in Chinese media. Through an analysis of six of the highest-grossing films in the domestic box office in Mainland China, this article examines how Chinese masculinity is developed and reproduced using popular media after official measures are instated. In this preliminary study, I suspect that we will find that masculinity is still increasingly diversifying, however, representations are not inclusive of men who embody feminine characteristics. Although gender portrayal is becoming increasingly diverse beyond simple gender binaries, domestic Chinese films predominantly emphasize hegemonic masculinity, reflecting an underlying hierarchy. This shift of masculinity is reinforced by the Chinese Communist Party's (CCP) policies and initiatives to strengthen China's soft power through cultural production.

Soil Carbon and Hydrological Responses to Conservation Management in California's Napa Valley Vineyards

zachary orlando-milbauer
Sponsor: Maria Lazcano Larkin, Ph.D.
Land Air & Water Resources

California's irrigated vineyards are experiencing increased drought vulnerability from groundwater depletion and a changing climate. As both a climate change mitigation and adaptation strategy, there is growing interest in stacking soil conservation practices (cover crops, no-till, organic amendments, crop-livestock integration) within vineyards due to their potential to build soil organic carbon (SOC) and thus also overall soil health. Soil organic carbon is also important for soil hydrological properties, with increased SOC levels potentially improving soil water retention. However, despite widespread soil conservation practice adoption in California vineyards, little is known about the impact of these practices on soil water storage capacity and SOC in the long term. Therefore, we assessed the SOC pools and soil-water relations in 16 vineyards in Napa County with distinct management legacies and varying soil conservation practice combinations. In summer 2023, we collected soil in vineyard alley rows at a depth of 0-40 cm within each vineyard block to quantify total SOC, particulate organic carbon and mineral-associated organic carbon fractions, and soil water characteristics. We hypothesize that greater soil conservation practice adoption will yield greater SOC and water retention, therefore serving as a dual-purpose climate change adaptation and mitigation strategy for vineyards.

Exploring Language Input Dynamics: Joint Attention and Non-Joint Attention Episodes During Naturalistic Puzzle Play

Linda Ortega
Sponsor: Lisa Oakes, Ph.D.
Psychology

Naturalistic play provides contexts for infants to reason and learn about the world. Infants' joint attention with parents is associated with longer visual attention (Deák et al., 2014). Moreover, when parents touch and talk about objects during joint attention, infants engage in even more sustained attention (Suarez-Rivera et al., 2019). However, it is unknown whether parents talk more during joint attention episodes than at other times. Particularly, we hypothesize that parents provide more language input during joint attention than when only the infant is looking at an object. To test this hypothesis, we will analyze a dataset including 53 parents and their 9-to-11-month-old infants playing with an age-appropriate puzzle while their eye-gaze was recorded with head-mounted eye-trackers. Parents were instructed to play as they would at home. We transcribed the parents' speech and coded where each play partner was looking. Joint attention episodes were identified as periods when both parent and infant were focused on any part of the puzzle. We identified episodes when only the infant was looking at the puzzle or when neither parent nor infant were looking at the puzzle. We anticipate that, on average, parents will say more words during joint attention episodes than other episodes.

Ketogenic Functional Overload

Cyril Osifo-Doe
Sponsor: Keith Baar, Ph.D.
Neuro Physio & Behavior

The ketogenic diet (KD) primarily comprises high fat, intermediate protein, and relatively low carbohydrate. A KD shifts metabolism to rely on fatty acids and ketones as primary fuel sources. Over the last decade, the KD has gained popularity as an intervention that allows athletes to lower their body weight to power ratio. However, how a KD affects skeletal muscle hypertrophy has not been thoroughly investigated. In the present study, we surgically removed the gastrocnemius and soleus muscle on a single limb of 36 male rats resulting in chronic overload of the plantaris. Thereafter, rats were put on an isocaloric control or ketogenic diet and allowed to freely roam their cages for 3, 7, or 14 days after the surgical intervention. We hypothesized that animals on a KD would show greater fiber cross-sectional area concomitant with a decrease in inflammatory response compared to the control diet-fed counterparts. Data after sample collection showed a 30-70% increase in muscle mass of the plantaris over the ensuing 3-14 days. Analysis of the cross-sectional area of muscle fibers is still ongoing to determine the ketogenic diet's impact on muscle hypertrophy.

Secularized Millennials' Values and Culture Within the Workplace

Alex O'Sullivan
Sponsor: David Mccourt, Ph.D.
Sociology

As millennials gain majority representation in the workplace, their work ethic remains understudied, yet is relevant to the present and future landscape of workplace and economic culture. Further, while previous sociological research has shown a correlation between religious practices and workplace attitude and fulfillment, the millennial generation has increasingly moved away from religious practice, especially Christianity. This study examines the relationship between the secularization of individual millennials and their work habits, focusing on a convenience sample of middle-class millennials from California, their experiences in leaving their faiths, and their present perspectives on labor. Through initial analysis of their stories, two distinct ideal types of experiences appear to emerge, a circumstantial-passive separation and a reactionary-active separation. These two methods appear to result in a fundamental distinction in respondents' rationalization of labor and their life fulfillment. Related to the stability of the connection to their religious and familial upbringing, the former category seems to have a more altruistic relationship to their labor, whilst the latter group's value rationalization is focused on leisure and personal life fulfillment. Further analysis is expected to produce a working theory and open further avenues of research regarding these relationships.

Let the Light In: Understanding Importance of Eye Size as an Indicator of Ecological Niches in Brown Rockfish

Emma Pacheco
Sponsor: Christina Pasparakis, Ph.D.
Environmental Toxicology

Thirty-two locally caught brown rockfish were given to us by the New Sea Angler in the Bodega Head region. Our study on brown rockfish (Sebastes auriculatus) delved into aspects such as size variation and the relationship between iris diameter, the cephalic, and fork length. We compared the iris diameter to the cephalic and fork length to see if there was any correlation between the two. Additionally, comparing the cephalic length in respect to brain size. As older brown rockfish tend to live deeper in the ocean, we speculated that their iris diameter should be bigger due to needing to absorb more light. Being able to absorb more light is important for fish so they can see predators as well as their food source. Due to the reliance on light absorption it's only rational to think the eyes diameter should be bigger in relation with the overall size of the fish. These investigations contribute to understanding rockfish biology and provide valuable insights that can be further explored.

Effect of Diclofenac on Cardiomyocyte Cells

Adyasha Padhi
Sponsor: Aldrin Gomes, Ph.D.
MED: Physiology & Membrane Biol

Nonsteroidal anti-inflammatory drugs (NSAIDs), such as aspirin and ibuprofen, are commonly used to manage pain, decrease inflammation & fevers, and prevent blood clots. NSAIDs have also been linked with increased risk of gastrointestinal bleeding, myocardial infarction, and stroke. Diclofenac is an NSAID used around the world associated with the highest risk of stroke & heart attacks in clinical studies and recently became available over-the-counter in a topical form in the United States. However, the mechanisms of damage by diclofenac to cardiomyocyte cells are not well understood. The goal of my investigation is to determine if physiologically relevant doses of diclofenac increase oxidative stress and cause cardiomyocyte cell damage by conducting cell culture experiments using C2C12 mouse myoblast cells. These experiments include mitochondrial membrane potential experiments, cell survival assays, western blotting, superoxide ion detection, and proteasome biochemical assays. Preliminary results show that there were significant differences in mitochondrial membrane potential assays between control & diclofenac treatment demonstrating that diclofenac-treated cells were more likely to experience mitochondrial dysfunction. Mitochondrial membrane health is associated with oxidative stress and damage, which is supported by increased levels of reactive oxygen species in diclofenac-treated cells, and this damage is associated with higher risks of stroke & heart attack.

Sex-specific Regulation of Meiotic Crossover Numbers in *C. elegans*

Pranav Padture
Sponsor: Joanne Engebrecht, Ph.D.
Molecular & Cellular Bio

Many Double Strand Breaks (DSBs) are induced in DNA during meiosis to ensure crossovers (COs) between homologous chromosomes, allowing for accurate chromosome segregation and genetic diversity. In the nematode *Caenorhabditis elegans*, CO numbers are tightly regulated in hermaphrodites, leading to one CO per chromosome pair, while in males we sometimes observe more than one CO. We hypothesized that the conversion of a single DSB into a CO is less robust in males as opposed to hermaphrodites. To test this hypothesis, we studied Crossover Site Associated - 1 (COSA-1) protein, which localizes to crossover sites and is essential for CO formation. We used a GFP fusion of COSA-1 to visualize COs. We subjected worms to varying doses of irradiation (IR) to induce different numbers of DSBs. Subsequently, we imaged the gonads with deconvolution microscopy and monitored GFP fluorescence. We measured the number of COSA-1 foci in late-pachytene nuclei of males and hermaphrodites. Preliminary results show that in contrast to hermaphrodites, there is a linear relationship between IR dose and COs in males. The results from this study will provide insight into the sex-specific regulation and robustness of COs in male *C. elegans*.

Acceptability, Feasibility, and Satisfaction of an Online Webinar Series for the Spanish, Autism Community

Alejandro Pagan
Sponsor: Emilio Ferrer, Ph.D.
Psychology

The Latino community has seen a 30% increase in diagnosed autism spectrum disorder(ASD) since 2018, making it the U.S. minority population with the largest recent increases in diagnoses. Rooted in a community-based participatory research (CBPR) approach, the use of online webinars can effectively disseminate information to underserved Latino communities. The presented study comes from a larger investigation of an intervention program for bilingual, Latino young adults (18-25 years old) with ASD. The program aims to help participants transition into adulthood while also providing support for their Spanish-speaking parents. In this study, a virtual webinar series was given to 17 Spanish-speaking Latino parents and 17 bilingual, Latino young adults with ASD. Seven topics were discussed including self-advocacy, legal rights, the transition to university, employment, internet safety, romantic relationships, finances, and social-emotional learning. Findings demonstrated between 77% to 100% acceptability, feasibility, and satisfaction from Latino, bilingual young adults and their Spanish-speaking parents. Young adults most preferred the self-advocacy webinar, while parents most preferred the legal rights webinar. Parents provided feedback that they would appreciate future webinars to include a discussion about friendships in adulthood, and young adults reported they would like a webinar discussing internships and alternate paths to college.

Plants vs. Pests: Evolutionary and Enzyme Engineering Approaches to Construct Efficient Acylsugars for Sustainable Plant Self-Defense

Deblina Pal
Sponsor: Yann-ru Lou, Ph.D.
Plant Biology

Acylsugars are specialized metabolites produced for herbivory defense in the Solanaceae family, which includes staple crops such as tomatoes. However, during domestication, crops have lost the ability to produce these natural defense compounds, making them susceptible to pest damage. To reintroduce acylsugars in agricultural applications, knowledge of their evolutionary diversity and resulting activity differences is required. Acylsugars are constructed by acylsugar acyltransferases (ASATs) which catalyze the addition of acyl chains of various lengths to a sugar backbone. Our project investigates the differences in substrate specificity between tomato (*Solanum lycopersicum*) ASAT1, which accepts a range of acyl chain lengths, and black nightshade (*Solanum nigrum*) ASAT1, which only accepts longer acyl chains. To identify the cause of these variations in activity, we utilized *in silico* protein folding to pinpoint key amino acid differences between these homologous enzymes. We performed mutagenesis and introduced *S. nigrum* mutations on a *S. lycopersicum* ASAT1 backbone. Our *in vitro* enzyme assays verified that this approach is promising, with five critical regions that need further investigation. Through understanding different ASAT1 enzyme activities, we aim to engineer more potent acylsugars for sustainable pest management. We hope to reintroduce them in cultivars for improved food safety and security.

Perception and Attitudes Towards Research Findings in Social Media Versus General News

Nithya Palakodety
Sponsor: Alison Ledgerwood, Ph.D.
Psychology

Social media has increasingly been used to communicate scientific findings to a wider audience. Existing research suggests a higher percentage of viewership of news through social media, however there is a need for empirical research on the viewers' attitudes towards them. Our study aims to assess perceptions of scientific findings when they are viewed in a social media format versus a general news article. Participants will be asked to take a series of questionnaires through Qualtrics, assessing their trust and interest in scientific findings. Trust will be defined by the article's perceived credibility and a participant's likelihood of sharing the news, measured using Likert-type scales. Interest will be assessed by a participant's time spent on a post or article, how well they understood the research, and their likelihood of doing further research. Utilizing graphic design elements to feign the presentation of social media and news articles, this study aims to measure trust and interest in scientific research when it is communicated over different platforms. We hypothesize that research findings presented on news platforms will gain more trust while those presented on social media will gain more interest. Our results may provide insight into more effective scientific communication.

Comparing the Relationship Between Complex Speech Sounds and Auditory Scenes in Recollection and Familiarity

Hannah Pallapati
Sponsor: Andrew Yonelinas, Ph.D.
Psychology

Prior research has established that visual forms of working memory are supported by recollection and familiarity, however, whether these processes also contribute to auditory working memory remains unclear. In this study, we examine auditory working memory for pure tones, complex speech (i.e., pitch, syllable, and location), and auditory scenes. For each paradigm, 24 young adults were given an auditory change-detection task where sounds were presented one after another. Participants were tasked with making confidence judgments indicating whether the sounds were the same or different, and Receiver Operating Characteristics (ROCs) were used to analyze performance. The results indicated that in each paradigm we examined both recollection and familiarity contributed to auditory working memory. Future studies will utilize these paradigms to examine the effects of aging and neurological disorders such as medial temporal lobe amnesia on the neural processes supporting auditory working memory. Additionally, future studies will examine differences in change detection performances between confidence judgments and binary responses (i.e., “perceive” or “sense”).

Characterizing Tomato Exodermis Suberization in *sltf2* Stable Knockout Mutants

Yingzhou Pan
Sponsor: Siobhan Brady, Ph.D.
Plant Biology

Suberin is a polymer composed of phenylpropanoid-derived aromatic and aliphatic compounds that is present between primary cell wall and plasma membrane. It is deposited in the tomato root exodermis cell type that lies underneath the epidermis. It has been shown that root exodermis suberin is important for the drought tolerance in tomato, however how exodermis suberin deposition is genetically regulated remains unknown. Initial screenings of exodermis-enriched genes revealed candidate transcription factors that may be involved in this process, specifically *SlTF2*. Preliminary *sltf2* mutant hairy root assays showed reduction in exodermis suberin, however its function has not been validated in stable transgenic plants. Here, we use stable *sltf2* knockout mutant tomato plants to test whether this gene is necessary for suberin deposition in the tomato root exodermis. Understanding the role of *sltf2* in root suberization can aid in the development of drought-tolerant plants, and thus further agricultural development and environmental conservation.

Preparing Justice-Oriented Professionals: A Case Study on Redlining, Air Pollution, and Cardiovascular Disease

Ethan Pang
Sponsor: Brie Tripp, Ph.D.
Neuro Physio & Behavior

National mandates to decrease healthcare disparities have reverberated for decades within the medical community. However, medical implicit biases and a lack of critical consciousness–awareness of, confidence in, and advocacy for addressing health disparities–among healthcare professionals continue to perpetuate health injustices. This project aims to better prepare undergraduate pre-health majors to address and advocate for health justice in their future careers. Through the inclusion of Social Justice in Science (SJS) case studies in undergraduate pre-health classrooms, our primary research question is: “In what ways do students’ critical consciousness and implicit biases shift after completing SJS cases?” To answer this, we developed a case study that tasks students enrolled in an upper-division pre-health physiology course to analyze literature on redlining, current air pollution data in impoverished areas, and the associated pathophysiology of cardiovascular disease (CVD). By measuring students' implicit biases and critical consciousness before and after the case study, we hypothesize that students will be more aware of the reasons CVD disparities exist, and feel empowered to change these inequities in their future medical careers. Our work provides an avenue to start reducing deeply ingrained implicit biases early in pre-health students’ academic careers and enable students to start developing a critical consciousness.

Anatomical Variations in Porcine Skin Wound Healing

Sriansh Pasumarthi
Sponsor: Roslyn rivkah Isseroff, M.D.
MED: Dermatology

Chronic wounds are defined as wounds that fail to proceed through the normal phases of wound healing in an orderly and timely manner. Understanding wound physiology would lead to improved clinical outcomes. Porcine models are frequently used due to their similarity to human skin, however, regional anatomic variations have been reported. To better understand if this pre-clinical model can be reliably used to study wound healing in humans, this project aims to determine if porcine wound healing correlates with the variations in dermal thickness in the different anatomical locations. Eight full-thickness 2.0cm^2 wounds, down to the fascia layer, were made along the pig’s dorsal paravertebral area. Four wounds were identified as cranial (closer to the head) and caudal (near the tail). At day 7 post wounding, wounds were excised, fixed, and sectioned for histological analysis. Significant variations were noted in the subcutaneous and dermis respectively, with cranial wounds (6774µm, 2455µm) typically exhibiting greater depth than caudal wounds (4584µm, 2883µm). Despite these variations in the depth of the tissue layers, subsequent analysis shows no statistically significant differences in re-epithelialization rates between the two anatomical regions, suggesting the need for additional research to enhance our understanding of porcine models.

Exploring Strain-Release Pentafluorosulfanylation of [1.1.0]Bicyclobutane

Ansh Patel
Sponsor: Cody Pitts, Ph.D.
Chemistry

Fluorinated groups are known to impart unique properties onto their parent compounds. Medicinal chemists have taken advantage of them to modulate biologically relevant properties such as oral bioavailability, metabolic stability and lipophilicity. Currently, 20-25% of all FDA approved drugs contain at least one fluorinated group i.e.-CF_3, -CF_2H, -F, which clearly showcases their need in current and future drug development. The pentafluorosulfanyl (SF_5) group ranks among the aforementioned fluorinated functional groups in terms of medicinal potential. Despite this significance, there is only one SF_5 containing drug, DSM-265, an antimalarial drug, currently undergoing clinical evaluation. Historically, accessing the SF_5 group proved challenging due to the heavy reliance on hazardous reagents. However, recent advances in the synthesis of pentafluorosulfanyl chloride (SF_5Cl), a gaseous SF_5 transfer reagent, have enabled the handling of the reagent under ambient conditions dissolved in a hydrocarbon stock solution. Throughout this project, we have shown the addition of SF_5Cl across strain-release reagents, which can potentially serve as hybrid bioisosteric replacements for the trifluoromethyl benzene scaffold.

Investigating ECM Differences and Response to Loading Differences Between MRL and B6 Cartilage Constructs

Rahul Patel
Sponsor: Gabriela Loots, Ph.D.
MED: Orthopaedic Surgery

Osteoarthritis is the most common form of arthritis affecting ~7% of the population. It is primarily characterized by the deterioration of cartilage at the ends of articulated bones, and affects mostly joints in the hands, knees, hips and spine. Despite its prevalence, there are currently no effective treatments or cures. Recently, our group has determined that different strains of inbred mice exhibit varying susceptibility to post traumatic osteoarthritis (PTOA), where C57BL/6J are highly susceptible while the 'superhealer' MRL/MpJ are resistant to PTOA. We hypothesized that composition of the extracellular matrix (ECM) of the articular cartilage and response to mechanical loading may be responsible for this difference. To test this, two mice per strain were utilized per experiment to harvest articular chondrocytes. Primary cells were embedded into hydrogels (low-melting point agarose), and cultured for fourteen days (D14). To identify differences, RNA was collected after embedding (D0), D6, D7, and D14; glycosaminoglycan (GAG) content was also quantified by GAG assays at these timepoints. Stiffness was measured by the Young Modulus. To identify ECM proteins modulated by loading, constructs were subjected to thirty minutes of cyclic loading and RNA was collected and sequenced one day and eight days post-loading.

Exploring the Nexus between Depression and Smoking in Unhoused Populations: Improving Holistic Healthcare at Willow Clinic

Dev Patel
Sponsor: Kirti Malhotra, M.D.
MED: Int Med - Genl Medicine

Current literature posits a connection between smoking and depression. This quality improvement study explores this relationship within the patient population of Willow Clinic, a student-run clinic serving the unhoused population of Sacramento via medical and social services. A retrospective chart review was conducted of past patient medical history, namely to collect information on the PHQ-9 metric (a metric for screening depression) and smoking data. Smoking data, obtained through a comprehensive smoking cessation form, encompassed parameters such as smoking frequency, pack years, and duration of smoking. Results revealed a significant association ($p = 0.002 < 0.05$) between smoking status and PHQ-9 scores when comparing active smokers to non smokers. Among the 190 patients who reported as active smokers, 70 had screened positive for a depression diagnosis, while 84 individuals failed to meet the screening criteria. These findings contribute valuable insights into the complex interplay between depression and smoking habits in unhoused populations. This highlights a need to connect screening practices together, where for example, a positive smoking habits screening leads to a mandatory depression screening. Such dual clinic referrals would improve holistic healthcare practices, which are especially crucial for a transient patient population like the unhoused.

Rat Primary Cortical Cell Tri-Culture and Mono-Culture To Study Microglia Motility Under Amyloid-Beta Exposure

Arushi Patel
Sponsor: Erkin Seker, Ph.D.
Elect & Comp Engr

Emerging evidence suggests the pivotal role of soluble amyloid-β (Aβ) oligomers in the etiology of Alzheimer's Disease. However, the precise mechanisms underlying Aβ cellular uptake and its interaction with microglia remain elusive. Conventional in vitro models often lack the necessary cell types to fully capture these intricate cell-cell interactions. In order to bridge this gap, a tri-culture model incorporating neurons, astrocytes, and microglia, was compared with mono-cultures primarily consisting of microglia. This model facilitated the investigation of microglial motility and Aβ clearance in response to Aβ exposure. We compared microglial motility in mono-culture (primarily microglia) to tri-culture (including neurons, astrocytes, and microglia). Using time-lapse imaging, we examined how microglia respond to external cues from other cell types. The main focus was on measuring microglial motility to show their altered behavior due toAβ exposure. Our preliminary results show the utility of these cell culture models for investigating microglia motility to stimuli implicated in the pathogenesis of AD.

How Sample Characteristics in Scientific Paper Titles Influence Readers' Judgments

Hannan Pathan
Sponsor: Alison Ledgerwood, Ph.D.
Psychology

Current publication practices within psychology are often biased, favoring dominant over marginalized samples. The overrepresentation of White and western countries in high-ranking journals has negative consequences, including neglecting valuable research and overgeneralizing the psychological experiences of these groups to all humans. Some psychology journals now require authors to specify sample characteristics in their titles. Designing effective policies is challenging, however, due to a lack of evidence regarding how this specificity impacts readers. Our research assesses how various individuals might react to literature titles with different sample characteristics: (1) a control title with no sample characteristics, (2) a dominant sample title (e.g., "among White participants''), and (3) a marginalized sample title (e.g., "among Black Participants"). In Study 1, participants evaluated study titles in a within-subjects design, but we observed some order effects. In Study 2, we will therefore use a between-subjects design. Participants will rate how important, applicable, and legitimate they find a study based on its title, and how much they desire to read a summary of that research.

Automated Image Collection and Species Classification for *Anopheles* and non-*Anopheles* Mosquitoes

Atmaja Patil
Sponsor: Gregory Lanzaro, Ph.D.
VM: Pathology, Micro, & Immun

Anopheles mosquitoes, a set of species capable of transmitting malaria to humans, exhibit unique, visible characteristics that set them apart from other mosquito species. Leveraging these distinguishing features, our project aims to develop an automated system for the classification of *Anopheles* and non-*Anopheles* mosquitoes, facilitating rapid categorization of mosquito samples and accelerating the pace of research on malaria prevention. To achieve this, we designed an automated microscope stage capable of capturing high-quality images of mosquito specimens. We've also built an object detection model, based on the YOLOv8 algorithm, to accurately identify and photograph mosquitoes on the stage without manual intervention. The heart of our methodology is an image classification model that distinguishes between mosquito species by analyzing these images. From here, our goal is to integrate all three of these parts together in a process that is fully automated end-to-end, to build improved versions of the microscope stage prototype, and to improve the image classifier model through hyperparameter tuning and additional training on new images taken using the aforementioned stage and object detector.

Determining Gaps in Health Literacy and Communication Between Healthcare Providers and Patients Who Experienced a Hypertensive Disorder During Pregnancy

Shwetha Patil
Sponsor: Leigh ann Simmons, Ph.D.
School of Nursing

Research emphasizes strong links between hypertensive disorders of pregnancy (HDPs) and negative health outcomes, such as increased risk for chronic hypertension, cardiovascular disease, and mood disorders. However, there is a significant lack of awareness about this relationship among healthcare providers and patients alike. This project is part of a larger study conducted in collaboration with CommuniCare+Ole Health Centers in Yolo County. From March 2023 to September 2023, we conducted initial interviews with eight patients (n = 8) diagnosed with an HDP from CommuniCare+Ole Health Centers to understand their experiences during and after their pregnancy. For this project, we will conduct a qualitative analysis on these initial interviews to identify the barriers that patients experienced when navigating the healthcare system, learning about their diagnosis, and understanding the impact that HDPs have on their mental and physical well-being. Initial analyses suggest that patients are largely uninformed about the long-term risks that HDPs have on their health, suggesting a need to focus on interventions regarding health literacy and overall awareness about HDPs. The results of this qualitative analysis will yield insight into areas of focus regarding maternal well-being during the postpartum period and the facilitation of communication between healthcare providers and patients.

Role of Sodium Channels in the Dorsal Root Ganglion Junction

Andrew Patton
Sponsor: Timothy Lewis, Ph.D.
Mathematics

Nociceptive ("pain") signals are transmitted from the periphery through the Dorsal Root Ganglia (DRG) in the spine to the central nervous system. Pathologies in DRG neurons are thought to underlie many cases of chronic pain. There are nine currently known types of voltage-gated sodium channels (NaV1.1-9) that affect signaling; NaV1.7 has been shown to strongly influence the pathologies present in the DRG, and therefore therapies are targeting NaV1.7 as a promising non-opiate pain solution. The goal of this study is to explore how the density of NaV1.7 in the DRG affects the frequency of action potentials, which is thought to underlie the magnitude of pain. We construct a computational model of C-type primary ("pain signaling") neurons of the DRG that accounts for the branched geometry of the T-junction in the DRG neurons. We employ numerical methods to simulate action potentials and obtain the DRG's response over a range of stimulus frequencies and strengths. Specifically, we quantify the filtering properties of the DRG neurons with respect to the geometry of the DRG neuron and density of NaV1.7. Thus, our modeling work could provide insight into conditions that give rise to chronic pain and into potential therapies.

Optimization of a 17-Color Spectral Flow Cytometry Panel for Analysis of Human Immune Responses to Viral Infection

Arushi Paul
Sponsor: Barbara Shacklett, Ph.D.
MED: Int Med Infectious Dis

HIV is a chronic viral infection that has taken the lives of an estimated 40 million people worldwide to date. HIV infection is fatal if untreated; however, most people with HIV develop strong immune responses, including both T-cells and B-cells/antibodies, that can be measured and characterized in the laboratory. A better understanding of these immune responses may help the research community to develop successful vaccines and/or immunotherapies for HIV. We routinely use Flow Cytometry to characterize immune cells in blood and tissue samples from people living with HIV. We are currently developing a 17-color "spectral" flow cytometry panel to assess immune cell subsets. This process involves testing new antibody-fluorochrome combinations to identify those that provide the clearest depiction of the cell populations of interest, using positive and negative control samples. Once the panel is fully optimized, we will use it to characterize CD4 and CD8 T-cells, B-cells, macrophages, NK cells, MAIT cells, Regulatory T-cells, memory/effector T-cell subsets, and markers for T-cell activation and senescence. These studies are directed towards better understanding the roles played by individual immune cell subsets in fighting HIV infection.

Uncovering the role of OLFML3-induced malignancy in human GBM cells

Tatiana Pechnikova
Sponsor: Christine Toedebusch, D.V.M.
VM: Surg/Rad Science

Glioblastoma (GBM) is an aggressive, uniformly fatal primary brain tumor in adults. There has not been a new treatment approved by the FDA since 2009, highlighting the urgent need for a new therapeutic target. Our laboratory has identified that olfactomedin-like 3 (OLFML3), a secreted glycoprotein, has multiple pro-tumorigenic roles in GBM. My preliminary data has demonstrated that exposure to recombinant human OLFML3 (rhOLFML3) enhances features of malignancy in human GBM cells through increased cellular migration. To determine the OLFML3-responsive pathways, we have evaluated the transcriptome of human GBM cells following exposure to rhOLFML3 via RNA sequencing. Treatment with rhOLFML3 induced up-regulation of several genes in human GBM cell lines. Genes with the greatest up-regulation, interleukin 6 (*IL6*) and C-X-C motif chemokine ligand 10 (*CXCL10*), are also critical drivers of GBM progression. I am currently evaluating additional patient-derived GBM cell lines with variable molecular profiles (e.g., *EGFR* amplification, *MGMT* methylation) for phenotypic responses to rhOLFML3 and will examine OLFML3-responsive pathways in each cell line at the protein level via western blot. This study will advance our understanding of OLFML3 singling in human glioma cells and inform the development of OLFML3-targeted therapeutic strategies.

Natural Sequence Diversity of Maize Diterpene Synthase, *Zm*KSL1, Influences Diterpenoid Production in *Nicotiana benthamiana*

Jedidiah Peek
Sponsor: Philipp Zerbe, Ph.D.
Plant Biology

Maize(*Zea mays*) is a vital crop, especially to the Americas, where it is the most widely grown grain. Disease and climate conditions result in huge crop losses every year. Because of this it is crucial to understand defensive pathways in maize in order to breed more resistant lines. Recent studies discovered two unique diterpenoid groups, Kauralexins(KXs) and Dolabralexins(DXs), with known and predicted roles in pathogen defense and abiotic stress resistance. RNA-seq revealed a gene, *Zm*KSL1, that coexpresses highly with the KX and DX biosynthetic genes. *Zm*KSL1 shows high levels of sequence variation across maize Nested Association Mapping(NAM) lines, which suggests potential difference in product formation across the inbred lines. We utilized *Agrobacterium*-mediated coexpressions in tobacco(*Nicotiana benthamiana*) for functional characterization of the different ZmKSL1 genes as well as large scale production of the products for NMR analysis. The variation in *Zm*KSL1 sequences resulted in large differences in product accumulation across the maize lines.

Investigating Intermolecular Dynamics of Astrochemically Relevant Five-Membered Nitrogen Heterocycles with Rotational Spectroscopy

Agnes Pek
Sponsor: Kyle Crabtree, Ph.D.
Chemistry

The vast majority of meteorites that fall to Earth are non-metallic chondrites. A subset, carbonaceous chondrites, have shown signs of abiotic synthesis of organic compounds. These include nitrogen-containing cyclic compounds like pyridines, quinolines, succinimides, lactams, and the amino acid proline. It is theorized that these molecules, carried by meteorites, could have contributed to the emergence of prebiotic chemical systems 3.8-3.5 billion years ago. A potential formation pathway of these meteoritic nitrogen heterocycles is believed to occur via reactions in the interstellar medium at low temperatures. Rotational spectroscopy is an effective tool in the characterization of polar molecules under space-like conditions, because it measures the energies of transitions between quantized rotational states unique to each molecule, providing precise information about its structure. We investigated the rotational spectra of select γ-lactam molecules with a combination of ab initio quantum chemical calculation and chirped-pulse Fourier transform microwave (CP-FTMW) spectroscopy. Our findings indicate that 2-pyrrolidone and *N*-vinyl-2-pyrrolidone both exhibit unique intramolecular movements, such as pseudorotation induced by ring-puckering motions. These movements cause signal splitting in the rotational spectra, necessitating additional analysis for potential barriers hindering the puckering motions. Resolving such large amplitude motions is vital to accurately interpreting the experimental spectra.

Addressing Sex Bias in Autism MRI Data: A Calibration Approach to Improve MRI-Based Classification

Allison Peng
Sponsor: Shizhe Chen, Ph.D.
Statistics

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that is characterized by repetitive behaviors, specific interests, or difficulty with social interactions. These symptoms have varying severity across individuals. In 2020, one out of thirty-six children were diagnosed with ASD as reported by the Centers for Disease Control and Prevention in the US. To address the high prevalence of ASD among children, research shows that early intervention is essential to reduce the severity of symptoms. Current diagnostic methods using behavioral assessments require a specialist evaluation, leading to an average wait of three years. Recent studies attempted to use published MRI scans to build an Autism classification model to expedite the diagnosis process. However, the classification model's training requires scans from diagnosed ASD patients and contains a disproportionate ratio of males to females. Such bias could result in inferior classifications for female subjects. We propose to address the sampling bias by calibrating the severity scores from behavioral assessments alongside MRI scans across the sexes. Using the calibration method, we can build a classification model that improves the diagnostic results of female subjects.

The Future of Gene Editing: An Analysis of Ethical Concerns and Public Perception

Aileen Perez
Sponsor: Susan Lott, Ph.D.
Evolution & Ecology

Genome editing is a developing field that has opened the possibility of many scientific advancements from agriculture to human health improvement. Concerns have arisen about the boundaries and unintended consequences of gene editing in humans as its technologies and applications continue to evolve. Somatic gene editing clinical trials for various diseases have begun to be applied, but germline gene editing remains widely restricted. This research explores the moral and ethical implications of modern genetic technologies, delving into the development of gene editing, its societal impact, and future applications in humans. A comprehensive literature review provides insight into the current discourse of gene editing technologies. Surveys and interviews targeting undergraduates majoring in Genetics and biological sciences, graduate students in the Integrative Genetics and Genomics program, and professionals actively engaged in the genetics field provide a qualitative exploration of their perspectives and opinions concerning the future of gene editing. These findings seek to inform discussions and decision-making processes related to the ethical use and regulation of gene editing in the human germline, ultimately contributing to the responsible advancement of genetic research applications.

Validation of CHD8 Protein-Protein Interactions with PAF Complex in Cultured Cell Lines

Daniela Perla
Sponsor: Alexander Nord, Ph.D.
Neuro Physio & Behavior

CHD8 haploinsufficiency has been linked to autism-like phenotypes. However, its interactions with other proteins in the nucleus of cells remains unknown. After validation of candidate protein targets via mass spectrometry, a Proximity Ligation Assay was carried out. This technique allows for the in-situ validation of protein-protein interactions on cultured cell lines. Probes are bound to constant regions of primary antibodies and the resulting signal is amplified via DNA hybridization and polymerization. Our results have allowed for the validation of protein-protein interactions between CHD8 and the PAF complex in Hek Cells. The PAF complex is a 5 sub-unit protein complex known to regulate chromatin modifications, gene transcription, and RNA polymerase II (PolII) elongation. An immunocytochemistry procedure was also achieved on Hek Cells to map the expression of CHD8 and candidate PAF proteins. We are currently working on analyzing these interactions in neurons, and are also exploring protein-protein interactions between CHD8 and RBM8A.

A storybook intervention study on the development of uncertainty monitoring 3- and 4-year-old children

Chiara Perni
Sponsor: Simona Ghetti, Ph.D.
Psychology

Uncertainty monitoring, a central metacognitive skill, refers to the ability to correctly report subjective feelings of uncertainty which emerges around three years of age (Lyon & Ghetti, 2011). In the current study, we evaluated the effect of a storybook intervention supporting the connection between the use of uncertainty language for ongoing uncertainty states in in young children. Data were collected from 69 children (M= 48 months, SD= 3 months) with a target sample size of 72. The intervention consisted of three conditions varying the language used to describe a storybook scavenger hunt, uncertainty language marking if children knew or did not know an object's location, general mental state language asking children about their likes and dislikes, and a math condition asking children to count different objects. Children's uncertainty monitoring was evaluated with a perceptual identification task administered before and after the intervention with greater differences in subjectively rated confidence between correct and incorrect trials in the task reflecting better uncertainty monitoring. Our statistical analysis will focus on evaluating change from pre- to post-training in children's uncertainty monitoring as a function of experimental conditions, shedding new light on mechanisms supporting metacognitive development in young children (Gonzales et al., 2021).

Respiratory Sinus Arrhythmia, Global Health, and Sports Participation in Youth

Shanice Perry
Sponsor: Camelia Hostinar, Ph.D.
Psychology

Low socioeconomic status (SES) is often associated with stress and stress is associated with poor health. However, some youth with low SES show fewer somatic symptoms in response to stress as moderated by higher parasympathetic activity (Alen et. al, 2023). Respiratory Sinus Arrhythmia (RSA) is a biomarker of parasympathetic nervous system activity and of resilience to stress. This study aims to elucidate how RSA is related to SES and global health by replication and extension of a previous study conducted in children 9-10 years of age (Alen et. al, 2023). RSA data was obtained from a larger study on social disconnection from a sample of approximately 150 adolescents aged 11-15 years old. The MacArthur Health and Behavior Questionnaire (HBQ) was used to measure participant's global self-reported health. Two hypotheses are proposed. The first is that RSA will moderate the association between SES and global health, as previously demonstrated in a younger sample (Alen et al., 2023). A secondary, exploratory hypothesis is to test whether children who play a team sport will have higher RSA values and better global health. More information about physiological resilience can help to increase the resilience of children and adolescents experiencing chronic stress in their environment.

Hyperosmolarity-induced Activity of NFAT5 in Mozambique Tilapia Gills

Kathleen Petcu
Sponsor: Dietmar Kueltz, Ph.D.
Animal Science

In mammals, NFAT5 is a well-established osmoregulatory transcription factor with a critical role in the kidney and other osmotically-challenged cells. Recent studies indicate that NFAT5 has a similar role in cells of Mozambique Tilapia (*Oreochromis mossambicus*). *O. mossambicus* is an ideal model to study NFAT5 function due to its extreme osmoregulatory capabilities. The kidney is the primary osmoregulatory organ of mammals, and an increase in NFAT5 mRNA abundance is a typical response to hyper-osmotic (HO) exposure in cells of this tissue. In this experiment, we exposed *O. mossambicus* to HO stress and are characterizing NFAT5 mRNA response in gill tissue, the primary osmoregulatory organ of fish. 12 fish were divided into two experimental groups exposed to different conditions. One group experienced only freshwater conditions (0 ppt), whereas the other experienced a daily salinity increase of 15 ppt per day from 0 to 75 ppt. Gills were dissected from each fish, followed by RNA extraction and cDNA synthesis. Next, NFAT5 mRNA abundance will be measured by quantitative PCR with primers targeting NFAT5 and reference genes (beta-actin and 18sRNA). The primary goal of this study is to determine whether NFAT5 mRNA abundance will increase in salinity-challenged tilapia gill cells.

Picky Eaters: do seed-eating animals show a preference among native oak species?

Sarah Perry
Sponsor: Andrew Latimer, Ph.D.
Plant Sciences

California's native oak woodlands face an uncertain future due to climate change, diseases, and human development, among other variables. While many factors play a role in this uncertainty, one of the earliest filters on oak tree survival is the removal of acorns by seed predators. This study aims to determine the extent of seed loss to mammalian, rodent, and avian seed predators. Throughout fall 2023 and winter 2024, we analyzed acorn predation and species-specific preferences. Trail cameras at five sites across Quail Ridge Reserve allowed us to observe seed predator feeding behavior over time. We chose four oak species representing a range of tannin contents to determine if tannins, bitter compounds in acorns, play a role in predation. Preliminary results show that acorn woodpeckers and squirrels contribute significantly to the removal of oak acorns, with a slight preference for the red oak species over the white oaks. Other seed predators observed include deer, small rodents, scrub jays, and owls, each with varying impact on acorn abundance depending on the specific site. Continued analysis on species-specific impact and seed-eater habits (caching and/or eating) will allow conservationists to allocate their efforts towards specific oak species, promoting effective protection in oak-dominated ecosystems.

Analyses of Plant Virus Infiltration Techniques and the Process of Viral Infection in *Nicotiana Benthamiana*

Wolfgang Peterson
Sponsor: Yen-wen Kuo, Ph.D.
Plant Pathology

In the world of plant virus studies, there is a lot of research being done to develop and optimize the applications for viral vectors, which are capable of targeting and silencing specific genes in the plants in which they infect. There are two viral clones/vectors used for the assays: wild-type (WT) and defective (Def) grapevine geminivirus A (GGVA). Previously, the WT- and Def-GGVA were always infiltrated together via co-infiltration for specific gene silencing and phenotypic effects. This method of infiltration has been adopted by many plant virus researchers; however, the investigation of whether infiltrating WT and Def clones sequentially has any impact on the time at which the plant shows phenotypic effects is needed. In this study I am testing this by infiltrating *Nicotiana Benthamiana* plants initially with a WT GGVA viral infectious clone, followed by several separate infiltrations with Def-GGVA (negative control) or Def-GGVA with a inserted sequence that can target and silence the phytoene desaturase gene of *N. benthamiana* (NbPDS; Def-GGVA_NbPDS), which will cause a bleaching phenotype. Whether this method increases, decreases, or has no effect on the time of phenotypic expression, these studies will yield valuable insights and optimal application protocols for the GGVA viral vectors.

Sterile Washes Reduce Fungal-Like Disease in Seagrass (*Z. marina*) Seeds

Eric Pham
Sponsor: Jonathan Eisen, Ph.D.
MED: Medical Microbiology & Imm

Seagrass meadows are essential to the coastal ecosystem however, due to many harmful effects that include habitat destruction and human interactions, meadows are quickly disappearing. Many restoration methods focus on seagrass (*Zostera marina)* seed germination, though a barrier to these efforts is a fungal-like disease that stunts germination, bringing a low germination rate even lower. This project evaluates the effectiveness of ethanol and bleach sterile washes and copper's antimicrobial properties to treat the pathogen in seeds collected from Bodega Bay, CA. In addition, the project assesses the impact of hydrogel beads as a part of a series of proof of concept studies to test its ability to artificially mimic sediment. We created a crossed experimental design testing sterile washes, copper treatments, hydrogel beads and their interactions using 480 seeds randomly assorted into 8 treatment groups. The study concluded that sterile washes significantly reduced the presence of disease. Unexpectedly, the copper treatment significantly exacerbated disease in these seeds. We also found no effect of hydrogel beads on the presence of disease. To identify the fungal pathogen, we cultured and extracted DNA for genomic sequencing. Analyzing the genome will allow us to understand how to minimize disease rates and increase seed germination.

Heat Shock-Inducible Gene Expression and Egg Optimization in *Hydra vulgaris*

Hieu Pham
Sponsor: Celina Juliano, Ph.D.
Molecular & Cellular Bio

Hydra Vulgaris exhibits remarkable regenerative capabilities and is effectively immortal when grown in the laboratory. *Hydra's* stem cells differentiate during regeneration to replenish all types of cells in the adult *Hydra* body. Our Juliano Lab studies the molecular mechanisms of *Hydra vulgaris* development, regeneration, and the role of stem cells in those processes. To understand specific gene functions in these processes—for example, genes encoding transcription factors—it is useful to be able to control the induction of their expression through transgenesis. Therefore, the first goal is to construct a plasmid with a heat-shock promoter that drives green fluorescent protein (GFP) expression and then inject it into *Hydra* embryos to develop transgenic animals. Transgenic *Hydra* will be tested for its promoter's function to visualize GFP at 32^{o}C. The positive result allows the induction of alternative functional genes in future research including RNAi constructs to knock down gene function. Furthermore, transgenesis requires an abundant amount of eggs for microinjection which is currently limited in our field. Hence, the second goal involves applying Hydra to stressful growth conditions and eliminating males to test the effect on female differentiation and optimization. Successful methods will be applied widely to supply eggs for *Hydra* transgenesis.

The Effects of *Dh31* and *Pdfr* on the Body Temperature Rhythm of *Drosophila melanogaster*

Thy Pham
Sponsor: Fumika Hamada, Ph.D.
Neuro Physio & Behavior

The circadian rhythm contains the body temperature rhythm (BTR) which is the fluctuation of body temperature throughout a day cycle and helps maintain health. Mechanisms of BTR are conserved from flies to humans. By understanding the circadian rhythm of fruit flies, *Drosophila*, we elucidate the mechanisms that control the human circadian rhythm. The temperature preference rhythm (TPR) is defined by dependence on behavioral changes in Drosophila's preferred temperature.The BTR of *Drosophila* is influenced by class-B G-protein coupled receptors (GPCR). This study focused on two GPCRs: diuretic hormone 31 receptor (*Dh31r*) and pigment dispersing factor receptor (*Pdfr*). This experiment sought to find the mechanisms by which *Dh31r* and *Pdfr* control TPR of *Drosophila* using mutants with decreased amounts of *Dh31r* and *Pdfr*. This study produced results depicting the circadian rhythms made for different lighting conditions: light-dark (LD) and dark-dark (DD). The results of LD and DD conditions for *Dh31* and *Dh31r* mutants showed that males did not increase daytime body temperature, while *Pdf* and *Pdfr* mutants exhibited a loss of anticipation for males and females. By studying GPCRs and their functions, it can give us a deeper understanding on how temperature regulation of the body affects circadian rhythm and health.

Control of Tiltwing Hover via Trailing Edge Slipstream Deflection and Prop-Rotor Cyclic Pitching

Tristan Anthony Pham
Sponsor: Camli Badrya, Ph.D.
Mechanical & Aerospace Engr

Tiltwing is a type of VTOL (vertical take-off and landing) aircraft configuration that achieves thrust vectoring by rotating the propulsion-wing element. Such configuration features lower noise and drag in hover, along with shorter transition time compared to other vectored thrust methods. Historically, experimental tiltwings like CL-84 and Vertol VZ-2 had achieved stability in hover by incorporating thrust at the tail to control pitch, but a tailrotor adds complexity and weight. It is also known that tiltwing has limited yaw control, as it is susceptible to gusts and in hover. The implementation of trailing edge flaps and cyclic articulation of the rotors can be a simpler system that provides control in hover. The stability of a tiltwing scale model in hover will be studied by coupling these two mechanisms; the extent to which this system can provide control will be explored by modeling of the flight mechanics and demonstrated with a scaled flight test vehicle.

Determining the Binding Mechanism of P-Rex2 and PTEN Using P-Rex Chimeras

Chi Phan
Sponsor: Jennifer Cash, Ph.D.
Molecular & Cellular Bio

Phosphatidylinositol-3,4,5 triphosphate-dependent Rac exchanger (P-Rex) is a subfamily of RhoGEFs that is involved in activation of Rho GTPases leading to cell proliferation, growth and motility. P-Rex1 and P-Rex2 are closely related proteins that share a similar domain layout; however, only P-Rex2 is regulated by PTEN, a tumor suppressor that binds and inhibits P-Rex2 through an unclear mechanism. Mutations in P-Rex2 are often associated with diseases like cancer, therefore understanding the binding mechanism of P-Rex2 and PTEN can serve as an important step towards rational drug design against P-Rex2. Based on prior truncation studies, we hypothesize that the PH domain and IP4P subdomain are responsible for mediating this interaction. Alternatively, some studies suggest PTEN binds through the IP4P subdomain and PDZ2 domain. To test our hypothesis, we have generated P-Rex1 chimeras containing either the PH or PDZ2 domain replaced with P-Rex2 sequence. We are characterizing the ability of these chimeras to interact with PTEN using biochemical assays. We expect the P-Rex1 chimeras containing the domains responsible for P-Rex2–PTEN binding to reduce PTEN activity and have lower GEF activity compared to wild-type P-Rex1 when incubated with PTEN. Through this process, we will determine which domains facilitate the interaction between P-Rex2 and PTEN.

National Rates of Protective Eye Goggle Use in Girls' High School Varsity Field Hockey

Jennifer Phelan
Sponsor: Daniel Herman, M.D.,Ph.D.
MED: Physical Medicine & Rehab

Purpose: Despite evidence indicating eye goggles (EG) mitigate ocular trauma, the national mandate for EG use in girls' high school varsity field hockey was lifted in 2020. The purpose of this study was to determine the rate of post-mandate voluntary EG use. Methods: Teams in a 2021 national game film database were evaluated for EG use. Teams were categorized by school type (Public or Private), state of field hockey game development (Established or Emerging), and Region (Northeast, Mid-Atlantic, South, Midwest, and West). Results: 632 teams representing 11,852 athletes were evaluated, with only 109 athletes (0.92%) observed wearing EG. EG use was lower among public (0.84% of 10,271 athletes) compared to private (1.45% of 1,581 athletes) school teams (chi^2=20.44, p=0.018). EG use was lower in Established regions (Northeast and Mid-Atlantic, 0.69% of 8,961 athletes) versus Emerging regions (South, Midwest and West, 1.63% of 2,891 athletes, chi^2= 5.60, p<0.001). Conclusions: EG use after the national mandate was rescinded is exceedingly low. Given these low levels of use, a large opportunity for ocular injury prevention exists via stakeholder education or local or state mandates.

Inversion-Mediated Differential Expression of *CHRNA7* at Human Chromosome 15q13.3

Louie Nathaniel Pinpin
Sponsor: Megan Dennis, Ph.D.
MED: Biochem & Molecular Med

Genomic structural variants (SVs, >50 base pairs), comprising deletions, duplications, inversions, and translocations, can contribute to diverse traits and diseases. We hypothesize that inversions, in particular, rearrange the three-dimensional structure and organization of chromatin leading to divergent gene expression in modern humans. Focusing on chromosome 15q13.3 locus implicated many neurodevelopmental conditions, we identified hundreds of humans carrying a previously-identified 1.7 Mbp inversion. Using existing RNA-seq data from lymphoblastoid cell lines (LCLs) in 731 individuals, we narrowed in on *CHRNA7* as exhibiting significantly increased expression due to the inversion. To validate this result, we performed quantitative real-time reverse-transcription PCR (RT-qPCR) of *CHRNA7* expression in LCLs and compared results between individuals homozygous for the direct allele and individuals heterozygous for the inversion allele. We will perform RT-qPCR on additional individuals carrying the chromosome 15q13.3 inversion to show reproducibility of our *CHRNA7* gene expression result. As we progress further, we will validate differential expression of additional genes at newly-discovered inversions. Now that high quality human genome assemblies are becoming available, we can now begin to understand how SVs affect gene regulation as well as how they contribute to genetic variation leading to human-specific traits and diseases.

Analyzing Tobacco Product Placement in Checkouts Within Different Stores in California

Jesus Pizano
Sponsor: Jennifer Falbe, Ph.D.
Human Ecology

The checkout area is a critical point for influencing consumer behavior, including the purchase of tobacco products. Given the health consequences of tobacco use, understanding its prevalence in store checkout areas is vital. This study extends the methodology used to evaluate the nutritional quality of checkout products to assess the prevalence of tobacco in checkout areas of various retail settings. In a 2021 cross-sectional study, we sampled 102 stores from four cities in northern California, consisting of different chain stores (including dollar stores, drugstores, specialty food stores, supermarkets, and mass merchandisers), along with independent supermarkets and grocery stores. Observational evaluations were conducted on each product displayed in checkout areas using the Store CheckOUt Tool (SCOUT), previously used for gathering data on a census of product facings at sampled checkouts. This approach was employed to estimate the number of product facings, specifically adapted to focus on tobacco products. This research is poised to offer valuable insights into the retail practices surrounding tobacco product placement and the potential need for regulatory interventions.

Nutsedge Inactivation in Soil Using Biosolarization

Prairva Plepalakon
Sponsor: Christopher Simmons, Ph.D.
Food Science & Technology

Cyperus esculentus, a species of nutsedge, is considered one of the worst weeds in the world. Nutsedge grown in association with crops reduces the nutrient content of the crops significantly which is a huge loss for growers. It can be difficult to control because of its underground system of rhizomes, tubers, and bulbs. Nutsedges reproduce by tubers that can be dormant for up to 10 years, making it difficult to get rid of completely. The current control strategies are very tedious and slow, using harmful chemical fumigants that are hazardous to humans. Biosolarization is a safer alternative to fumigation that has been tested on other soil pests. This research aims to validate that biosolarization can be an alternative method for agriculture on soil infested with *C.esculentus*. To see if biosolarization can control the nutsedge, a tetrazolium chloride (TZ solution) staining technique was applied to validate the survival or death of the tubers. Using the TZ method, it was concluded that biosolarization significantly brought down the viability of tubers in the soil. Furthermore, the staining technique can be proven to be a procedure to validate biosolarization.

A Systematic Review of Cognitive Function and Dementia among Military Veterans

Dilprit Pooni
Sponsor: Rachel Whitmer, Ph.D.
MED: Neurology

Military veterans are often underrepresented in the cognitive aging and dementia literature. We aim to understand the gap in the current literature and how service in the military is associated with cognitive functioning and dementia. To further our understanding, we will be conducting a systematic literature review utilizing the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Through search engines, such as PubMed and Google Scholar, we will identify articles using keywords: “Alzheimer's,” “dementia,” “cognit*,” “military,” and “veterans.” We only included peer-reviewed studies that are in English, from 2010-2023. We plan to explore the magnitude and breadth of current studies on between military service and cognitive function. We will determine how risk factors associated with military service, such as post-traumatic stress disorder (PTSD), depression, and traumatic brain injury (TBI), mediates risk for cognitive impairment and dementia. Military veterans are faced with adverse risk factors different from their civilian counterparts and are often not considered in studies of cognitive aging or dementia. Therefore, it is important to study the veteran population in order to better understand factors that affect their cognition and inform future studies to target cognitive issues affecting this understudied population.

Associations between Self-Concept, Vocabulary, and Motor Skills in Infants

Anushka Potdar
Sponsor: Simona Ghetti, Ph.D.
Psychology

The development of the sense of self is a prerequisite for necessary skills such as understanding one’s own thoughts, feelings, and actions, perspective-taking, navigating interpersonal relationships, as well as other socio-emotional milestones (Baumeister, 1999). Previous accounts have suggested that self-concept may emerge from linguistic and motor input in infancy (Rochat, 2010), but there is little direct evidence that this is the case. To begin to explore these possibilities, we have assessed self-concept, vocabulary, and motor skills in forty-eight 18-22 month-old infants during a two-week larger-scale study. We plan to assess the relations between self-concept, vocabulary, parent-reported motor ability, and memory. We expect that 1) greater motor ability will predict more frequent self-recognition as a measure of self-concept, 2) a larger vocabulary will predict more frequent self-recognition. Our analyses will account for effects of age and other potentially confounding variables to provide new insight on the emergence of self-concept in infancy.

Utilizing NIH All of Us Genomic Datasets to Analyze Health Disparities in Hypertrophic Cardiomyopathy

Swati Pothukuchi
Sponsor: Dr. luis Carvajal-Carmona, Ph.D.
MED: Biochem & Molecular Med

Hypertrophic cardiomyopathy (HCM) is one of the most common inherited heart conditions worldwide, but remains clinically underdiagnosed, especially in minority populations. This is in part due to the overrepresentation of white populations in data used to identify markers associated with HCM, despite recent studies illustrating ethnic disparities in clinical presentation, management, and outcome of HCM. Understanding the genetic etiology of HCM is important not only to study the disparity in development of cardiomyopathy, but to develop more accurate predictions and diagnoses of the condition for patients of all ethnic backgrounds. Towards this end, this study aims to evaluate the prevalence of known and predicted pathogenic variants across different ethnic cohorts by analyzing known pathogenic variants and using variant effect prediction algorithms to assess novel variants in the patient data using the AllofUs database. The NIH AllofUs research initiative has been developing one of the most diverse biomedical databases worldwide, currently standing at more than 760,000 participants, with more than 80% from populations underrepresented in biomedical research. The use of this diverse patient data for our analysis will provide us with etiological information that has the potential to further our understanding of the development, diagnosis, and treatment of HCM.

The Dark Corners of the Genome: Understanding the Patterns of Evolution in Retrogenes

Dellaraam Pourkeramati
Sponsor: Ian Korf, Ph.D.
Molecular & Cellular Bio

Bowhead Whales are the oldest living mammals ever recorded at more than 200 years on average. Many mammalian species have been able to extend their average lifespan by lifestyle changes however, Bowhead Whales partially owe their longevity to a gene duplication created by the reverse transcription and insertion of a second PCNA gene; a retrogene. To better understand how to find retrogenes and the circumstances in which they appear, we are using computational methods with RNAseq data from *Arabidopsis Thaliana* to examine expression levels of open reading frames(ORFs) that strongly resemble other genes but are more expressed than pseudogenes. Specifically, retrogenes have introns inserted in their untranslated regions. Intron insertions in 5'UTRs correlate with higher levels of expression while 3' UTR insertions are associated with lower levels of expression. We intend to find out where these intron insertions are more likely to appear and what effect they have on expression based on position.

Context-Dependent Language Input in Parent-Infant Interactions: A Comparative Analysis of Puzzle and Busyboard Play

Nikhita Prabhu
Sponsor: Lisa Oakes, Ph.D.
Psychology

Language input during parent-infant interactions is crucial for early language acquisition. Not only does the quality of parental speech to infants predict later language ability, it also varies depending on the context. We transcribed parental speech during play in a sample of 53 parent-infant dyads (*M* infant age = 9.2 months; 17 girls, 36 boys). Dyads participated in 3-min puzzle and busyboard play activities. Sessions were transcribed for all vocalizations made by parents. From the transcripts, we calculated the total number of words (i.e., tokens) and the unique number of words (i.e., types) uttered by each parent. We also calculated the total number of tokens and types of *spatial* words and *object naming* words provided by parents. Our final analyses will include data for *action* words as well. Preliminary analyses revealed that the puzzle task prompted higher levels of total tokens and types compared to the busyboard task. Furthermore, regardless of the task, parents consistently provided more spatial words than object labels. However, object labeling increased during the puzzle task compared to the busyboard. These findings highlight the context-dependent nature of language input in parent-infant interactions, emphasizing how different play activities prompt varied linguistic responses from parents.

Genome Analysis of *Ralstonia solanacearum*, to Identify Genetic Differences That Could Influence Host Range and Pathogenic Fitness

Neha Prasad
Sponsor: Tiffany Lowe-Power, Ph.D.
Plant Pathology

Ralstonia solanacearum is a gram-negative bacterial wilt pathogen within the RSSC (*Ralstonia solanacearum* species complex) that has a large host range. The RSSC contains pathogens that will colonize the xylem. Due to the high virulence of *Ralstonia,* bacterial wilt disease causes a significant loss in agricultural production, threatening economic and food security. *Ralstonia solanacearum* has spread to many countries, with unknown origins. Investigating the diversity of gene content in different *Ralstonia* strains can help with identifying genetic influence on host range and disease management. Through this investigation, we will generate hypotheses surrounding the virulence and fitness of the pathogen. Our data collection consisted of extracting DNA from 20 *Ralstonia* strains isolated from Tanzania, followed by genome sequencing. The bulk of our collection was analyzed using the software KBase as our bioinformatic platform. In KBase, we analyzed the quality of the Illumina sequencing data and assembled the raw data into genome sequences. Currently, our cohort is working to construct a phylogenetic tree that compares the evolutionary relationships of our strains with all publically available genomes from the RSSC. We will identify evolutionary relationships between our strains and their relatives to identify which genes can influence host range, virulence, and fitness.

Antigen-Specific Therapy for Myasthenia Gravis

Jeena Prasad
Sponsor: David Richman, M.D.
MED: Neurology

Myasthenia gravis (MG) is a chronic, autoimmune disease that affects over one million people worldwide. Autoantibodies target the acetylcholine receptor (AChR) leading to inflammation of the neuromuscular junction, and use-induced fatigue in patients. Current treatment plans for MG involve corticosteroids (prednisone). These are quite toxic at the high doses needed for remission. Patients are thus put on various immunosuppressants to lower steroid doses, which in turn compromise their immune system. There is a critical need for a long-term MG treatment that does not compromise patients' immune systems. We hypothesize that an antigen-specific treatment that removes only the autoantibodies will serve this function. We developed a biologic that is highly specific to most AChR-directed antibodies, and used an animal model to determine if binding of anti-AChR antibodies in Experimental Autoimmune Myasthenia Gravis (EAMG) would reduce titers and successfully treat EAMG. After inducing EAMG via immunization of Lewis rats with AChR isolated from the electric organ of *Torpedo californica,* we began treatment at day 28, the onset of the model's chronic phase. Rats received intraperitoneal (IP) injections of the drug daily for three weeks. We observed that anti-AChR titers decreased after treatment and rebounded to untreated levels once treatment stopped.

Visual Sampling of Target and Non-Target Context Information During Difficult Search Tasks

Ak Prathipati
Sponsor: Joy Geng, Ph.D.
Psychology

When searching for a target, we often hold an idea in mind of what that target looks like – a target template. However, when targets are difficult to find we may rely on other context features to help guide our search. In this study, participants were trained to associate target faces with distinct scene backgrounds. We tracked their eyes as they were tested on these scene/face associations, and quantified the degree to which viewers used either target template information or scene context information to help them complete the task. Here, we report unique gaze patterns that reflect attention to relevant vs. irrelevant target and scene information. We further test whether more attention to context over target information leads to faster target recognition. Together, these results suggest that searchers rely on background scene context information early on in difficult search tasks. These results provide further evidence as to how searchers use both *guidance* and *target* information as templates in difficult tasks.

Testing Seabird Bycatch Markers on Black Footed (*Phoebastria nigripes*), Short Tailed (*Phoebastria albatrus*), & Laysan (*Phoebastria immutabilis*) Albatrosses

Elisa Pulido
Sponsor: Benjamin Sacks, Ph.D.
Veterinary Genetics Lab

Seabird bycatch continues to negatively impact seabird populations. Albatross is one species of seabird that has been consistently vulnerable to these types of threats, alongside others. The use of genetic information has proven to be extremely valuable in conservation efforts such as species identification. I tested CR, COI, and Cytb primers on 15 total samples of the Black Footed (*Phoebastria nigripes*), Short Tailed (*Phoebastria albatrus*), and Laysan (*Phoebastria immutabilis*) albatrosses. I found that these primers were able to accurately amplify the sequences of these three species of albatrosses and resulted in a positive 1.5% agar gel. In addition, on the Basic Local Alignment Search Tool (BLASTn), I found that the amplified sequences resulted in a high query coverage, low e-value, and a high percent identity. With these findings, these primers can be used to amplify a range of seabird species. Most importantly, these primers can be used in the conservation efforts of species being impacted by bycatch and other threats.

Visualization of the Wnt3 Gradient in *Hydra*

Pranathi Puttha
Sponsor: Celina Juliano, Ph.D.
Molecular & Cellular Bio

Previous studies have implicated the importance of Wnt signaling in the whole-body regeneration of many animals from different taxa. In the Juliano lab, the model organism *Hydra vulgaris*, capable of full body regeneration, is studied to better understand the mechanisms driving regeneration. When a *Hydra* is bisected, the presence of Wnt designates where the head will regenerate. Wnt acts as a ligand on the outside of the cell to influence gene expression. Wnt genes are expressed at the hypostome and are hypothesized to diffuse down the body of the *Hydra*, creating a gradient. While hypothesized, this gradient has never been visualized directly in *Hydra*. By tagging Wnt3 with a fluorescent protein (GFP) via a customized plasmid and transgenesis technique, we will be able to visualize the gradient in vivo. Ultimately, I aim to 1) engineer a plasmid to tag Wnt3 with a fluorescent protein, 2) grow a transgenic animal from an injected *Hydra* embryo, and 3) visualize the location of the Wnt protein by viewing the mature animals under a fluorescent microscope.

Pistachio Salt-tolerance: Using Hybrids to Narrow QTLs for Salt-tolerance via Chloride Analysis

Sam Qiao
Sponsor: Patrick james Brown, Ph.D.
Plant Sciences

Soil salinity increases in the central valley account for a loss of approximately 10% of total agricultural revenue in pistachios (Pistacia vera). Based upon the research from Sheikhi et al., we understand that interspecific hybrid (P. atlantica X P. integerrima) pistachio rootstocks segregate for alleles that confer salt tolerance at 2 specific loci: P. atl13 and P. int13. In further research, we hope to fine map the quantitative trait loci (QTL) to narrow down the possible candidate genes responsible for salt tolerance via the recombinant regions of the hybrids. We also hope to further understand whether orthologous genes between different species, P. atlantica and P. integerrima, influence salt tolerance. One method to understand the mechanism for salt tolerance is to measure salinity, via chloride analysis, at various locations among pistachios (upper, middle, and lower leaves as well as the stem & bark) in order to understand where salt is sequestered under salty conditions.

Identification of Genes Involved in Meiotic Chromosome Organization in Budding Yeast, *Saccharomyces cerevisiae*

Rokhshid Rafiei
Sponsor: Sean Burgess, Ph.D.
Molecular & Cellular Bio

Proper chromosome arrangement is essential for normal chromosome segregation during meiosis. Failure of these processes can lead to nondisjunction or problems in gamete production, leading to aneuploidy and infertility, respectively. Previous research in budding yeast, *Saccharomyces cerevisiae,* has identified two main protein complexes, Linker of Nucleoskeleton and Cytoskeleton (LINC) and Nuclear Pore Complex (NPC) that are involved in meiotic chromosome segregation. This work is focused on Csm4, a protein in the LINC complex, whose concurrent mutation with certain other proteins such as Nup2 disrupts meiosis. Our goal is to identify more proteins like Nup2 that have a synthetic phenotype with Csm4 mutation. To do this, a *pGAL1-CSM4* strain was treated with ethyl methanesulfonate (EMS) to induce unknown mutations which we hypothesize to include mutations in proteins of interest. After conducting the genetic screening for 1200 mutants, I found 48 candidates with the desired phenotype. I performed further analysis to identify the candidates with mutations in a single gene. After performing complementation tests, they will be sent for whole genome sequencing to identify the mutations of interest and their respective proteins. This can further illuminate specific protein interactions during chromosome segregation and can help us understand the reasons behind meiotic defects in humans.

Neural Mechanisms Underlying Social Behavior in Clonal Fish

Nishika Raghavan
Sponsor: Kate Laskowski, Ph.D.
Evolution & Ecology

Individuals behave differently. These differences can affect their antipredator behavior. When faced with a predator, individuals have to make a tradeoff between foraging and hiding. Such decisions are integrated in the brain. In this experiment, we used a genetically clonal species of fish called Amazon mollies (*Poecilia formosa*). Despite being genetically identical, they exhibit differences in individual behavior. We categorized mollies as either 'high', 'low', or 'average' based on the amount of time it took them to resume foraging after a simulated predator attack. We then compared neural activity using immunohistochemistry (IHC) techniques. We stained and counted active neurons in the Preoptic Area (POA), Hypothalamus, and Ventral Telencephalon (VT). Multiple linear models showed no relationship between active cell count and the POA and Hypothalamus. However, the models showed a relationship between active cell count and the VT. This analysis implied that low-latency individuals are associated with different levels of activation in the VT in response to a predation startle stimulus. We conclude that the VT may be a region involved with antipredator responses and that there may be a relationship between time it takes to emerge from shelter and neural activation.

Studying the Impact of Chd8 Haploinsufficiency on Cerebellar Function at the Transcriptional Level

Darlene Rahbarian
Sponsor: Alexander Nord, Ph.D.
Neuro Physio & Behavior

Mutations in the chromatin-remodeling factor *CHD8* (Chromodomain-Helicase DNA Binding Protein 8) have emerged as a significant genetic risk factor for autism spectrum disorder (ASD). Mice carrying Chd8 haploinsufficiency ($Chd8^{+/del5bp}$) exhibit ASD-like traits accompanied by slightly smaller cerebellum in MRI studies. Recent studies implicate the cerebellum in high-order cognitive functions that are tightly related to intellectual disability and ASD. Here, to investigate the global transcriptional effects of CHD8 haploinsufficiency in the mouse cerebellum, I purified total RNA from 24 mouse cerebellum samples at postnatal day 12 (PND12) from $Chd8^{+/del5bp}$ and wild type control littermate mice and studied global transcriptional profiling using bulk RNA-sequencing and conducted 1) differential expression 2) gene ontology enrichment and 3) SFARI gene set enrichment analyses, which revealed perturbations to metabolic, proliferative and synaptic pathways in the Chd8 haploinsufficient mice cerebella. Our findings provide groundwork for future studies on the association between aberrant cerebellum signaling and ASD-relevant neuropathology.

Development of breath test for respiratory virus diagnostics

Shaina Rahman
Sponsor: Cristina Davis, Ph.D.
Mechanical & Aerospace Engr

To increase the capacity to test for respiratory viruses worldwide, such as COVID-19, the development of a new type of test is needed. Due to health complications, many patients may not be able to partake in the widely available nasopharyngeal swab test or blood test, so an alternative noninvasive test is highly desired. The purpose of our study is to distinguish unique breath VOC (volatile organic compounds) biomarkers of respiratory viral infection, and then use these biomarkers to develop a portable breath analysis device that could be used by clinicians to noninvasively diagnose patients. This breath analysis device would use our miniature differential mobility spectrometry (DMS) detector, coupled with chip-based gas chromatography. The device will include a custom chip-based preconcentrator, which will be concentrated with chemical sorbent to allow extraction of VOCs from breath. We currently recruit subjects from the UC Davis Medical Center and collect exhaled breath through Tenax Sorbent Tubes that capture VOC biomarkers and collect nasopharyngeal swabs along with demographic information. Our findings so far indicate that there is variation in the VOCs found between different respiratory viruses, including the distinct strands of COVID-19.

Resveratrol as a Fountain of Youth or Death?: Fungal Detoxification of Plant Defense Compounds

Gurshan Rai
Sponsor: Dan Kliebenstein, Ph.D.
Plant Sciences

Botrytis cinerea is a generalist fungal pathogen noted for its damage to agricultural crops and vineyards. In particular, *B. cinerea* has several mechanisms for detoxifying plant chemical defenses. We focused on the detoxification of resveratrol, a plant defense compound with economic importance ranging from the wine industry to human health. Using in vitro plate assays, we measured fungal growth when exposed to resveratrol. Differential growth showed significant genetic diversity across 96 strains of *B. cinerea*. Given that *B. cinerea* has a relatively small genome showing polygenicity in many of its cellular functions, a genome-wide association study (GWAS) identified multiple candidate genes for this detoxification process. Because GWAS identifies correlations but doesn't test for causation, we further tested candidate genes using a dsRNA silencing assay. We predict the genes tested in the dsRNA experiment will show an effect on both fungal detoxification and plant defenses. This line of questioning will include a greater range of candidate genes in the future. We hope to identify the key elements of Botrytis's detoxification mechanisms and further our understanding of this complex, polygenic process.

Teacher Perspectives on the Impact of the COVID-19 Pandemic on the Education of Neurodiverse Students

Simran Raina
Sponsor: Nicole Sparapani, Ph.D.
Education

Introduction. There has been an increase in the percentage of students requiring special education or related services. This increase has been markedly impacted by the COVID-19 pandemic, as an increasing percentage of neurodivergent students are placed in inclusive general education classrooms. Prior research primarily focused on caregiver perspectives during the pandemic. Thus, this study aims to focus on teacher perspectives, as teacher-student relationships may influence student outcomes. Furthermore, teachers can speak on the educational and social impact of the pandemic on their students. Method. Data was obtained from 4 teachers, ranging from TK to third grade, from different schools in Northern California. These teachers were interviewed on their experience teaching after the pandemic, specifically regarding classroom management, student outcomes, and professional development or other related resources. All teachers had experience teaching before, during, and after the pandemic. Results. From these interviews, three themes arose including, teacher support, behavior labeling, and limited skill development. Conclusion. This study provides insight into how teaching, especially of neurodivergent learners, has been impacted by the pandemic as we enter this "post-pandemic era". It also serves to highlight the need for increased support for teachers to better navigate supporting different types of learners.

The Intersection of Living Situation and Suicidal Ideation: A QI Project to Tailor Willow Clinic Mental Health Services

Pragadeesh Raj
Sponsor: Kate Richards, M.D.
MED: Family & Community Med

Suicidal ideation (SI) disproportionately affects unhoused individuals, increasing the risks for substance use and psychiatric crises. Prior research on relationships between shelter and SI is sparse, with one study exploring the role of shelter case managers providing mentorship while residents supported at-risk peers. The study noted in general, social isolation and risky behaviors are reduced at shelters due to accessible support. To investigate this relationship, the Behavior Health Team (BHT) conducted a quality improvement study on the relationship between shelter status and suicide ideation (SI) among the unhoused patient population of the Willow Clinic, a UC Davis Health affiliated student-run clinic operating in Sacramento. To place quantitative associations upon the described relationship, BHT conducted a retrospective chart review of SI among patients with and without shelter. SI was determined by PHQ-9 screening results and shelter status via self-reported living situation. Significant associations between suicide ideation and shelter status were found ($p = 0.000063 < 0.05$), with a large increase in negative SI screening for sheltered individuals compared to their unsheltered counterparts. Further investigation is needed regarding this association and potential confounding variables, including trauma endured while unsheltered and barriers to being sheltered, to enhance protocols to support this population.

Evaluating Healthcare Trends and Disparities in Rural Communities: A Comparative Analysis of Annual Patient Data at the Knights Landing One Health Center

Shreyas Raj
Sponsor: Brenden Tu, M.D.
Student Hlth & Counseling Svcs

The Knights Landing One Health Center (KLOHC) in Knights Landing, California delivers comprehensive healthcare services to its diverse rural and farmworking population. In recent years, KLOHC has generated annual patient reports measuring the quality of patient care. This research study performs a comparative analysis of patient data spanning the years 2022-2023 and 2023-2024, with an emphasis on several factors to identify trends and disparities, to inform targeted interventions aimed at enhancing the standard of medical treatment in Knights Landing. This quality improvement study will involve the comparison of data extracted from patient medical records within the specified time periods. Data parameters include patient demographics (age, gender, ethnicity, primary language, zip code), current diagnoses, treated medical conditions, prescribed medications, PHQ-9 scores, clinic appointments (in-person and telehealth), mental health and physical therapy consultations, laboratory examinations, and specialty clinic referrals. Statistical descriptions and correlations will be applied to identify patterns and inconsistencies between the two timeframes. The comparative analysis of patient data will provide valuable insights into demographic shifts, healthcare usage trends, and fluctuations in prevalent health conditions. By utilizing these findings, KLOHC can adapt its healthcare services, enhance targeted interventions, and improve health outcomes for its multifaceted patient demographic.

Do the Number and Placement of EEG Electrodes Impact Multi-Variate Pattern Analyses of Visual Processing?

Aishwarya Rajan
Sponsor: Steven Luck, Ph.D.
Psychology

In the past decade, Multivariate Pattern Analysis (i.e., decoding) has become increasingly utilized in studies of neural processes. Identifying optimal methods in this domain thus has significant value in improving the sensitivity and power of future EEG neural decoding work. With this aim in mind, this study will investigate the influence of electrode count on the magnitude and reliability of neural decoding in electroencephalography (EEG) in the context of visual processing. Specifically, we will evaluate differences in the decoding of visual scene identity across five electrode montages, varying in number (64\32\16) and positioning of electrodes (distributed vs. high-density posterior). These montages will be created by subsetting 64-channel data recorded from 20 subjects viewing real-world scenes. We hypothesize that (1) the increase in spatial resolution from a higher number of electrodes, as well as (2) an increase in electrode density over posterior sites (which are more likely to record activity from the visual cortex), would enhance the reliability, and thus the observed effect size, of visual scene identity decoding from scalp-based EEG recordings. This investigation will provide valuable insights in identifying optimal balance points between reliable measurement and practical considerations such as cost, comfort, and setup time.

Evolving Minds: Contrasting Emotion Reasoning in Children and Adults

Rachel Raju
Sponsor: Kristin Lagattuta, Ph.D.
Psychology

Individual's emotional experiences depend both on their expectations about what might happen and what has already occurred. Children's ability to reason about others' emotional states requires the development of Theory of Mind (ToM): Understanding others' intentions, desires, and beliefs. Previous research indicates age-related advances in ToM proficiency, with 8 to 10-year-olds demonstrating more sophisticated understandings of mental states. They successfully consider internal factors (e.g. other's beliefs, desires), but tend to outweigh external factors (e.g., outcomes of situations) when explaining emotions. In this study, we investigated differences between how 8 to 10-year-olds and adults reasoned about emotions following an outcome. Participants were read four illustrated stories with two characters holding differing expectations about a future outcome. Each story contained 3 different outcomes: Positive (e.g., winning a big teddy bear), Negative (e.g., not winning a big teddy bear), and Attenuated (e.g., winning a small teddy bear). Participants reasoned how characters would feel after each outcome and explained their responses. We analyzed these emotion explanations by outcome under the hypothesis that adults would refer more to mental states in their emotion explanations whereas children would refer more to outcomes and desires than mental states in their emotion explanations.

Developing a Prostate Tumor-on-a-Chip Platform to Study Efficacy of CAR T-Cells

Tara Raju
Sponsor: Steven George, M.D.,Ph.D.
Biomedical Engineering

Chimeric Antigen Receptor (CAR) T-Cell therapy is an immunotherapy that uses T-cells with engineered T-Cell Receptors (TCR) so they can more easily recognize and kill tumor cells. Current methods for assessing efficacy of CAR T-Cells are constrained by limitations: 2-dimensional (2D) *in vitro* models lack the complexity of the *in vivo* tumors, and animals have different biology than humans. Microfluidic tumor-on-a-chip models present the opportunity to study human tumors in a 3D tissue complex and observe activity at a high spatial and temporal resolution. We developed a microfluidic chip to recreate the prostate tumor microenvironment using prostate cancer and endothelial cells. Maintaining the 3D structure within the small volumes of these platforms requires an extracellular matrix (ECM). I particularly focused on optimizing the composition of this ECM to develop the tumor chip. I found that fibrin dosed with the metalloproteinase inhibitor aprotinin allows growth of aggressive prostate tumors while still maintaining a 3D structure in the microfluidic chip. Further, we perfused CAR T-Cells that are engineered to target prostate stem cell antigen (PSCA) through the microvessels in the platform and demonstrated that the CAR T-Cells extravasate and specifically kill PSCA expressing tumors in the platform.

The Racialization of Caste in Tamil Nadu

Ashwin Ramakrishna
Sponsor: Nicole Ranganath, Ph.D.
Middle East/South Asia Program

This independent research project will examine the concepts of race within the caste dynamics of Tamil Nadu and how these conceptions interact with the lives and socialization of Tamil people in India and the diaspora. The performance of caste, particularly among Tamil Brahmins will be explored in an effort to understand the ways in which caste tradition presently exists and how it has been associated with the disenfranchisement of oppressed castes with respect to socioeconomic opportunities, as well as social interactions and dynamics. This project will delve into conceptions of Indo-European and Dravidian identities and their impact on Tamilian's perceptions and relationships with their culture as well as the culture of others. This project is a historical study with an emphasis on economic, political, and cultural factors in looking at this process of racialization. The primary methods utilized in the research of this project will be textual analysis and oral histories.

Analysis of Differential Methylation in Subtypes of Pancreatic Ductal Adenocarcinoma

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

Pancreatic ductal adenocarcinoma (PDAC) is the third leading cause of cancer-related deaths in the United States, with a 13% 5-year survival rate. There are two major molecular subtypes of PDAC, squamous and progenitor, characterized by drastically different transcriptional signatures. We previously found subtype-specific DNA methylation signatures from whole genome bisulfite sequencing (WGBS) analysis of patient-derived organoids (PDOs). HOMER motif analysis on differentially methylated regions (DMRs) that are hypermethylated in the squamous subtype showed enrichment of GATA6 and HNF4A, known master regulators of the progenitor subtype. I therefore hypothesized that WGBS analysis of commercially available PDAC cell lines would similarly uncover distinct DNA methylation profiles that impact progenitor transcriptional networks. To test this hypothesis, I performed WGBS analysis on 3 squamous and 5 progenitor commercially available PDAC cell lines. DMR calling identified 8,411 DMRs that completely separated the two subtypes in hierarchical clustering analysis. Meanwhile, HOMER motif analysis showed that HNF4A target genes are hypermethylated in the squamous subtypes of PDAC cell lines. These results recapitulated the findings from PDOs, suggesting that 2D cell lines are appropriate models for studying differential DNA methylation in PDAC subtypes.

Evaluation of the Efficacy of AAV8-SpCas9 Viral Vectors in Non-Human Primate Eyes as a Treatment for Choroidal Neovascularization

Sruthi Ramesh Kumar
Sponsor: Glenn Yiu, M.D.,Ph.D.
MED: Eye Center

CRISPR-based genome editing allows permanent suppression of the vascular endothelial growth factor (*VEGF*) gene as an alternate treatment option to monthly injections of anti-VEGF agents for patients with neovascular age-related macular degeneration (nAMD). Our previous study involved creating adeno-associated viral (AAV) vectors carrying *S.pyrogenes* Cas9 (SpCas9) and gRNAs targeting the VEGFA gene, effectively reducing choroidal neovascularization (CNV) in mice. Extending this to rhesus macaques, we injected varying doses of AAV8 vectors to deliver SpCas9 and gRNAs against VEGFA into 8 adult rhesus eyes, followed by laser-induced CNV 4 weeks later. We performed clinical examinations and imaging including fluorescein angiography (FA), and optical coherence tomography (OCT) every 2 weeks until 12 weeks post-injection. Eyes treated with low doses of AAV8-SpCas9 and active gRNA exhibited a potential reduction in VEGF protein levels and a decrease in CNV severity, as indicated by FA image analysis. Furthermore, all subjects developed concentric macular rings and subfoveal hyperreflective material early on, indicating outer retinal damage. This material, analyzed through immunohistochemistry (IHC), was found to include pigmented cells and collagen, suggesting subretinal fibrosis from altered retinal pigment epithelium (RPE) cells. Further studies are needed to improve the safety of AAV-mediated CRISPR-Cas9 genome editing in the retina.

Beyond the Swipes! Social Media Usage and Mental Well-being in College Student Community

Roberta Ramila
Sponsor: Azra Jahanitabesh, Ph.D.
Psychology

In the contemporary landscape, social media has become an integral part of individuals' lives, significantly influencing daily routines. This research project investigates the multifaceted relationship between social media usage patterns and their impact on mental well-being, with a focus on self-esteem, identity, comparison, and depressive symptoms. The study examines variables such as the time spent on social media, types of activities engaged in (e.g., passive scrolling, active posting), and social identity among college students. Approximately 100 UC Davis undergraduates participated in a 15-minute survey, providing insights into perceived and actual social media usage, self-esteem levels, and depressive symptoms. The research employs linear regressions and mediation analyses to unravel the intricate interplay between social media habits, self-esteem, and depression symptoms. The main hypothesis posits that increased passive social media use will exhibit positive correlations with depressive symptoms and lower self-esteem. By delving into these variables, the study aims to contribute valuable insights into the nuanced dynamics between social media engagement, social identity, and mental well-being among college students. The findings may inform strategies for promoting healthier social media habits and ultimately enhance the overall mental health of this demographic.

Prenatal Cannabis Use and Lung Development in Non Human Primates

Dania Ramirez
Sponsor: Kent Pinkerton, Ph.D.
VM: Anat Physio & Cell Biology

Maternal use of cannabis during pregnancy is increasing and generating greater concern for the health and development of the unborn child. In particular, the influence of maternal ingestion of cannabis during pregnancy on respiratory growth and health of offspring is unknown. It is known cannabis use during pregnancy can be associated with low birth weight, prematurity, and greater risk of stillborn birth. This study examined the ingestion of delta-9-tetrahydrocannabinol (THC), the main psychoactive component of cannabis, during pregnancy in non-human primates to study the effect of THC on offspring lung development. Female rhesus macaques ingested food pellets laced with or without THC. Maternal offspring were examined at term or at 6 months postnatal age. Lung airway and blood vessels were examined using stains for connective tissue (trichrome) and elastin (reticulin). No differences were noted at the end of gestation. In contrast, at 6 months of age, there was a significant increase in the volumes of connective tissue and elastin associated with decreased lung volume and pulmonary function. These findings demonstrate a structural modification during postnatal life in the lungs of infants of mothers ingesting THC, thus adding further evidence to suggest caution regarding cannabis use during pregnancy.

Investigating the Role of Iron as an Alternative to Antibiotics in Post-Weaning Pigs

Zealan Ramirez
Sponsor: Peng Ji, Ph.D.
Nutrition

During the post-weaning period, piglets endure major environmental challenges and dietary stress caused by immediate weaning to a plant-based solid diet, leading to an increased susceptibility to enteric pathogens. Traditional solutions have utilized antibiotics, however, with the rise of antibiotic resistance, alternative approaches are needed. This study aims to investigate the role of trace metal supplementation in modulating enteric resilience to enterotoxigenic *E. Coli* (ETEC) infection. Fifty weanling pigs were randomly assigned into five treatment groups, including the low iron diet with iron dextran injection (200 mg), iron adequate diet (120mg Fe/kg), high iron diet (1200mg Fe/kg), high copper diet (250mg Cu/kg), and high zinc diet (2500mg Zn/kg). During the 24-day study, ETEC was orally administered (10^10 CFU/dose) on days 13-16 to induce enteric infection. Fecal samples were collected on days 12, 18, 21, and 24. Tissue trace metal concentrations will be analyzed using ICP-OES and the virulence of ETEC will be quantified using RT-qPCR. Intestinal morphology of the ileum will be analyzed using hematoxylin and eosin staining. Evaluating this relationship can provide insights into piglet health and prevent the spread of ETEC.

Mapping Bai2 Expression in Hippocampal Neural Precursor Cells

Elizabeth Ramm
Sponsor: Elva Diaz, Ph.D.
MED: Pharmacology

Critical neuron generation and differentiation within the adult brain occurs after vast neurogenesis within the embryo. These new neurons originate from resident neural precursor cells (NPCs) and play key roles in learning, memory, and brain diseases like Alzheimer's and dementia. Our lab has identified the Brain-specific angiogenesis inhibitor 2 (Bai2) protein as an adhesion G-protein coupled receptor (aGPCR) that contributes to regulating neurogenesis, but little is known about its driving mechanism. In this study, we seek to explore the expression of Bai2 protein in the NPCs of the hippocampal dentate gyrus. For our experiment, we used tdTomato fluorescent protein in a transgenic mouse strain which allowed us to label NPCs and new-born neurons. We then perfused the brain tissue and performed immunohistochemical staining with anti-Bai2 antibody. The tissue was imaged, 3D rendered, and analyzed in Imaris software. Our image analysis showed strong colocalization of Bai2 staining within tdTomato-labeled cells and identified these cells as NPCs by their morphology. To understand what cell type the Bai2 protein presents is a key step to uncover how Bai2 regulates adult neurogenesis.

Genome Analysis of *Ralstonia solanacearum* Species Complex To Identify Genetic Differences That Affect Host Range and Virulence in Plants

Benjamin RAMIREZ
Sponsor: Tiffany Lowe-Power, Ph.D.
Plant Pathology

The *Ralstonia solanacearum* species complex includes *Ralstonia solanacaerum, Ralstonia pseudosolanacaerum, Ralstonia syzygii. Ralstonia* species are gram negative bacteria that colonize xylem in plants, leading to bacterial wilt. *Ralstonia* are an incredibly diverse group of plant pathogens whose host range includes potatoes, tomatoes, ginger, bananas, eggplants, and capsicum. Due to high virulence and environmental stability, *Ralstonia* poses a global threat to growers who suffer economic losses and food insecurity. By investigating phylogenetic relationships and genome differences, we will generate hypotheses about genomic factors that suggest differences in virulence and host range. Our genomic data is sourced from *Ralstonia* strains isolated in Tanzania and sequenced via Illumina sequencing. Using Kbase software, we uploaded and trimmed strain sequences. Continuing in Kbase, we assessed the quality of sequencing data which led to assembly of our sequence data into genomes. Genomes were then annotated for future research. Each genome was then compared to previously sequenced reference strains to estimate phylogenetic relationships. Continuing forward, we will combine all sequenced genomes into a singular phylogenetic tree to assess relatedness. We will identify phylogenetic relationships to suggest genetic factors and differences that affect host ranges and virulence.

Web-Accessible Life-Threatening Diagnostic Test Results for Urgent Clinician Notification

Dean Ramos
Sponsor: Gerald Kost, M.D.
MED: Pathology & Lab Medicine

This research aimed to examine critical limits and values available on the World Wide Web, assess drift in quantitative low/high thresholds since 1990-93, streamline urgent notification practices, and promote global accessibility. We identified Web-posted lists of critical limits/values at university hospitals. We compared 2023 to 1990-93 archived notification thresholds. We found critical notification lists for 26 university hospitals. The median number of tests was 62 (range 21-116). The breadth of listings increased. Statistically significant differences in 2023 versus 1990 critical limits were observed for blood gas (pO2, pCO2), chemistry (glucose, calcium, magnesium), and hematology (hemoglobin, platelets, PTT, WBC) tests, and for newborn glucose, potassium, pO2, and hematocrit. Fourteen hospitals listed troponin measurements. Qualitative critical values expanded across disciplines. Bioterrorism agents, contagious pathogens, and pathology were listed frequently, although only three hospitals listed COVID-19. Only one notification lists detailed point-of-care tests. Urgent notifications should prioritize life-threatening conditions. We recommend that hospital staff evaluate drift over the past three decades for clinical impact. Notification lists expanded, especially qualitative tests, suggesting that automation might improve efficiency. Sharing notification lists and policies on the Web will improve accessibility and harmonization of urgent notification and critical care practices in the 21st Century.

Policy, Systems, and Environmental Strategies to Increase use of SNAP Benefits at Farmers Markets: A Systematic Review

Monzerrath Ramos Gonzalez
Sponsor: Cassandra Nguyen, Ph.D.
Anr Nutrition

Farmers markets (FMs) that accept Supplemental Nutrition Assistance Program (SNAP) and offer nutrition incentives are a promising approach for improving accessibility and affordability of high-quality foods. However, studies show that low-income individuals experience barriers to using FMs. The aim of the review was to answer: What policy, systems, and environmental (PSE) strategies are suggested in the literature to increase use of SNAP benefits at FMs? Systematic searches were conducted in academic databases and peer-reviewed journal websites. Results were screened for standard inclusion criteria. Of 7,742 identified references, 86 publications were included in the final review. Most studies (70%) used cross-sectional data collection. Evidence suggested promising PSE strategies included nutrition assistance program marketing, complementary nutrition incentive programs, and referrals for, or education about, FMs at external sites to potentially increase use of FMs among SNAP beneficiaries or other low-income shoppers. A list of PSE strategies with associated supporting evidence for their use at FMs was generated. This list of PSE strategies will be integrated into a FM assessment that can be used to support partnerships with FMs to increase the uptake of best practices in FMs toimprove their appeal and utility for SNAP beneficiaries and other low-income audiences.

Sulfur Cycles in Seagrass Root Associated Bacteria

Akhila Rao
Sponsor: Jonathan Eisen, Ph.D.
MED: Medical Microbiology & Imm

Seagrass is a model organism for plant-microbe interactions in both marine and terrestrial ecosystems. Sulfides present in the sediments of seagrass beds are phytotoxic to seagrass and are unable to be oxidized in the low oxygen environment, leading to seagrass death. Studies have shown that the root and rhizosphere of seagrass in habit microbes, known as sulfur oxidizing bacteria, that perform sulfur cycles. These seagrass root associated microbes oxidize the sulfide to sulfite and use the sulfite as an energy source. In this study, we focused on seagrass, *Zostera marina* from Bodega Bay, CA, to understand the sulfur cycle of the microbiome and how it impacts seagrass function. We isolated pure bacterial colonies from the seagrass root, performed DNA extractions and sequenced the bacterial genomes. The genomes were analyzed using the software and data science platform, KBase, to identify the taxa and important functions that are related to sulfur cycling.

LupBook: An Open Source Interactive Textbook Framework

Arnav Rastogi
Sponsor: Joel Porquet-Lupine, Ph.D.
Engr Computer Science

LupBook is an open source interactive textbook framework designed to enhance the teaching of programming languages through enabling readers to experiment with concepts in real-time as they learn them. Unlike existing platforms that rely on server-based code execution, LupBook operates entirely on the client's side, enabling offline usage. The project introduces a virtual machine, emulating a minimal RISC-V based system with a full but minimal Linux-based software stack. This approach allows code components within the interactive textbook to be executed locally, fostering a continuous learning experience. In this poster, our student team will present our contributions to the project which include: a set of new interactive components and navigational features. We've worked on various interactive components that improve the learning experience available for users. The development of multiple-choice questions, matching exercises and parsons exercises, ensure that book authors have flexibility in choosing question types for their specific needs. We've also added an improved user experience, created through the development of seamless navigation, integrating features such as a table of contents and settings bar, facilitating font adjustments and dark mode for enhanced readability. LupBook represents a significant advancement in interactive textbook technology, empowering educators to create engaging and customized learning experiences.

Developing Anti-Racist Curricula: Exploring Liver Disease in Latiné Populations through Justice-Oriented Case Studies for Pre-health Students

Akshaya Ravi
Sponsor: Brie Tripp, Ph.D.
Neuro Physio & Behavior

Extensive initiatives have aimed to engender an anti-racist paradigm shift in medicine to reduce healthcare disparities. However, many pre-health students receive no education on how science and medicine perpetuate healthcare injustices, nor do they have the opportunity to collectively engage in justice-oriented actions. This study aims to increase awareness among undergraduate pre-health majors on how racism in medicine and society re/produces health disparities and what can be done to advocate against racial injustices. To achieve this, we have developed a series of Anti-Racist Case Studies that engage undergraduates in learning physiology through the lens of healthcare disparities. One such case involves analyzing data on the 1) pathophysiology of liver disease, 2) scientific injustices that perpetuate liver disease disparities in Latiné populations, and 3) ways to advocate with Latiné communities for justice. We will implement this case in an upper-division physiology course to measure changes in pre-health students' pathophysiology knowledge, awareness of factors contributing to healthcare disparities, and confidence to advocate for racial justice through quantitative (survey) and qualitative (interviews) research methods. We hypothesize pre-health students will become more aware of why healthcare disparities exist and feel empowered to act in solidarity with those most affected by systemic racism.

In-Depth Examination of Commercially Available Educational Games For AI, Machine Learning, and Data Science: A Glimpse Into Trends and Educational Value

Adityaa Ravi
Sponsor: Setareh Rafatirad, Ph.D.
Engr Computer Science

Serious digital games are designed to serve educational and training objectives while incorporating game-like elements. By leveraging the interactive nature of gameplay, they deliver specific learning outcomes, skill development, and problem-solving experiences. In this study, we performed a comprehensive analysis of commercially available and playable educational serious games designed for teaching Artificial Intelligence (AI), Machine Learning (ML), and Data Science (DS). These games are not just tools for learning; they are gateways to democratizing AI education. They provide an engaging and accessible platform for acquiring knowledge, thereby playing a crucial role in fostering an equitable educational environment. Our objective is to pinpoint both the existing strengths and the areas of improvement within these games. We identified 35 such games and assessed them across 18 criteria and explored correlations between pairs of criteria. These criteria focused on interaction methods, support provided, accessibility, and the content covered in the games. Through gameplay and extensive review of research papers, we categorized these games, shedding light on the current trends and educational potential of AI-based games in the fields of ML, AI, and Data Science to meet various educational and learning needs.

Can Nanopore DNA Sequencing Locate Recombination points of Hybrid F2 Lettuce Plants?

Peter Reifenstein
Sponsor: Richard Michelmore, Ph.D.
MED: Medical Microbiology & Imm

During Prophase 1 of meiosis, homologous chromosomes interchange their DNA at recombination points (crossovers). Recombination promotes genetic diversity, but is limited by the distribution and frequency of crossovers along the chromosomes, making it important to better understand its mechanism. Current methods to determine crossovers at the DNA level are inefficient, therefore, we aimed to develop a high-throughput approach. First, we crossed domesticated (*Lactuca sativa*) and wild (*Lactuca serriola*) lettuce plants to generate hybrid F1 progeny, which were self-crossed to produce F2 individuals containing many recombinant chromosomes produced by crossovers. We used Oxford Nanopore Sequencing to obtain the sequences of long stretches of individual DNA molecules, known as reads, from a pool of F2 individuals. We developed an algorithm that employs a high quality single nucleotide polymorphism (SNP) set between both parents to classify reads as being from either parent or recombinant. Recombinant reads exhibit a switch from SNPs from domesticated lettuce to SNPs from wild lettuce (or vice versa), revealing the locations of crossovers. Our preliminary analysis found 1,063 high quality recombinant reads from a pool of approximately 55 individuals. Next, we will use this method on CRISPR-mutated plants to identify potential genes involved in recombination.

Even Small Disease Lesions Reduce Seagrass Photosynthetic Activity and Growth

Malia Reiss
Sponsor: John Stachowicz, Ph.D.
Coastal & Marine Science Inst

Eelgrass (*Zostera marina*) meadows provide key ecosystem services but are threatened by seagrass wasting disease, caused by the slime mold *Labyrinthula zosterae*. Infections produce lesions of necrotic tissue, but sometimes these are only a small fraction of total leaf area. However, a small lesion at the base of an actively growing blade may have a plant-wide impact by reducing translocation of photosynthetic sugars or causing early leaf senescence. We assessed the effect of this on leaf growth by comparing the effect of removing the leaf tissue distal to a lesion, with a healthy leaf with the same amount of tissue removed. We measured whole-plant growth over 4 weeks and found that clipping had a negative effect on both lesioned and healthy plants, but had a more severe negative impact on healthy plants, demonstrating that infection not only reduces the productivity of lesioned area, but also the rest of the leaf. Unlesioned plants also experienced quicker and more dramatic recovery after clipping versus clipped diseased plants. Together our results suggest that even a small lesion can affect plant growth and that plant-wide lesion area measurements may not scale directly with costs in plant growth.

Studying Sorghum Drought Stress to Identify Genes Related to Nutritional Quality Traits

Gabriel Rendon
Sponsor: Christine Diepenbrock, Ph.D.
Plant Sciences

As the world's largest sorghum producer by weight, the United States depends on the quality of sorghum it produces for ethanol production, livestock feed, and human consumption. Growers from South Africa also depend on sorghum production as its second-grown cereal. However, growers in both countries have been facing drought stress, which may threaten sorghum yield and worsen food insecurity issues. This study aims to improve sorghum's productivity and nutritional quality under drought conditions. Plots of genetically diverse sorghum genotypes in well-watered vs. drought-conditioned sorghum fields were grown at the UC ANR West Side Research and Extension Center. Each plot was harvested, then aliquoted and ground into fine powder. As our primary method of data collection, we used Near Infrared Spectroscopy (NIRS), a nondestructive technique that allows us to quantify compositional traits such as protein, fat, fiber, ash(total mineral content), and moisture percentages. Using this data from the NIRS, we can compare the differences in grain composition and agronomic traits. In the future, we hope to do a genome-wide association study (GWAS) to identify single nucleotide polymorphisms (SNPs) that differ between sorghum grown in well-watered and drought conditions.

Modifying an RNA Isolation Protocol to Study the Total Gene Expression at the Bone Fracture Site

Renato Reyes
Sponsor: Augustine Saiz, M.D.
MED: Orthopaedic Surgery

Traumatic injuries such as long bone fractures cause a significant decrease in quality of life as well as financial hardships as limited mobility is linked with decreased work productivity. Despite the importance of polytrauma, little is known about the gene expression profile of the fractured bone in polytrauma. Experiments such as bulk RNA sequencing identify the total gene expression of tissues such as fractured bone. However, this is highly dependent on the accuracy and efficacy of the used protocol for isolating RNA from bone. Hence, in this study, we compared two different protocols for isolating RNA from bone and compared the RNA Quality Score (RQS) of our samples. The standard measurements indicate that an isolated RNA with high quality should have a score above 7. The quality control analysis was done at UC Davis Genomics Center. Our results demonstrated that using the Qiagen kit with the column filter (RQS = 7.6) is more effective in isolating RNA than the Qiagen kit without the filter (RQS = 7.2). This established and tested protocol could be a useful technique for studying the gene expression pattern of fractured bone.

Cultivating Community and Safe Foods with The Civic Urban Farmer Program

Mia Reyes
Sponsor: Sara Garcia, Ph.D.
VM: Population Hlth & Reprod

Urban food producers in Northern California face logistical challenges such as urban policy, soil health, profitability, and issues surrounding food safety. These challenges oftentimes hit communities of color at a far greater cost, with many nonprofit organizations finding themselves scrambling for resources. The no-cost, 11-week program, offered a combination of virtual and in-person, hands-on workshops, that seek to provide accessible and technical expertise for producers in the area. The train-the-trainer model offered classes that included a variety of topics such as soil health, composting, food safety, and urban policy. The program has hosted two cohorts, with over fifty participants. At the conclusion of the program, individuals were asked to self-assess their changes in knowledge. Data collection challenges lie in participation in the online surveys, yet current data from both cohorts, reveals a substantial uptick in knowledge after participating in the program. The success of the program revealed that small urban farmers within the Sacramento and Bay Areas, display a need for resources and education that are tailored specifically towards the cultivation of healthy and safe food. The continuation of the Civic Urban Farmer Program will be explored, as well as the expansion of the program in other parts of California.

Differences in Health Care Utilization in CA using the CHIS Database

Natalie Reyes
Sponsor: Miriam Nuno, Ph.D.
MED: Public Health Sciences

Racial background, socioeconomic status, and health conditions or behaviors may factor into decreased use of necessary healthcare services available to an individual. Demographic, health profile, and socioeconomic data from the 2019 Adult California Health Interview Survey (CHIS) was analyzed through a series of chi-square tests to identify additional factors associated with lower health care usage. Results show that individuals could not attend their appointments (22%), did not have enough time (13%), and thought appointment hours were inconvenient (6%). 14% of respondents reported no usual place of healthcare, with younger individuals (*18-40 years, 23%, p=0.0047*), participants living below the federal poverty level (*0-99% FPL, 22.3%*), Latinx populations (*22%, p=0.0999*), and those with current smoking practices (everyday *smoker 22%, some days smoker 28%, p=0.0250*) reporting the highest burden. Individuals experiencing the most extreme level of poverty (0-99% FPL) have less access to a usual place of healthcare than respondents above the poverty line (300% or above FPL). From our analysis of the 2019 Adult CHIS Data, Californians from racial/ethnic minority groups, younger individuals, low socioeconomic status, and those with occasional smoking habits have lower trends of healthcare utilization.

The Effects of Ambient Noise Level on Black Phoebe Song Structure

Aidan Reynolds
Sponsor: Gail Patricelli, Ph.D.
Ag Evolution & Ecology

Urbanization is a growing threat to biodiversity and imposes pressures on wildlife, including increased noise pollution. These conditions may inhibit intraspecific communication and negatively affect the fitness of species that rely on effective auditory signaling. The Black Phoebe, an insectivorous songbird, has shown outlying success in urban environments and unnaturally high ambient noise levels. We hypothesized that aspects that make Phoebe songs more conspicuous and identifiable will be emphasized in environments with louder ambient noise to increase efficiency of communication and territory defense through song. We predicted that Black Phoebes in areas with higher LEQ and LMax sound measurements will produce larger frequency bandwidths and show shorter time intervals between each song phrase. Songs were collected with a Marantz recorder and shotgun microphone. Song aspects were analyzed using Raven Pro. Ambient noise had a substantial effect on Black Phoebe song structure, whereby male Black Phoebes increased song rate in environments of higher ambient noise levels. Based on positive trends, there is a possible effect of Leq and LMax noise levels on frequency bandwidth. Furthermore, LMax had a stronger effect on phrase frequency than Leq, implying the importance of overpowering short spikes of noise rather than overall sound level.

Influence of Selenium on Mercury Toxicity in Sacramento Splittail of the San Francisco Bay Estuary

Emily Anne Richter
Sponsor: Brett Poulin, Ph.D.
Environmental Toxicology

Aquatic environments across the globe are increasingly endangered by rising concentrations of pollutants, including mercury (Hg). The San Francisco Bay Estuary has been especially impacted by Hg contamination and consequent methylmercury (MeHg) toxicity due both to the gold mining industry of the nineteenth century and heavy industrialization of the twentieth and twenty-first centuries. A growing body of studies suggests that selenium (Se), while also acting as a toxin to aquatic organisms, can influence MeHg microbial production, bioaccumulation, and biomagnification; regions of the San Francisco Bay Estuary are Se-enriched to varying levels, providing an opportunity to observe trends between selenium levels and mercury bioaccumulation. 121 samples of Sacramento Splittail (*Pogonichthys macrolepidotus*) muscle tissue, collected from across the estuary and previously documented to have a range in total Se concentration, were analyzed for total Hg and MeHg concentrations. The concentrations and speciation of Hg were compared to the concentration of Se to aid interpretations of Hg toxicity. The results provide information that will help improve the understanding of how Se-Hg interactions can influence MeHg bioaccumulation in fish across an estuary.

Viable but Non-Culturable *Salmonella*: A longitudinal investigation into the effects of nutritional starvation

Katie Risoen
Sponsor: Bart Weimer, Ph.D.
VM: Population Hlth & Reprod

Salmonella is the leading cause of foodborne illness worldwide and is of high priority for the development of improved food safety practices. This prevalent pathogen can enter a viable but non-culturable (VBNC) state wherein microorganisms are metabolically active but not actively replicating, making them undetectable with conventional plating methods. Despite being in a VBNC state, it is unknown if *Salmonella* retains pathogenicity while being undetectable. Although VBNC *Salmonella* may pose a serious threat to public health, induction and metabolic regulation of VBNC *Salmonella* remains largely undefined, necessitating further investigation into this physiological state as a public health concern. This study tested how sugar deprivation contributed to the induction of VBNC in six *Salmonella* serotypes using colony counts to assess non-culturability in conjunction with qPCR and ATP assays to measure viability. While colony forming units decreased over time, cellular activity, indicated via qPCR and ATP assays, indicated *Salmonella* did not die but instead entered the VBNC state. Investigation into the dynamics of virulence via invasion and metabolic factors for VBNC *Salmonella*, as illustrated here, can support the development of improved food safety protocols and detection methods, ultimately contributing to public health prevention efforts.

The Effects of *Dh31* and *Pdfr* on the Body Temperature Rhythm of *Drosophila melanogaster*

Kazim Rizvi
Sponsor: Fumika Hamada, Ph.D.
Neuro Physio & Behavior

The circadian rhythm contains the body temperature rhythm (BTR) which is the fluctuation of body temperature throughout a day cycle and helps maintain health. Mechanisms of BTR are conserved from flies to humans. By understanding the circadian rhythm of fruit flies, *Drosophila*, we elucidate the mechanisms that control the human circadian rhythm. The temperature preference rhythm (TPR) is defined by dependence on behavioral changes in Drosophila's preferred temperature.The BTR of *Drosophila* is influenced by class-B G-protein coupled receptors (GPCR). This study focused on two GPCRs: diuretic hormone 31 receptor (*Dh31r*) and pigment dispersing factor receptor (*Pdfr*). This experiment sought to find the mechanisms by which *Dh31r* and *Pdfr* control TPR of *Drosophila* using mutants with decreased amounts of *Dh31r* and *Pdfr*. This study produced results depicting the circadian rhythms made for different lighting conditions: light-dark (LD) and dark-dark (DD). The results of LD and DD conditions for *Dh31* and *Dh31r* mutants showed that males did not increase daytime body temperature, while *Pdf* and *Pdfr* mutants exhibited a loss of anticipation for males and females. By studying GPCRs and their functions, it can give us a deeper understanding on how temperature regulation of the body affects circadian rhythm and health.

Validation of Neurexin-TurboID as an Effective Proteomics Tool

Melanie Robles
Sponsor: Christina Kim, Ph.D.
MED: Neurology

Understanding the neural pathways associated with particular behaviors at the proteomic level can aid in mechanism identification and inform novel therapeutic approaches. Alterations in membrane proteins are often associated with various neurological disorders. However, it is challenging to isolate specific membrane proteins from neuronal subpopulations for analysis. TurboID is a biotin ligase which can, in the presence of biotin, label proteins within a ~10nm radius. Coupled with mass spectrometry of enriched biotinylated proteins, it is a promising *in vivo* tool for proteomic labeling of targeted neural circuits. Our lab has generated an AAV-Nrxn-TurboID that fuses the N terminus of TurboID to a truncated form of neurexin (Nrxn), which is believed to localize to neuronal cell membrane. My project hypothesizes that our neurexin-TurboID primarily localizes to the membrane of neurons and is capable of tagging nearby membrane proteins with biotin. To test this, we performed an *in vitro* analysis of the expression of our neurexin-TurboID in cultured neurons, and then did an image analysis in ImageJ to check for the construct's localization and the presence of nearby biotinylated proteins. My results suggest that Nrxn-TurboID is capable of biotinylating proteins in the presence of biotin and localizes differently than cytosolic TurboID.

Deep Space Habitat Mockup for Human/System/ Robotic Interaction Research

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

As humanity's ambition for space exploration grows, the NASA HOME STRI (Habitats Optimized for Missions of Exploration Space Technology Research Institute) leads the development of sustainable deep-space habitats. This initiative pursues the design and development of a deep-space habitat research mockup, critical for studying complex dynamics of human-robot collaboration and system integration in an off-Earth environment.

The objective of the mockup is to replicate spatial, technological, and environmental challenges expected in deep-space habitats, providing a realistic setting for evaluating the interplay between humans, robots, and essential life support systems. This investigation will assess the efficiency and reliability of robotic assistance and the integration of critical operational systems, aligning with the overarching goals of the NASA HOME STRI.

Utilizing an interdisciplinary approach, the project bridges robotics, human factors research, and life support engineering, among other fields. Insights garnered from this initiative will not only advance space exploration technologies but also have far-reaching implications for designing habitats in extreme terrestrial environments and enhancing human-robot interactions in various settings.

This research mockup, in collaboration with other HOME initiatives, is set to significantly contribute to the development of technologies ensuring the safety, efficiency, and sustainability of human life in space and on other planets.

Disbudding Dairy Calves with Caustic Paste: Exploring the Impact of Contact Duration on the Healing Process

Victoria Rodas
Sponsor: Cassandra Tucker, Ph.D.
Animal Science

Caustic paste disbudding is a common procedure in the dairy industry used to prevent horns in adult cattle. Caustic paste is used during the first week of life. When the alkaline-based paste is applied to the skin, a chemical burn occurs in the following hours. We explored the effects that the duration of contact has on damage caused to horn-growing tissue. A shorter duration of paste contact could potentially reduce the wound's severity and other negative consequences, such as rubbing paste on other body parts. We observed 30 Holstein calves randomly assigned to one of two treatments: caustic paste was wiped off after 1 h or left on to dry/absorbed into the horn bud. The healing process of the tissue was analyzed through wound size and tissue types. We measured the wound diameter at 2 time points and scored the tissue types 2x/wk. We scored 8 tissue types for the presence or absence: fresh paste, attached necrotic, detaching necrotic, exudate, granulation, crust, new epithelium, and healed. We hypothesized caustic paste left on for 1 hour will result in less severe damage, as evidenced by a smaller wound and faster healing, compared to when paste is left to absorb.

A Social Network Analysis to Better Understand Rural Farmworking Healthcare Outreaching Efforts

Gloria Rodriguez
Sponsor: Natalia Deeb Sossa, Ph.D.
Chicano Studies

Knights Landing, CA is home to a rural, tight-knight community that primarily consists of migrant farmworkers. Historically, this population has been underserved in many areas, including the lack of a health care center until 2012, when the Knights Landing One Health Center (KLOHC) was founded with a mission to provide linguistically-sensitive and culturally-competent care. Within KLOHC, the Community Outreach committee was created to disseminate information about important resources to the Knights Landing community. Traditional outreach efforts have included door-to-door flyering and phone banking, however, it has been difficult gauging the effectiveness of these efforts in reaching the community members that may benefit the most from the services KLOHC provides. Therefore, the aim of this research would be to map out the social networks of Knight's Landing residents to gain a better understanding about how information is spread throughout the community to increase the effectiveness of outreach efforts. Methods for this qualitative research include surveying multiple community members (estimated 20-30 collected surveys) about general social networks and what their main sources of information are, essentially creating a social network map. Through the map, the aim is to better understand the community dynamics of Knights Landing and inform future KLOHC outreach efforts.

Pinpointing EN1 Expression in Pancreatic Ductal Adenocarcinoma Metastasis

Ana Ximena Rodriguez Parra
Sponsor: Changil Hwang, D.V.M.,Ph.D.
Microbiology & Molec Genetics

Pancreatic cancer is the fourth leading cause of cancer deaths for all ages, and with a 13% five-year relative survival rate, the outlook at diagnosis is generally grim. Pancreatic Ductal Adenocarcinoma (PDA) composes 90% of all pancreatic cancer cases. The disease manifests in the lining of pancreatic ducts, and then metastasizes through the circulatory or lymphatic systems. Engrailed-1 (EN1) is a homeobox transcription factor that regulates growth and differentiation during embryonic development. Overexpression of EN1 has been found in several human malignancies with negative outlooks and is associated with aggressive PDA metastasis. My objective is to determine whether the metastasis of late-stage PDA is caused by EN1 production or if the process of PDA metastasis precipitates *En1* production. This study will use *Kras$^{+/LSL\text{-}G12D}$; Trp53$^{+/LSLR172H}$; Pdx1-Cre; En1-GFP* (KPCG) mice, which model PDAC and express Green Fluorescent Protein wherever EN1 is expressed. This model will allow us to visualize EN1 expression in pancreatic cancer progression. By performing anti-GFP immunohistochemistry, I will compare levels of expression between the primary neoplasm site and metastases and be able to determine whether metastasis is driven by EN1 overexpression, or if that overexpression is a result of metastasis.

Investigating Surface Roughness of Dry-Ground Polyetheretherketone (PEEK)

Maya Rohrer
Sponsor: Barbara Linke, Ph.D.
Mechanical & Aerospace Engr

Alternative materials for orthopedic implants are of interest to the veterinary community due to the high cost of custom metal implants. As a plastic with material properties close to those of bone, polyetheretherketone (PEEK) is an attractive alternative. 3D printing PEEK implants allows for cheaper manufacturing than metal implants while still mimicking the original anatomy. However, the high surface roughness of 3D-printed parts may make an implant unsafe. Grinding effectively reduces surface roughness but little research exists on grinding 3D-printed PEEK. This project will investigate grinding 3D-printed PEEK parts on a belt grinder to reduce surface roughness. To gain better insight into how complex parts will respond to grinding, rectangular PEEK parts will be printed at three different angles to the horizontal. A fine grit belt will be used to grind 2mm into the part on an automated belt grinder with a target surface roughness of R_a = 0.3µm. In addition to taking mass and surface roughness before and after grinding, ground faces will be imaged on a scanning electron microscope to look for delamination. Once roughness data is collected, conclusions can be drawn about whether grinding is effective for reducing the surface roughness of 3D-printed PEEK implants.

The Relationship Between Ethnic Discrimination and Body Dissatisfaction: BMI as Moderator

Rocio Roman
Sponsor: Adrienne Nishina, M.D.,Ph.D.
Human Ecology

Body dissatisfaction is an individual's perception of their body conflicting with their perceived *ideal* body shape. Body dissatisfaction is correlated with poorer mental health problems and eating disorders. Existing research points to differences in body dissatisfaction between ethnic groups, however there are gaps in why differences exist. Furthermore, self-perception can be negatively affected by ethnic discrimination which is commonly experienced by youth. We tested if more ethnic discrimination experienced by youth is related to higher body dissatisfaction, and if this association differed by Body Mass Index—given that higher BMI has been found to exacerbate the feelings of body dissatisfaction—using a multiple regression analysis. Data were drawn from daily surveys taken by 10th grade students in California and Oregon (50% Males, 50% Females; 27% White, 73% students of Color). Analyses indicated that greater ethnic discrimination is significantly related to greater body dissatisfaction (β = .13, *SE* = .11, p = .03). Although, BMI was directly related to body dissatisfaction (β = .30, *SE* = .01, $p < .001$), it did not moderate the relationship between ethnic discrimination and body dissatisfaction (β = .10, *SE* = .02, p = .09), indicating that ethnic discrimination experiences predicted body dissatisfaction regardless of actual body size.

Variance in Relative Ionocyte Area (RIA) of Larval Gopher Rockfish Sebastes carnatus Across Combined Hypercapnia and Hypoxia

Kamille Romero
Sponsor: Nann Fangue, Ph.D.
Wildlife & Fisheries Biology

Upwelling naturally exposes coastal fishes to lower pH and dissolved O_2 (DO) levels, and future climate change is predicted to exacerbate these environmental conditions. Fishes exposed to hypercapnia (high CO_2 low pH) and hypoxia (low O_2) must regulate the internal ionic, osmotic, and acid-base (IOA-B) disruption using specialized ion-transporting cells called ionocytes. In adult fish, ionocytes are found in the gill, whereas in larval fish, ionocytes are on the skin. Relative ionocyte area (RIA) is used to estimate IOA-B capacities in larval fish. Here, pregnant gopher rockfish (*Sebastes carnatus*) were exposed to treatments: Ambient: pH 7.8, dissolved oxygen (DO) 8.0 mg/L, High:pH 7.4, DO 3.5 mg/L, Extreme: pH 7.3, DO 2.8 mg/L at Moss Landing MarineLaboratories. 0-days post parturition larvae were immunostained against the Na^+/K^+-ATPase (NKA), then individual RIA was quantified. Preliminary results (n=5-10) show larvae in high and extreme treatments had lower standard length, which indicates hypercapnia and hypoxia stunted development. Interestingly, larvae from the high treatment had significantly higher RIA than their ambient and extreme counterparts. This suggest IOA-B capacities can be upregulated, but only if sufficient DO is available for the aerobically-demanding process. Additional samples, maternal impacts, and long-term effects are being investigated.

Article 26 Backpack: Bridging the Digital Divide in Higher Education for Refugee and Displaced Students

Fiona Ronne-Mcniel
Sponsor: Keith Watenpaugh, Ph.D.
Religious Studies

Article 26 Backpack aims to make the promise of the 26th article of the Universal Declaration of Human Rights achievable: quality higher education, accessible to everyone. Backpack, which currently supports over 4500 displaced students, was developed to meet the needs of displaced Syrian students pursuing higher education in neighboring countries, not only provides crucial document storage to students who may have limited safe places to store personal information, but also a wealth of scholarship and employment opportunities, free academic credentialing, and test vouchers. As a result of our experience working directly with refugee communities and alongside college counselors with lived experience of displacement, Article 26 Backpack has extensive knowledge of the barriers displacement presents to pursuing higher education. Our presentation will address Backpack's key findings over its seven years of work, examining programming models and survey results from Rwanda to Afghanistan to identify key points of difficulty that hamstring refugee students on their pursuit of higher education, among them the severe financial strain of application prerequisites and limited digital literacy and wifi access.

The Connection between the HPA Axis and Circadian Rhythms-A Potential Mechanism for Chronic Pain

Madeleine Rose
Sponsor: Camelia Hostinar, Ph.D.
Psychology

Despite advancements in medicine, the prevalence of neuroendocrine and psychological health conditions that contribute to chronic pain is increasing. Pharmaceutical treatments may provide temporary symptomatic relief, but they are not a long-term solution. Scientific literature has yet to explore connections between the hypothalamic-pituitary-adrenal (HPA) axis, circadian rhythms, and chronic pain in children. The Adolescent Brain Cognitive Development (ABCD) study is the largest longitudinal developmental study in the U.S. The ABCD dataset has a sample size of 11,857 at baseline (Mean age = 9.48 years, SD = .51, 52% male, 48% female). Preliminary analysis revealed a correlation between the severity of pain and how long pain persisted ($p < .001$). A subset of participants who experience pain for half a day (n=1451) or all day (n=1717) will be examined. We plan to evaluate the impact of chronic pain on the timing of sleep-wake cycles (using wearable device data) and the diurnal release of hormones, including DHEA, estradiol, and testosterone sampled from saliva. Participants who do not report chronic pain will serve as controls in statistical models. Mapping circadian rhythms and the diurnal release of hormones could aid in designing new treatments that do not mask, but remedy chronic pain.

Food Mapping: Connecting Food Resources With UC Davis Students

Mia Rosenquist-Snyder
Sponsor: Nina Napawan, M.A.
Human Ecology

All over the United States, college students face barriers with accessing EBT, affording food, and budgeting time to cook and eat. This makes eating sufficient nutritional meals a challenge for many college students. A study that synthesized over 40 sources, found that more than one in three students face some form of food insecurity. At the University of California, Davis, efforts like the Pantry, the Student Farm, the Freedges, food centered student organizations, and the Teaching Kitchen work to combat student food insecurity. But, how could their resources work together to reach and help students the most effectively? This project will research and prototype a working database that compiles nutritional, affordable, diverse resources for students (ex: recipes, where to cook on campus, how to cook with a microwave, and how to maximize a low budget). By providing a food map for students, we can increase the use of campus resources and help students struggling with food insecurity access affordable food opportunities.

Artisanal and Small-Scale Gold Mining Causes Changes in Vertebrate Biodiversity in the Peruvian Amazon

Evan Roybal
Sponsor: Rachael Bay, Ph.D.
Evolution & Ecology

Artisanal and small-scale gold mining (ASGM) has been increasing in the western Amazon in recent decades, leading to increased anthropogenic impacts on the environment such as deforestation and mercury pollution. This can have negative effects on the fitness of species, ultimately resulting in reduced biodiversity in mined areas. To assess the impact of ASGM on biodiversity we sampled 17 lakes in the Madre de Dios region of Peru, six of which are either being actively mined or have been in the past. We used metabarcoding techniques on environmental DNA extracted from lake samples to identify the taxa present in each lake and subsequently used this data to calculate and compare alpha diversity and community composition of mined and unmined areas. We found that alpha diversity is not significantly impacted by mining; however, there were significant differences in community composition between mined and unmined lakes. Additionally, we saw that unmined lakes closer to ASGM sites had communities that resembled mined lakes more closely than more distant unmined lakes did. This suggests that ASGM does not impact overall biodiversity but does have an effect on community composition that extends to reach areas not in direct contact with ASGM.

What Children with Type 1 Diabetes and their Families Need

Hannah Ruelos
Sponsor: Simona Ghetti, Ph.D.
Psychology

Type 1 Diabetes is a chronic illness marked by a need for constant monitoring and treatment. For young children, parental involvement is essential to the successful management of the disease, but during the transition to adulthood, adolescents begin to take responsibility for their care. Given the the unique challenges and barriers faced by this population, including taxing tracking and decision-making on insulin delivery and stress of managing a chronic disease, we plan to conduct a systematic review of patient and parents' reports to assess the greatest needs of both families of children with Type 1 Diabetes and young adults transitioning into adult care. According to the literature, we expect adolescent patients to seek guidance from their diabetes care team about four key areas: 1) addressing gaps in knowledge regarding diabetes self-management skills, 2) starting an earlier transition of care, 3) preparing for the differences among pediatric and adult care, and 4) establishing continuity of care. We hypothesize that adolescents will request these kinds of resources more than young children and their parents, indicating diverse needs in treatment support for adolescents.

American Jews, the Left, and Israel

Tobias Russell
Sponsor: Juan Tellez, Ph.D.
Political Science

The relationship between American Jews, the American political Left, and Israel is central to understanding American-Israel relations, US foreign policy, and the future of the state of Israel and the Israel-Palestine conflict. Furthermore, these three variables and their relationships to one another are central to understanding and predicting the post-10/7 era of the Israel-Paletine conflict as it manifests both domestically and aboroad. This raises the question: what is the history of the relationship between the aforementioned variables? The University of Chicago's General Social Survey (GSS), which has collected poll data on these issues and populations since 1972, offers an opportunity to explore how American Jews' relationship to the Left and Israel have ebbed and flowed over time. Using GSS data, other poll data, and the relevant literature, I have: identified trends in this relationship over time, explained those trends, and analyzed their relevance in regards to the current conflict in the Middle East.

A Half-Union: The Success and Failures of Federalism in India From 1947 to 1964

Suvam Sabat
Sponsor: Sudipta Sen, Ph.D.
History

From the moment the clocks struck midnight on August 15th 1947, the leaders of India had embarked on a monumental task of creating a republic out of a myriad of princely states and the former British Raj States. This was a multi year long process, hampered by the Partition and the millions of refugees in both the North and East of the subcontinent. The Indian National Congress led by Jawaharlal Nehru believed that the best option for the country was to implement federalism, a system in which the national government has more power over state governments, as a means to modernize and further develop the country. The purpose of this paper is to use both book's and the writings of the historical individuals involved in order to highlight the successes and failures of federalism in India. One success was the internal integration of the many states into the states of modern India, and one of the failures was the attempt to make Hindi the official language, and the threat of revolt by the Southern Indian states as a result. The mixed results of the federalization had lasting effects on the interactions between the federal government and the state governments.

Within-Plant Distribution of Key Pests of Lettuce (Western Flower Thrips and Aphids) and Interaction With Time

Jadyn Sacoolas
Sponsor: Ian Grettenberger, Ph.D.
Anr Entomology/Nematology

Lettuce growers in California's Central Coast are tasked with managing several key pests including Western Flower Thrips (*Frankliniella occidentalis). F. occidentalis* vectors impatiens necrotic spot virus (INSV), which causes significant losses in Salinas Valley lettuce production. In addition, aphids can contaminate harvested lettuce and cause decreased crop yield. Insecticides are heavily relied upon for management of thrips and aphids. There are opportunities to increase the efficiency of insecticide applications to improve pest management. One aspect of pest ecology that interacts with insecticide management is the distribution of pests within a lettuce plant. Increased understanding of thrip dispersal throughout a plant can lead to more targeted spraying, therefore reducing the amount of insecticide used. Additionally, how distribution may change temporally (day versus night) could influence insecticide efficacy. We conducted a study examining within-plant distribution of thrips and aphids using samples of romaine lettuce collected from two farms in the Salinas Valley during the day and night. Individual lettuce plants were divided into inner/outer sections or upper/middle/lower sections in the field, then bagged for processing. This research contributes to a greater effort creating more integrated approaches to managing thrips and aphid populations in the Salinas Valley to increase management effectiveness and reduce environmental effects.

Investigation of the Relationship Between Tract-Specific White Matter Hyperintensity Burden and Functional Connectivity in the Default Mode Network

Abrar Sadikeen
Sponsor: Audrey Fan, Ph.D.
Biomedical Engineering

White matter hyperintensities (WMH) are regions in white matter (WM) that appear unexpectedly bright on fluid-attenuated inversion recovery (FLAIR) magnetic resonance imaging (MRI) scans. Functional connectivity (FC), derived from functional magnetic resonance imaging (fMRI), quantifies the "synchrony" of the blood-oxygen-level-dependent (BOLD) signal between different brain regions. Research indicates that WM in frontal regions and FC in the default mode network (DMN) both degrade with aging and contribute to worsened memory performance. While a direct relationship between the two is not well-established, we hypothesize that WMH are lesions that degrade the FC between regions of interest (ROIs). This study explores this relationship by correlating the WMH within DMN tracts with FC between DMN ROIs, in 94 subjects with FLAIR and fMRI scans obtained from the UC Davis Alzheimer's Disease Research Center (ADRC). For each subject, tract-specific relative WMH (%WMH) was quantified. After identifying ROIs connected by each tract, the FC between ROIs was calculated using CONN software. %WMH and FC were then correlated using a multiple linear regression model. Results indicated a possible negative correlation in the left inferior fronto-occipital fasciculus (IFOF). Future directions may include: using a simple neural network for regression analysis and exploring WMH-FC relationship outside the DMN.

Naphthalene Toxicity in Female Juvenile Mouse Lung and Impact of Ergothioneine Pre-Treatment

Aysia Saeturn
Sponsor: Laura Van Winkle, Ph.D.
VM: Anat Physio & Cell Biology

Biological disparities between males and females, along with age-specific susceptibilities, significantly affect how lungs respond to toxic substances. Naphthalene (NA), commonly found in wildfire smoke and vehicle emissions, poses a risk to respiratory health. Previous studies have shown increased toxicity in lung epithelial club cells of the conducting airways following NA exposure in adult mice. These cells produce club cell secretory protein (CCSP), which defends against oxidative stress. Ergothioneine (ET), a dietary antioxidant, was investigated as a potential protective pre-treatment. This study aimed to investigate whether ET could mitigate NA-induced club cell toxicity, focusing on juvenile female mice. Female mice (N=3/group) received oral ET (70 mg/kg) or saline control (SA/CO) for five days. Two experimental groups (ET/NA; SA/NA) were also given the same treatments and then all mice were injected with 150 mg/kg NA intraperitoneally, and lung tissues were examined after 24 hours. Histopathology and unbiased stereology were used to quantify epithelial changes. Preliminary findings suggest that the SA/NA group showed increased vacuolated club cells, while the ET/NA group exhibited intact, healthy cells. This implies that ET can alleviate NA-induced toxicity in the proximal airways of juvenile female mice.

Exploring the Therapeutic Potential of Targeting Mutant p53 for Triple-Negative Breast Cancer

Amy Salim
Sponsor: Xinbin Chen, D.V.M.,Ph.D.
MED: Int Med Hem/Onc

Triple-negative breast cancer (TNBC) is an aggressive form of breast cancer that has limited treatment options because the cells lack estrogen and progesterone receptors along with HER2 proteins, making them resistant to hormone therapy. Due to its aggressive nature and lack of effective treatment options, there is a pressing need to develop new therapeutic strategies for TNBC. Considering that the tumor suppressor gene p53 is frequently mutated in more than half of human cancers, including 80% of TNBC cells, mutant p53 becomes a promising target for potential treatment. Initial findings have demonstrated that the level of mutant p53 proteins is decreased when treated with the copper ionophores Cu-ATSM and Elesclomol. Moreover, the preliminary data have proposed that treatment with these two copper ionophores can inhibit cell proliferation in a mutant p53-dependent manner. Methods including drug treatments on cell cultures, western blots, and colony formation assays are used to confirm previous findings to evaluate the effectiveness of copper ionophores on this aggressive type of cancer. This study can be further validated using multiple cancer cell lines to determine the mechanism of how copper ionophores can repress mutant p53 expression to lay the foundation for future research on other targeted cancer treatments.

Photoreceptor and RPE Degeneration in an Optogenetic Mouse Model of Geographic Atrophy

Youcef Sahraoui
Sponsor: Glenn Yiu, M.D.,Ph.D.
MED: Eye Center

Geographic atrophy (GA) in age-related macular degeneration (AMD) is a leading cause of vision loss among the elderly. However, the lack of well-characterized animal models has hindered the development of effective treatments. Here, we develop an optogenetic mouse model to emulate the oxidative stress in GA by expressing reactive oxidative species-generating mCherry to retinal pigment epithelium (RPE) mitochondria and inducing focal photoablation. We subretinally injected an AAV8 vector expressing mCherry under an RPE-specific VMD2 promoter into the eyes of C57BL/6J mice. Three weeks after transduction, we induced focal mCherry photoactivation by exposing a small ocular region to 561 nm light via scanning laser ophthalmoscopy (SLO). Changes in outer retinal thickness were evaluated through weekly *in vivo* imaging with optical coherence tomography (OCT) and *ex vivo* immunohistochemistry. The photoablated region was characterized by decreased mCherry labeling compared to the unexposed region, which displayed much greater fluorescence. Furthermore, a statistically significant reduction in the lengths of rod outer segments and cone density was noted one week following photoablation, which persisted through three weeks ($p < 0.05$). Our optogenetic mouse model simulates focal photoreceptor and RPE atrophy seen in GA, offering a platform for testing novel treatments for AMD.

Supplementation with Tributyrin as a Therapeutic Strategy in Modulating GI Symptoms in a Mouse Model of Angelman Syndrome

sameeha salman
Sponsor: Melanie Gareau, Ph.D.
VM: Anat Physio & Cell Biology

Angelman syndrome (AS) is a rare neurodevelopmental disorder characterized by developmental delays, epilepsy, and behavioral issues, often accompanied by gastrointestinal (GI) symptoms like constipation. This study investigates the therapeutic potential of Tributyrin (Tb), a triglyceride form of the short-chain fatty acid, butyric acid, in modulating GI symptoms in a mouse model of AS. Given the critical role of the gut-brain axis in neurological health, we hypothesized that Tb administration could alleviate GI symptoms and influence gut-brain communication in AS. AS and wild type (WT) mice received daily Tb (10mM in drinking water) or placebo for 4 weeks post-weaning. Hippocampus, prefrontal cortex, distal colon, and ileum tissues were collected for gene expression by PCR for all 4 groups: WT + vehicle/Tb and AS + vehicle/Tb mice, and analyzed for serotonin and GABA signaling. Our results demonstrate altered serotonin and GABA signaling in brain and gut tissues in AS mice, which were restored by Tb supplementation. Our findings suggest that Tb can impact neuronal communication in the gut and brain. These findings support the potential of Tb as a novel therapeutic avenue for managing GI symptoms and improving neurological outcomes in AS, highlighting the importance of the gut-brain axis in neurodevelopmental disorders.

Development of a CRISPR-Cas13a Assay for Genetic Detection and Monitoring of Invasive Nutria in the Central Valley of California

Alexis Samaniego
Sponsor: Andrea Schreier, Ph.D.
Animal Science

Early detection of invasive species is crucial for effective population control and eradication. However, traditional field surveys often struggle to detect species in the initial stages of invasion. Utilizing trace amounts of environmental DNA (eDNA) and environmental RNA (eRNA) shed by invasive species offers a more reliable method for early detection. Combining eDNA and eRNA minimizes the risk of false positive detection, as eRNA degrades faster than eDNA and is only released by living organisms, thereby enhancing detection precision. Once developed, CRISPR-based tools can deliver accurate, sensitive, and rapid results for invasive species monitoring, potentially without requiring expensive equipment or extensive training. Leveraging the sensitivity and accuracy of CRISPR-Cas13a (SHERLOCK), a genetic identification tool adept at detecting DNA and RNA in environmental samples, we are developing a tailored assay to identify invasive nutria (*Myocastor coypus*) in California's Central Valley, where these semi-aquatic rodents threaten flood infrastructure. Our assay targets the mitochondrial cytochrome B gene, and has been validated using DNA and RNA extracted from nutria muscle tissue sourced from the California Department of Fish and Wildlife (CDFW). In collaboration with CDFW, we are gathering water samples from nutria-invaded waterbodies to extract eDNA and eRNA for testing with our SHERLOCK assay.

Advancing Western Blotting Techniques – Exploring pH, Salt Composition, and Transfer Stack Sizes

Siona Samanta
Sponsor: Aldrin Gomes, Ph.D.
MED: Physiology & Membrane Biol

Over the last 40 years, Western blotting – used to detect and quantify sample proteins – has become an increasingly prevalent lab technique. Due to the current method's susceptibility to variation and error, this proposal explores three adjustments to traditional protocol: (1) comparing sodium chloride (NaCl) and potassium chloride (KCl) in Tris-buffer, (2) adjusting the pH of Tris-buffered saline with Tween 20 (TBST), and (3) varying the filter-paper stacks during protein transfer. As the buffer's salt-composition influences protein binding to the membrane and other proteins, comparing Tris-buffers composed of NaCl and KCl allows us to deduce which salt more effectively enhances Western blot performance. Similarly, pH affects the efficiency of protein binding and antibody interactions; varying TBST's pH allows us to determine the optimal pH to maximize protein retention on the membrane while minimizing non-specific binding. Lastly, adjusting the size and distribution of filter-paper layers used during protein transfer helps us identify the ideal combination that reduces incomplete transfer or uneven protein distribution. In order to analyze these factors independently, individual experiments are being conducted for each alteration, ensuring precise observations of the effects of the targeted changes. Overall, this project seeks to refine standardized conditions that promote consistent, reliable Western blots.

Manipulating the Epigenome to Promote CRISPR-Cas9 Efficiency: How does the absence of H3K4me1 affect DNA repair?

Maris Samsel
Sponsor: John Monroe, Ph.D.
Plant Sciences

CRISPR-Cas9 offers a promising avenue for precise DNA modification in plant genomes. Its double strand cut triggers a cellular repair response via either homology-directed repair (HDR) or non-homologous end joining (NHEJ). While HDR utilizes existing base pairs for high fidelity replication, NHEJ rejoins DNA strands with low fidelity, often resulting in mutations, which can be used by plant breeders to eliminate unfavorable genes. These mutations can cause base pair knockout, where base pairs are inserted or deleted at the target site, and the DNA is ligated with the remaining ends. Prior research by Weiss et al. demonstrated that the presence of H3K4me1 hinders CRISPR-Cas9 plant mutagenesis. In addition, plants contain genes (PDS5 proteins) that promote HDR, which also bind H3K4me1. My project aims to test the effects of H3K4me1 and PDS5 proteins on CRISPR-Cas9 mutation efficiency. The long-term goal of this work is to help advance CRISPR genome editing applications by promoting NHEJ-mediated base pair knockout, enabling targeted genomic modifications with potential applications in climate-resilient crop development.

A Ketogenic Diet Increases Citrate Synthase Activity in the Muscle of Male Rats with Alzheimers Disease

Airan Sanchez
Sponsor: Jon Ramsey, Ph.D.
VM: Molecular Bio Sciences

AD is a neurodegenerative disorder that impacts the behavioral, and cognitive traits that affect a person's memory. However, it does have other non-cognitive effects as it lowers muscle strength and motor performance in muscle which can be crucial in a person's ability to take care of themselves. Ketogenetic diet has been shown to have beneficial effects on AD in relation to cognition and neurons in animals such as mice. At 6 months of age, we fed AD rats continuous and intermediate (Am CD meal, pm KD meal) ketogenic diet for 6 months at which time we collected the muscle and measured citrate synthase activity. Since citrate synthase is a marker of mitochondrial content and mitochondrial function it's important in our data to know the levels of citrate synthase which can indicate that the ketogenetic diet does affect citrate synthase. In summary, KD increased the citrate synthase activity in males but not females. We see a significant sex effect with females having an overall higher cs activity and male cohort having a significant diet effect.

Molecular Characterization of Craniofacial Development during *Ambystoma mexicanum* Embryogenesis

Kathryn Sandberg
Sponsor: Crystal Rogers, Ph.D.
VM: Anat Physio & Cell Biology

The exact molecular development that create the divergent craniofacial and integument structures across species are not well characterized. *Ambystoma mexicanum* (axolotl) embryos are commonly used as models for regenerative research, but there is still much to be discovered about their developmental processes and the key regulators involved in the formation of their differentiated tissues. To gain insight into how the craniofacial cartilage and integument sensory structures form from transient neural crest cells, I used immunohistochemistry and fluorescence imaging methods to visualize the spatiotemporal localization of proteins important for cranial and sensory morphogenesis. Specifically, I characterized the expression of neural crest progenitor cells marked by PAX7, as well as differentiated cartilage, glia, and epithelial tissues marked by Runx2, Col2a, GFAP, P0, and ECAD. I visualized these proteins at multiple stages in late embryogenesis from tailbud to late tadpole stages. To date I have identified that PAX7-positive neural crest cells begin in the neural tube and migrate to the epidermis and the ventral region of the face. Further, neuroblasts, or premature sensory structures, form at the same stage as the condensing cranial cartilage. Here we have identified localization of neural crest derivatives and have visualized tissue specific markers of these structures.

Food Tolerance and Pair Bonding Among Speed-Dated Titi Monkeys

Manleen Sandhu
Sponsor: Karen Bales, Ph.D.
Psychology

Within the Animal Kingdom, monogamy is a rare phenomenon, observed in a select group of species including humans, prairie voles, and certain non-human primates. Among these, *Callicebus cupreus*, or Titi monkeys serve as a model species for studying social monogamy in humans. Extensive research reveals their ability to form intricate pair bonds with their partners in which they demonstrate long-lasting emotional connections and distress upon separation from their pairmate. The development of social bonds is demonstrated as Titi monkeys engage in partner-specific affiliative behaviors, such as grooming and tail twining. Little research, however, has been conducted on the feeding tolerances of monkeys in a pair bond relationship. Food tolerance corresponds to the pairmates' behavior while either of them are feeding. To analyze food tolerance, their tendencies while feeding in either close contact, proximity, or at a far distance are observed. Gaining knowledge on how pairmates behave during intimate activities like feeding, offers meaningful insights into the role food tolerance plays in forming, strengthening, and maintaining social pair bonds. In this study we investigate the relationship between feeding tolerance and affiliative behaviors in well established pairmates.

Twins (*tws*) Regulates Seasonal Physiology in *Drosophila melanogaster*

Madison Sandler
Sponsor: Joanna Chiu, Ph.D.
Entomology/Nematology

Changes in photoperiod and temperature modulate organismal physiology and behavior over the calendar year. Adaptations to these changing conditions are crucial for survival and impact cycles of human physiology and disease. The protein EYES ABSENT (EYA) has been shown to sense seasonal cues in both insects and mammals. In *Drosophila melanogaster*, EYA has been demonstrated to regulate seasonal reproductive dormancy, but the molecular mechanisms underlying this function remain unclear. In mammals, a protein called TWINS (TWS) was shown to interact with EYA and mediate its activity in tumorigenesis. We therefore hypothesize that TWS plays a role in regulating *Drosophila* seasonal biology alongside EYA. We further predict that the expression of *tws* changes in response to environmental changes. To test this, we assayed *tws* mRNA expression and protein expression in wild-type flies subjected to different temperature and/or photoperiod to simulate seasonal changes. After 3 days, flies were collected every 4 hours over a day-night cycle prior to RNA and protein extraction. *tws* mRNA expression was assayed by quantitative RT-PCR, and TWS protein expression was assayed via western blot. Our data show that *tws* expression is impacted by changing environmental conditions, suggesting that *tws* plays a role in regulating *Drosophila* seasonal physiology.

Declarative and Procedural Memory Contributions to Argument Structure and Word Order Learning

Sofia Saraj
Sponsor: David Corina, Ph.D.
Linguistics

This study, grounded in the Declarative/Procedural Hypothesis, seeks to disentangle the learning processes underlying verbal argument structure and basic word order within an artificial language paradigm as a model of second language acquisition. According to the Declarative/Procedural Hypothesis, learning a new argument structure should recruit long-term declarative memory, while learning a new word order should recruit long term procedural memory. Participants will undergo assessment across four memory procedures of declarative and procedural memory. Furthermore, participants will engage in learning sessions featuring sentence structures that are unconventional to English. Grammaticality judgment tasks, administered twice, will gauge participants' ability to distinguish between grammatical and ungrammatical sentences of the artificial language. Ungrammatical sentences will be strategically manipulated to reflect English syntax. Pilot data will be presented, leveraging multiple linear regression. We will analyze response metrics, including reaction time and accuracy as a function of memory measures. By elucidating the intricate interplay between memory systems and grammatical learning, this research promises nuanced insights into language acquisition processes, and paves the way for a deeper understanding of the cognitive mechanisms underlying acquisition of syntax.

Acute Locomotor Inhibition and Chronic Tolerance to Levodopa is Mediated by the Dopamine D3 Receptor

Rhea Sarmah
Sponsor: Jennifer Whistler, Ph.D.
MED: Physiology & Membrane Biol

Parkinson's disease (PD) is a progressive neurodegenerative disorder characterized by cell death of neurons responsible for the production of dopamine. The primary treatment for PD is levodopa, which increases the remaining neurons' ability to produce dopamine. However, chronic levodopa can lead to levodopa-induced dyskinesia (LID), causing further motor impairment by unknown mechanisms. Here, we examine how acute and chronic levodopa administration alters dopamine dynamics in the brain. We used wild-type (WT) or mice with a conditional knockout for the sorting protein GASP1 (D3FG) and administered either levodopa or saline for three weeks. We tracked mouse locomotion over time in an open-field assay and found that while WT mice become tolerant to the locomotor inhibitory effect of levodopa, D3FG become sensitized to this inhibition and are resistant to cocaine-induced hyperlocomotion. We also examined acute dopamine dynamics using fiber photometry in the nucleus accumbens and found that levodopa in WT mice inhibits dopamine transients elicited by fentanyl, an effect that is not present with D3FG mice. These data suggest that the dopamine D3 receptor is involved in the etiology of LID and could be potentially used as a therapeutic target for the treatment of PD.

Comparison of Mule Deer and Mountain Lion Suitable Habitat and Roadkill Strikes in Southern California

Chloe Schaecher
Sponsor: Fraser Shilling, Ph.D.
Inst Of Transportation Studies

Mountain Lions (*Puma concolor*) and Mule Deer (*Odocoileus hemionus*) are both common large mammals in California and in a close predator-prey relationship. As large, ranging animals, both species are at high risk for human-wildlife conflict as urbanization increases. A prime example of this is roadkill strikes, which can approximate the density of species within the urban matrix. I aim to determine whether there is a difference in correlation between habitat suitability and roadkill volume for Mountain Lions and Mule Deer. To determine whether either species is straying further from their ideal habitat into urban matrices, I isolated Mule Deer and Mountain Lion strike data along major roadways in L.A. County using data from the California Roadkill Observation System (CROS) in ArcGIS Pro. I then used existing habitat models for each species to interpret whether either was exceeding expected distances from optimal habitat. Preliminary findings suggest Mule Deer are less selective about roads and other developments in their range than Mountain Lions. They are also hit further from their most suitable habitat more often than Mountain Lions. By analyzing movement and habitat selection for Mountain Lions and Mule Deer together, we can better protect both species within the urban matrix.

Neonata Pulse Oximetry Disparities due to Skin Pigmentation

Isabelle Schlegel
Sponsor: Heather Siefkes, M.D.
MED: Pediatrics

Accurate measurement of oxygenation is vital in neonatal care, particularly for critically ill newborns. While arterial blood gas analysis is the standard, its invasiveness limits its use, especially in neonates. Pulse oximetry offers a noninvasive alternative but may be inaccurate, particularly in individuals with darker skin pigmentation. The recent pandemic highlighted the inaccuracy of pulse oximetry in darker skin individuals and this inaccuracy may contribute to healthcare disparities. This study investigates the impact of skin pigmentation on the precision of pulse oximetry in neonates. It compares simultaneous measurements of peripheral capillary oxygen saturation (SpO2) and arterial oxygen saturation (SaO2) in newborns with varying degrees of pigmentations. The investigators hypothesize that pulse oximetry overestimates SpO2 among newborns with darker skin, underestimating hypoxemia severity. Investigators believe that after adjusting for SaO2, this discrepancy will correlate with skin pigmentation such that pulse oximetry will overestimate oxygenation in newborns with darker skin. They believe the distribution of SaO2-SpO2 discrepancy will have more variance in the newborns with darker skin. Additionally, they explore the influence of gestational age and packed red blood cell transfusion on SpO2 accuracy in relation to skin pigmentation. This promises to improve clinical outcomes and reduce disparities across different skin pigmentations.

The Search for a Targeted Anticoagulant

Ashley Scott
Sponsor: Angelique Louie, Ph.D.
Biomedical Engineering

Atrial fibrillation (AF) leads to significant risk of stroke and heart attack by thromboembolism. Clotting is a product of poor function in the left atrial appendage (LAA), where ineffective contraction results in stagnant blood flow. Thus, anticoagulation therapy is the treatment goal. Current medications carry a significant risk of hemorrhage, as these circulate throughout the body at controlled levels. Therefore, it is necessary to develop localized treatments. Anticoagulant activity has been found in sulfate dextran-coated iron oxide nanoparticles (SDIO), nanoparticles found by our lab that targets macrophages. Macrophages are found in the LAA of patients with AF, so the targeted delivery of anticoagulants here could provide therapeutic benefits without risk of complications. We tested this in vivo by performing transfer aortic constriction (TAC) surgery on mice to induce clot formation. They were randomized to receive SDIO, dextran sulfate, or saline treatment, and one week later, were euthanized for organ collection. We developed an objective scoring method to determine clot burden from histological sections. These were scored by blinded reviewers, and analysis to date shows that SDIO treated mice have less clot burden, as expected. The results of this study will guide us in developing targeted anticoagulants for AF patients.

Effect of Cattle Grazing on Ground Squirrel Abundance and Behavior

Michelle See
Sponsor: Fraser Shilling, Ph.D.
Inst Of Transportation Studies

The California Ground Squirrel (*Otospermophilus beecheyi*) [CGS] is a keystone species which shares its home with cattle on rangelands throughout California. We are interested in tracking how the presence of cattle affects the CGS because their population fluctuations affect other wildlife species (e.g. coyotes, birds of prey, and other burrowing species), and a preliminary relationship has been shown through linear analysis of camera trap data. We have chosen parcels of public land in Point Reyes and private land in Contra Costa Water District that have both cattle and CGS, and a separate plot containing only CGS. Squirrel data will be collected using faux ground squirrel calls, walking quadrats, and counting warrens alongside camera trapping data which would be used for population density and behaviour reporting. Cow presence will be cross-referenced with rangeland records and physical sightings. We hypothesize the presence of cattle will have a predominantly negative effect on the population of CGS, because of behavioural changes, den trample, and predator avoidance. The results of this study are not meant to say rangelands and cattle have a harmful relationship, but to help find a compromise between using land for grazing and still keep it habitable for wildlife.

Personality and Stress Reactivity in Adolescence and Parental Social Buffering

Kelsey Sennett
Sponsor: Camelia Hostinar, Ph.D.
Psychology

The adolescent period is a time of rapid cognitive and emotional development resulting in physiological and psychological vulnerability. Personality factors play an important role in emotional reactivity, especially in shaping responses to acute stressors. Neuroticism, a tendency toward negative affectivity, has been linked to later psychopathology and may indicate underlying mood and anxiety disorders. Prior literature highlights the important role that parents play in buffering stress through close, contingent social relationships with their children. However, the associations between personality, stress reactivity, and stress-buffering during adolescence are unknown. In this study, we examine the role of personality on adolescent emotion reactivity, and the potential buffering mechanisms of parent-adolescent synchrony and attachment behaviors. Adolescents (N = 169, 11-15 years old) participated in a recorded reunion activity with their parent following completion of the Trier Social Stress Test. Their affect and behaviors were coded by independent raters. Personality factors were measured using the Big Five Inventory, and salivary cortisol recovery slopes were quantified to index stress reactivity. Upon statistical analysis, we aim to better understand how adolescents' bodies react to stressful situations depending on personality factors, affect, and parental social buffering. This will inform the field about managing stress and facilitating recovery among adolescents.

Characterizing the Nucleolus during Meiotic Prophase I in *Atf7ip2*-mutant Germ Cells

Dharssheni Senthil Kumar
Sponsor: Satoshi Namekawa, Ph.D.
Microbiology & Molec Genetics

H3K9 tri-methylation (H3K9me3) is regulated by a meiosis-specific protein, ATF7IP2 (MCAF2). Our lab recently characterized ATF7IP2's role as regulating gene expression and meiotic sex chromosome inactivation (MSCI) via H3K9me3 during mouse spermatogenesis. Without ATF7IP2, male germ cells cannot complete meiotic prophase I, resulting in germ cell death and infertility. During our study of MCAF2, we identified a low DNA density area, which we named the "DAPI-hole", where H3K9me3 regulators such as SETDB1 are mislocalized in ATF7IP2-mutant germ cells. Based on its size and location in the nucleus, we hypothesize that this DAPI hole is either the nucleolus or a double-dense body. To positively identify this structure, I will use immunofluorescence to stain for nucleolus-specific protein, Fibrillarin, and an rRNA nucleolar dye to understand if these nucleolar-specific components colocalize with the DAPI hole. In addition to its identification, I will use wild-type and Atf7ip2-KO germ cells to characterize the behavior of this structure during meiotic prophase I. Analyses of immunostaining results and quantification of overlap between Fibrillarin and rRNA nucleolar dye relating factors will reveal the identity and role of the DAPI hole in meiosis. Overall, completing this project will further our understanding of nuclear dynamics during mouse spermatogenesis.

Novel aggressive behavior analysis in a rodent model of MAR ASD

Harshavardhani Senthilkumar
Sponsor: Melissa Bauman, Ph.D.
MED: Dean's Office

Gestational exposure to maternal autoantibodies (aAbs) that cross-react with specific fetal brain proteins has been associated with autism. These aAbs target fetal brain proteins, such as stressed-induced phosphoprotein (STIP1), collapsin response mediator proteins 1 and 2 (CRMP1, CRMP2), guanine deaminase (GDA), lactate dehydrogenase A and B (LDHA, LDHB), and neuron-specific enolase (NSE). In this study, we examined the impact of prenatal aAbs exposure on offspring neurodevelopment using a rat model. Four treatment groups were exposed in utero to different combinations of maternal antibodies: CRMP1+CRMP2, STIP1+NSE, CRMP1+GDA, LDHA+LDHB+CRMP1+STIP1, or adjuvant controls. Offspring social development was evaluated using a Social Dyad test, in which the experimental rat was allowed to freely interact with a novel rat and video-recorded for ten minutes. Social behaviors were then scored and categorized into self-grooming, social investigation, play, and nonsocialinvestigation behaviors. A subset of these rats exhibited unusual aggressive behavior which is unprecedented for this study. We aim to analyze instances of aggression categorized as tail-biting and pulling, non-tail biting, and kicking within the different treatment groups. We expect to find differences in aggressive behavior between the groups and to understand the relevancy of this behavior to the preclinical model.

Halting the Asphalt Plant: A Community Effort

Sophia Serrano
Sponsor: Kenneth Andersen, M.A.
University Writing Program

This project aims to engage community support and raise awareness about the potential health and environmental ramifications of an asphalt plant that's been proposed for my hometown of Forestville, CA.

I am exploring how strategic communication can be used to effectively rally community members into action. This project intends to sway decision makers through the use of targeted PR efforts, including media outreach and grassroots organizing. My approach to developing a successful PR campaign includes establishing communication with local officials and reaching out to local organizations for support. The campaign will also incorporate social media activism and engagement in town meetings. I will use surveys and feedback to help fine-tune the messaging. I anticipate that this project will help bring awareness to the risks associated with the proposed asphalt plant and generate community-wide opposition. I also expect that the outcomes of this campaign will pressure decision makers to reexamine the proposal. Successfully halting the implementation of the asphalt plant would hold developers accountable for prioritizing the health of Forestville residents as well as preserving the surrounding natural environment. The success of this campaign would also highlight the effectiveness of strategic communication and prove how powerful community mobilization can be.

The Deceptive Divinity of Women in Relation to Nature in Margaret Cavenish's *The Blazing World*

Sriharini Seshachalam
Sponsor: Matthew Stratton, Ph.D.
English

In her work of prose, *The Blazing World*, Margaret Cavendish subverts the feminization of nature which is associated with the genre of the pastoral, which depicts women as passive objects of desire and caters to the male gaze. By employing elements of the emerging genre of utopia in order to amplify feminine power as divine, Cavendish blurs the distinction between what is natural and what is unnatural. The lens of eco-feminism reveals how Cavendish blurs the distinction of masculinized public spaces and roles as conquerors and discoverers with conventional depictions of feminized, domestic spaces which are often perceived to serve the male gaze. The female characters of the narrative do not adopt masculine traits in order to channel their ambition and power, but rather associate themselves with the natural world to expand their capacity for both creation and destruction. Cavendish subverts the portrayal of women and nature as divine, constant, and passive objects for men to admire and exploit, through her revision of the pastoral genre and use of utopian elements, engendering the female protagonist's transformation from victim to savior.

Skeletal Muscle Spheroids As Building Blocks for Engineered Muscle Tissue

Akash Sethi
Sponsor: Kent Leach, Ph.D.
MED: Orthopaedic Surgery

Spheroids exhibit enhanced cell–cell interactions that improve survival and mimic physiological cellular environment *in vivo*. Spheroids have been successfully used as building blocks for engineered tissues, yet the viability of this approach with skeletal muscle spheroids is poorly understood, for three-dimensional constructs. Bioprinting is promising to recapitulate hierarchical organization of tissue that is fundamental to function. Influence of bioprinting on muscle cell spheroids and their function are yet to be interrogated. Using mouse myoblasts and primary bovine muscle stem cells, we characterized spheroid formation as a function of duration and cell seeding density. We then investigated the potential of muscle spheroids in alginate bioink as building blocks for bioprinting myogenic tissue. C2C12 and bovine MuSCs formed similar sized bioprinted viable spheroids. Both fused into larger tissue clusters over time within alginate and exhibited tissue formation comparable to monodisperse cells. Compared to monodisperse cells in alginate gels, C2C12 spheroids exhibited greater MyHC expression after 2 weeks, while bovine MuSC spheroids' cells displayed increased spreading. Monodisperse and MuSC spheroids increased gene expression for mid- & late-stage myogenic differentiation. This suggests that muscle spheroids potentially can generate myogenic tissue via bioprinting and reveal areas of research that could enhance myogenesis and myogenic differentiation.

Investigating Fitness Effects of Packaging Mechanism Mutations in Cystovirus

Hirva Shah
Sponsor: Samuel Diaz, Ph.D.
Microbiology & Molec Genetics

Reassortment, the process through which segmented RNA viruses infecting the same cell exchange entire segments of genetic material, can result in novel viral strains with health and economic consequences. We are investigating how the genome packaging mechanism affects reassortment in *Cystoviridae*, a family of dsRNA bacteriophages that infect *Pseudomonas* bacteria. Their genome consists of three segments, each with a packaging '*pac*' region that allows for sequential packaging of the segments into a new virus particle. Using a reverse genetics system, we will mutate the *pac* region on one segment and observe how different mutations influence fitness. We will insert plasmids containing the mutant or wild-type genomes into the *Pseudomonas* host and plate the samples onto a petri dish for incubation. This will produce active virus, killing the host and creating zones of bacterial cell death called plaques. Comparing the plaque count produced by mutants versus the wild type will indicate the effect of the *pac* mutations on fitness. This experiment will help us identify candidate mutants to use for experiments on the role of the packaging region in reassortment.

Unsupervised Longitudinal Trajectories of Heart Failure With Preserved Ejection Fraction: An Echocardiogram-Based Cohort Study

Zulqarnain Shahid
Sponsor: Martin Cadeiras, M.D.
MED: Int Med Cardiology (sac)

Heart failure with preserved ejection fraction (HFpEF) is a national health issue, causing disability and death in millions of individuals. The objective of this study is to investigate the cardiac structure and function trajectories, as measured by echocardiography, and their correlation with clinical outcomes. We will use unsupervised methodologies to discover patterns in longitudinal echocardiographic data. We utilized data from the institution's electronic health record spanning from January 2014 to December 2022. Our study cohort comprised adult HFpEF patients (*≥18 years*). Employing unsupervised machine learning techniques, we sought to uncover temporal patterns within longitudinal echocardiographic data, potentially reflecting distinct trajectories of HFpEF. Longitudinal continuous variables were analyzed using linear mixed models, while clinical outcomes were assessed using Cox regression analysis and Kaplan–Meier survival curves. Our analysis identified 2,766 HFpEF cases, revealing two distinct echocardiographic clusters with differing clinical and demographic profiles and longitudinal trajectories. Notably, these clusters exhibited significant differences in mortality outcomes (*p=<.001*), with the group demonstrating worsened outcomes having echoed baseline echocardiographic profiles longitudinally. Longitudinal echocardiographic cohorts have been identified, and longitudinal trajectories using machine learning algorithms highlighted different trajectories over time associated with different clinical demographic and mortality outcomes.

Stereoselective Synthesis of Carbacycles by C–H Insertion of Donor/Donor Carbenes

Tania Shahvali
Sponsor: Jared Shaw, Ph.D.
Chemistry

While Donor/Donor Carbenes (DDCs) are relatively new, research conducted using them has shown their importance as catalytic intermediates due to their reduced electrophilicity, enabling high functional group tolerance. Previously, in our group, DDCs were used as a catalytic intermediate, resulting in the synthesis of heterocycles with high stereoselectivity. Now, our research goal is to expand on this methodology and synthesize a wide range of 5-, 6-, 7-, and 8-member carbacycles by C–H insertion of DDCs with high regio- and stereoselectivity. Similar to the previous method, we start by synthesizing our hydrazone substrate, which is subjected to our one-pot sequential oxidation followed by C–H insertion methodology to generate the desired carbacycle. Different chiral and achiral catalysts were screened to determine the effect on different ring sizes as well as steric and electronic effects. Further, the stereochemistry and regiochemistry were determined by 1H NMR and chiral HPLC. These analytical techniques showed that the reactivity and selectivity of these carbacycles vary based on the electronic and steric properties of the substrates. Finally, the wide range of compounds synthesized by this methodology attests to the utility of this methodology.

Simplistic Environments Improve Automated Tracking but Disrupt Animal Behavior

Aarav Sharma
Sponsor: Kate Laskowski, Ph.D.
Evolution & Ecology

The qualities of an organism's housing can have dramatic impacts on their behavior. This poses a problem for the study of animal behavior, where controlled, minimalistic environments are often necessary for recording behavior, but these simplistic surroundings could influence an organism's behavior in a way that limits the relevance of our findings. Thus, it is vital to find an environment that minimizes the tradeoffs between natural behavior and effective automated tracking. To do this, we tested how individual behavior changes with varying environments using a small Poecilid fish, the Amazon molly, while testing how network-based tracking models perform in these different environments. We created five distinct environments of varying colors and substrates. We observed that the behavior of Amazon molly does depend on the environment, both in their movement and use of space, with tracking performing best on the least natural environments. This highlights the importance of striking a balance between the requirements of natural animal behavior and the limitations of computer vision algorithms, and allows us to decide the extent to which we should impact behavior in order to cater to the needs of artificial intelligence.

Effects of Exercise and Furosemide on Left Ventricular Internal Diameter in Thoroughbred Racehorses

Victoria Shaw
Sponsor: Jessica Morgan, D.V.M.,Ph.D.
VM: Medicine & Epidemiology

Hypo-hydration from diuretics, such as furosemide, have been shown to alter heart size in horses. Additionally, exercise induced dehydration has been associated with a decrease in the left ventricular diameter in horses. We hypothesize, horses that receive furosemide before exercise will have a larger decrease in left ventricular internal diameter than horses who do receive furosemide. Point of care ultrasounds were performed before and after exercise on 100 Thoroughbred racehorses. Preliminary analysis of 16 horses (8 with furosemide treated and 8 controls) was performed with a student's T-test. Exercise resulted in a significant difference in the left ventricular internal diameter in diastole for horses that received furosemide ($P<0.02$) and for horses that did not ($P<0.0001$). Mean internal diameter pre workout (11.66±1.12) decreased to (10.40±1.05) post workout in furosemide treated horses, while mean internal diameter went from (11.61±1.12) to (10.40±0.39) in untreated horses. There was no significant difference in the change in left ventricular diameter between horses that received furosemide and those that did not ($P=1.0$). In conclusion, furosemide showed no significant impact on the change in left ventricular diameter in horses after exercise.

Predicting Neural Responses to Speech-in-Noise through Multiple Regression Modeling of Cognitive Performance.

Sana Shehabi
Sponsor: Lee Miller, Ph.D.
MED: Otolaryngology

Individuals with normal hearing exhibit considerable variability in their ability to understand speech in noisy environments. Previous research suggests the cause of this variance may be due to individual differences in cognition. To investigate the impact of cognition differences on speech perception, 25 adult participants with normal hearing completed various cognitive tasks such as the Flanker, Stroop, and Reading Span tasks. They also completed a continuous multi-talker speech spatial attention task while brain activity was recorded with EEG (electroencephalography). Event-related potentials (ERPs), specifically the auditory late latency response (LLR; ~50-250 ms), were extracted as a measure of neural speech encoding. LLR amplitudes were used to measure attention during speech perception. In particular, we compared LLR component morphologies of target and distractor speech stimuli to assess neural correlates of attentional gains during concurrent goal-directed and distractor narratives. Performance on cognitive tasks were used to predict LLR component amplitudes using multiple regression. Results show selective attention, inhibition, and temporal fine structure can predict LLR amplitude differences between the target and distractor stories. This provides valuable insights into the cognitive mechanisms governing auditory selective attention, which will ultimately help identify practical applications to improve communication outcomes for individuals in real-world listening scenarios.

Characterizing COX1 During Embryonic Development

Cierra Shelton
Sponsor: Crystal Rogers, Ph.D.
VM: Anat Physio & Cell Biology

Non-steroidal anti-inflammatory drugs (NSAIDs) are a commonly used class of analgesics that include medications like ibuprofen and aspirin. NSAIDs reduce inflammation by inhibiting the cyclooxygenase (COX) pathway, which activates inflammatory pathways. Inhibition of the COX pathway by NSAID exposure during embryogenesis is linked to congenital anomalies in tissues derived from the neural tube and neural crest lineages. However, despite common NSAID use by the public, significant knowledge gaps exist in the mechanistic pathway by which their exposures affect COX signaling during development. To fill these gaps, I will define where and when the COX1 gene and protein is expressed during embryonic development using in situ hybridization chain reaction and immunohistochemistry in chicken embryos at various embryonic stages. My work thus far has identified that COX1 is expressed in dividing cells in our tissues of interest, suggesting that it may play a role in the maintenance or growth of the neural tube and neural crest cells during embryonic development. By spatiotemporally characterizing COX1 in the embryo, further research can be conducted on its mechanistic role, revealing how birth defects arise when the COX pathway is inhibited.

Student Reflections on a Novel First-year Seminar With an Asset-based LatCrit-informed Curriculum to Improve Academic Outcomes for Latinx Students on Academic Probation or Subject to Dismissal

Siddhi Shenoy
Sponsor: Natalia Caporale, Ph.D.
Neuro Physio & Behavior

At a national level (and at UC Davis), ~25% of undergraduates find themselves in academic probation (AP) at some point in their degree. Despite this prevalence, there are few institutional support systems to aid the return of these students to good academic standing. This study examines the outcomes of a novel first-year seminar designed through a collaboration with the Strategic Latinx/Chicanx Retention Initiative and STEM Faculty aimed at supporting Latinx students on AP and subject to dismissal status. The seminar is rooted in asset-based frameworks and implements community cultural wealth and a LatCrit-informed curriculum. For this study, we utilized an inductive coding approach to analyze essay assignments completed by participants of the seminar during Winter 2023 (n=19) & Spring 2023 (n=22). Emerging themes were identified and discussed among researchers until reaching consensus. We will present data on the barriers and questions that students had when first coming into the seminar, their understanding of what their academic status meant, their self-reported benefits from participating in the seminar, and their takeaways from the experience. Our findings have implications for the development of culturally-relevant resources and programs that promote the retention and success of Latinx students facing academic challenges.

Economy of Sex Work in the Fiction of Ihara Saikaku

Steven Shenoy
Sponsor: David Gundry, Ph.D.
East Asian Lang. & Cultures

The history of occupational sex work in Japan, or *Fuzoku*, is quite extensive. In this presentation I will evaluate the economic conditions under which occupational sex work in premodern Japan flourished. By evaluating both narrative and clerical modes of the period, I employ cross-cultural analytical models primarily to works by famous Edo period sex-fiction writer Ihara Saikaku. My research combines the translational and analytical approaches to class hierarchy and modern western theories of labor value to describe the conditions of economy and society surrounding *Fuzoku* and other *eta* workers. The goal of this is to reconcile the disparity between our knowledge of Japan's premodern economy and the transitory role of the individual worker. I examine how Ihara Saikaku's frequent depictions of various social classes engaging in relationships that challenge social hierarchy illustrates a Japan where it is primarily capital that allows opportunistics to traverse to the highest social graces regardless of birth.

Evaluating the Impact of Seasonality on Gross Motor Development in Norwegian Brown Rats

Diya Shetty
Sponsor: Leah Krubitzer, Ph.D.
Psychology

Researchers have long been interested in the impact of environmental context on the development of the primary motor cortex and gross motor skills. However, knowledge gaps exist in the effects of seasonality on ethologically relevant motor tasks. In order to fill these gaps, I will be analyzing performance data of Norwegian rats reared in outdoor field pens on a ladder-rung walking task. Our testing was done on different postnatal days to monitor the development of coordinated body movement from early adolescence to adulthood. The temperature, humidity, and other seasonal events were recorded on each day that behavioral tasks were carried out. This data can determine if there is a correlation between seasonality and overall improvement in gross motor task performance tested in naturalistic environments. I hypothesize that, given the wide range of temperatures and weather events experienced by rats reared in naturalistic, outdoor environments, their performance on the ladder-rung walking task will be different across different seasons. Results from this project could lead to a better understanding of how seasonality shapes the motor cortex during crucial developmental periods and inform experimental design considerations for behavioral neuroscience studies.

Exploring *Zostera Marina* Shoot Microbiota for Pathogen Resistance and Ecosystem Health

Steven Shi
Sponsor: Jonathan Eisen, Ph.D.
MED: Medical Microbiology & Imm

Seagrass shoots play a vital role in marine ecosystems by providing habitat and food for various marine species, contributing to carbon sequestration, and helping stabilize coastal areas. Previous studies have shown that *Zostera marina* shoot associated microbiota play a huge role in supporting overall host health and can offer resistance to a wide variety of pathogens and diseases. The purpose of this study is to find isolates that directly contribute to resistance and we hypothesize that microbiome transplants can spread resistance and increase survivability of *Z. marina.* In order to better understand the microbiome in the shoots of *Z. marina,* bacteria were isolated from shoot tissues and cultured. We then extracted DNA from individual colonies for genome sequencing. Sequenced DNA was then analyzed using The Department of Energy Systems Biology Knowledgebase (KBase) platform. Analyses include taxa identification and gene annotation. In addition, we looked for genes related to pathogen resistance and compared metabolic pathways that could be beneficial for seagrass health. Understanding the microbiome associated with *Zostera Marina* shoots is essential for preserving these ecosystems and mitigating the impacts of critical changes.

Targeting Mutant p53 for the Treatment of Pancreatic Cancer

Yang Shi
Sponsor: Xinbin Chen, D.V.M.,Ph.D.
MED: Int Med Hem/Onc

Pancreatic ductal adenocarcinoma (PDAC) is a form of aggressive pancreatic cancer. PDAC causes a low survival rate because of its complications in diagnosis and the variety of mutations in different patients. Therefore, finding an effective treatment for PDAC is a pressing challenge. Recent genomic data show that tumor suppressor p53 is mutated in about 70% of PDACs, suggesting that mutant p53 may be targeted for PDAC treatment. Previous studies from our lab have identified a small molecule, called 094-63, that suppresses mutant p53 translation by inhibiting eIF4G. Here, we aimed to determine whether compound 094-63 has a killing effect on pancreatic cancer cells. Our preliminary data shows that compound 094-63 inhibits mutant p53 expression and subsequently, elicits growth inhibition. Currently, we are verifying these findings by performing western blots and colon information assays. Together, our data suggest that the compound 094-63 can be explored for the treatment of pancreatic cancer.

Associations between Self-Concept, Vocabulary, and Motor Skills in Infants

Yau Ka (Kimberly) Shih
Sponsor: Simona Ghetti, Ph.D.
Psychology

The development of the sense of self is a prerequisite for necessary skills such as understanding one's own thoughts, feelings, and actions, perspective-taking, navigating interpersonal relationships, as well as other socio-emotional milestones (Baumeister, 1999). Previous accounts have suggested that self-concept may emerge from linguistic and motor input in infancy (Rochat, 2010), but there is little direct evidence that this is the case. To begin to explore these possibilities, we have assessed self-concept, vocabulary, and motor skills in forty-eight 18-22 month-old infants during a two-week larger-scale study. We plan to assess the relations between self-concept, vocabulary, parent-reported motor ability, and memory. We expect that 1) greater motor ability will predict more frequent self-recognition as a measure of self-concept, 2) a larger vocabulary will predict more frequent self-recognition. Our analyses will account for effects of age and other potentially confounding variables to provide new insight on the emergence of self-concept in infancy.

How Sample Characteristics in Scientific Paper Titles Influence Readers' Judgements

Noah Sifry
Sponsor: Alison Ledgerwood, Ph.D.
Psychology

Current publication practices within psychology are often biased, favoring dominant over marginalized samples. The overrepresentation of White and western countries in high-ranking journals has negative consequences, including neglecting valuable research and overgeneralizing the psychological experiences of these groups to all humans. Some psychology journals now require authors to specify sample characteristics in their titles. Designing effective policies is challenging, however, due to a lack of evidence regarding how this specificity impacts readers. Our research assesses how various individuals might react to literature titles with different sample characteristics: (1) a control title with no sample characteristics, (2) a dominant sample title (e.g., "among White participants''), and (3) a marginalized sample title (e.g., "among Black Participants"). In Study 1, participants evaluated study titles in a within-subjects design, but we observed some order effects. In Study 2, we will therefore use a between-subjects design. Participants will rate how important, applicable, and legitimate they find a study based on its title, and how much they desire to read a summary of that research.

Effects of Sugar Metabolism in Muscle Cells using Bioassays and LC-MS/MS

Jaime Silva
Sponsor: Carlito Lebrilla, Ph.D.
MED: Biochem & Molecular Med

Metabolic flux represents the biochemical pathways that metabolites go through in cellular networks. Previous studies exploring the metabolic flux of sugars commonly utilize bioassays or analytical techniques (NMR or LC-MS/MS). Whereas bioassays are useful in determining functional phenotypes of cells, mass spectrometry (LC-MS/MS) provides an in-depth quantification of metabolites. Utilizing bioassays (MTS metabolic assay) and C^{13}-isotopic-labeling-LC-MS/MS, we quantified the metabolic flux of sugars (glucose, fructose, galactose) into the proteome of muscle cells. The cells were fed with media supplemented with C^{12} or C^{13}-isotopic-labeled glucose, fructose, and galactose. The MTS assay was quantified using UV-Vis spectroscopy. C^{13}-isotopic-labeling-LC-MS/MS was performed by extracting the proteomes and analyzing them using nanoLC-Orbitrap LC-MS/MS. The MTS metabolic activity assay showed significantly higher metabolic rates of muscle cells fed with glucose, compared to fructose and galactose. C^{13}-labeling LC-MS/MS revealed glucose incorporated into the majority of the proteome, with galactose and fructose found in the remaining proteins. Gene ontology analysis revealed that glucose is primarily incorporated into Metabolic proteins, fructose into Virus-associated proteins, and galactose into Macromolecule/cellular localization proteins. In conclusion, utilizing bioassays and LC-MS/MS showed a comprehensive picture of the metabolic flux of sugars into the cellular proteomes.

Prevalence of Viral Hepatitis B and Type II Diabetes Comorbidity: A Retrospective Study of At-Risk Populations within a Free Asian Clinic

Nicolas Silva
Sponsor: Mary Pauly, M.D.
MED: Int Med - Gastroenterology

Most patients seen at Paul Hom Asian Clinic are born in regions with high prevalence of hepatocellular carcinoma (HCC) and its primary risk factor, hepatitis B (HBV). 36.6% of our patients are anti-HBc seropositive ("core-positive"); such individuals are twice as likely to develop HCC, especially in the absence of serological immunity (anti-HBs). Additionally, type II diabetes mellitus (DM-2) presents significant risk for developing metabolic-dysfunction associated steatotic liver disease (MASLD), which is associated with a three-fold increase in HCC and cirrhosis in core-positive patients. We aim to study the prevalence of DM-2 and pre-diabetes (pre-DM) within groups categorized by hepatitis status and examine the significance of HBV and DM-2 comorbidity through laboratory results. We are retrospectively examining the medical records of approximately 150 adult patients screened for hepatitis at our clinic over the past 10 years. Incidence of DM-2 and pre-DM, laboratory results collected at the time of screening, and subsequent diagnosis of known liver disease comorbidities will be analyzed between groups. We propose that the results of this study can help inform screening for liver disease, including MASLD and fibrosis, and add to existing guidance for the monitoring and treatment of DM-2 in patients with a history of HBV.

Relationship Between Anxiety and Academic Performance in College Students: Pre- and Mid-COVID-19

Robanjeet Singh
Sponsor: Adrienne Nishina, Ph.D.
Human Ecology

Among U.S. college students, the increasing prevalence of anxiety impairs academic performance. The COVID-19 pandemic was a stressful, anxious period for many students, which may have then affected academics. We examine the relationship between general anxiety and academic performance (i.e., self-reported GPA). We hypothesized that (1) more anxiety would be associated with lower GPAs, and (2) there would be a stronger relationship pre-pandemic versus mid-pandemic, as students likely experienced additional anxiety due to COVID-19. California college students (N = 257; 74% female, 25% male, 1% other; 29% White, 41% Asian, 19% Latino, 1% Black, 10% Other) completed online surveys two years before the pandemic (2018) and during the pandemic (2020). Students completed daily reports on general anxiety across 5 days during a two-week period; these 5 reports were then averaged. We ran two separate linear regressions for pre- and mid-pandemic. Our results indicated there was no relationship between general anxiety and GPA pre-pandemic ($\beta = -.06$, $SE = .48$, $p = .34$) or mid-pandemic ($\beta = -.004$, $SE = .42$, $p = .96$). Overall, general anxiety and GPA were not related, perhaps because anxiety does not have a large effect on GPA long-term, or some teachers were more lenient during the pandemic.

Assessing Predator Avoidance Behaviors in a Warming Climate: When Should Monarch Caterpillars Drop From Leaves?

Prabhjot Singh
Sponsor: Louie Yang, Ph.D.
Entomology/Nematology

Non-consumptive effects (NCEs) are the sub-lethal effects that predators have on their prey, e.g., by changing their behaviors. Behaviors that allow prey to successfully avoid predation can still have negative effects on growth and reproduction. While the negative consequences of NCEs are documented under laboratory conditions, there are few studies that examine how variable environmental conditions affect non-consumptive effects. For our study, we examined a specific predator avoidance response by monarch caterpillars (dropping off milkweed in response to simulated attack) and how the rate of dropping and fitness cost of dropping varied with temperature. Our hypotheses were: 1) that warmer temperatures would make caterpillars less likely to drop off milkweed due to the risk of overheating and/or desiccation on the ground, and 2) that warmer temperatures would reduce survival, having a higher fitness cost (i.e., lower survival). We observed that drop rate decreased with increasing temperature until 30°C but increased drop rates at higher temperatures. High ground temperatures reduced caterpillar survival rate. Within the context of climate warming, the results of this experiment indicate that the negative NCEs associated with predator avoidance may increase under warming conditions.

Exploring Parental Gestures During Infancy

Divisha Singh
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Parents tend to speak with a high pitch and simple vocabulary when communicating with infants. Because language is multimodal, parents may also adjust their gestures for infants, similar to infant-directed speech. Previous studies showed that 10-month-olds understand parents' pointing. However, they do not understand representative gestures such as iconic gestures that depict aspects of a referent by adjusting hand forms (e.g., cupping hands depict a round shape for a ball) until 26 months. Little is known about whether parents adjust their gestures based on infants' communicative repertoire. This study explores how parents' representative and non-representative gesture types change based on infant age between 10-20 months. 46 parent-infant dyads (*M*age=14 months) participated in a 6-minute play session. We coded parents' gestures as deictics (e.g., pointing), iconic, conventional (i.e., thumbs up), and object manipulation (i.e., moving a toy back and forth). Considering the developmental milestones, we predict that parents will use more representative gestures (e.g., iconic) and fewer non-representative gestures (i.e., deictics, object manipulation) with older infants than with younger infants. These findings can enhance our understanding of whether infant-directed patterns extend beyond speech.

The Effects of Chronic Stress on cancer progression and metastasis: An in-vitro breast cancer cell model

Aman Singla
Sponsor: Michele La Merrill, Ph.D.
Environmental Toxicology

In the last decade, chronic stress and triple negative breast cancer (TNBC) rates have increased, disproportionally impacting marginalized communities. Several animal models, studying the effects of psychosocial stress on cancer have linked stress to cancer progression. However, little is known if it can be replicated in cells, especially to screen environmental pollutant's effect on stress responses. This research aims to create an *in vitro* TNBC cell model to investigate the effects of chronic stress on breast cancer progression. TNBC cell lines were cultured for 7 days with free cortisol between 1 and 100nM. RNA isolation revealed significantly elevated glucocorticoid receptor target gene expression, including FKBP5 and SGK1, in 100 nM cortisol treated Hs578T cells. Thus, Hs578T was chosen for long-term culture. Population doubling rate was assessed at every passage. DNA/RNA were collected to assess gene expression while cells were collected for Cyquant proliferation assay and Matrigel invasion assays. Studies using Hs578T cells with 20-day continual dosing of vehicle, 1 and 10 nM cortisol are ongoing. We expect this model to reflect chronic stress responses, distinct from acute effects. Through this model, we aim to understand chronic stress's impact on cancer progression and how toxicant burden can exacerbate these effects.

The Bay Area Food Guide - Coyote Edition: Comparing the Diets of Urban and Non-urban Coyotes via Stable Isotope Analysis

Emily Sit
Sponsor: Benjamin Sacks, Ph.D.
Veterinary Genetics Lab

Heterogeneous landscapes of urban environments create novel resource distribution within the ecosystem, leading to unique resources for urban wildlife. As wildlife integrate into expanding cities, their dietary niches shift in favor of urban resources, leading to unknown changes to population health and behavior, ecosystem processes, and human-wildlife conflicts. Mesocarnivores such as coyotes have recently cemented their role in maintaining the urban ecosystem. Their scavenger and predatory behavior have enabled successful diet adjustments to exploit novel urban resources, but the extent of anthropogenic influence on the urban coyote diet requires further investigation. In our study, we examined the dietary variation between urban and non-urban coyotes using stable isotope analysis. We used a linear mixed model to compare the δ13C (proxy for anthropogenic food) and δ15N (proxy for prey consumption) isotopic signatures of coyote whiskers, then calculated and compared the standard ellipse areas of the urban and nonurban isotopic signatures to determine the isotopic dietary niche breadth of the two groups. The variation in diet between urban and non-urban coyotes can have implications on population health and ecosystem dynamics, which is an essential tool for maintaining urban ecosystem health and enabling all wildlife to coexist in cities.

Comparative Study of Levels of Smoke-Related Volatile Phenols in Skin, Pulp and Seed Parts of Non-Smoke Exposed Versus Smoke Exposed Cabernet Sauvignon Grapes

Jesse Skratt
Sponsor: Susan Ebeler, Ph.D.
Viticulture & Enology

Smoke from wildfires releases volatile phenols from burning wood, which could permeate nearby vineyards, bonding with grape sugars to form glycosides. Consequently, smoke-exposed grapes may release these compounds during fermentation, resulting in wines with undesirable sensory characteristics, such as smoky, burnt, ashy or medicinal, commonly described as 'smoke tainted'. Despite this, there remains a significant knowledge gap regarding the distribution of these volatile phenols within grape berries—specifically, in the skin, pulp, and seeds. Evaluating smoke-exposed grapes is challenging as the same compounds naturally occur in grapes unaffected by smoke. This study aims to comparatively analyze the presence of smoke-related volatile phenols in the skin, pulp, and seeds of Cabernet Sauvignon grapes from California, distinguishing between smoke-exposed and non-exposed samples. The Californian wine industry has experienced a 27 percent growth over the past six years, with wine ranking as the state's fourth-largest agricultural export as of 2021. The escalating frequency of wildfires in California adversely affects wine quality due to smoke taint. This research endeavors to furnish data that could enhance industry standards in wine quality control, benefiting both the wine industry and consumers alike.

Gene-Editing Starch Branching Enzymes with CRISPR-Cas9 to Inform on the Importance of Starch Composition for Tomato Fruit Development

Kira Smit
Sponsor: Diane Beckles, Ph.D.
Plant Sciences

Tomatoes are popular and are high in nutrients. However, fruit with low consumer appeal will be discarded contributing to environmental damage. Starch accounts for 25-40% of tomato fruit dry weight at mature green constituting the primary metabolic flux in the organ. The amount and the physicochemical structure of starch influences the growth and development of cereals and tubers, species where it is well studied. However, it is currently unknown if starch composition plays a role in the fruit's development. We hypothesize that starch composition is intrinsically linked to the tomato fruit's ripening and growth by regulating the conversion between starch reserves and the sugars needed for energy and metabolism, thereby affecting fruit biomass and quality. To examine this, CRISPR-Cas9 gene-edits were made in the two starch branching enzymes (SBEs) genes in tomato. SBEs regulate starch structure and composition, and amount in leaves, seeds, and tubers, but they have not been investigated in tomato. These edited tomato mutants will inform on the importance of starch composition for fruit starch biosynthesis, fruit physiology and quality, by comparing them with the control lines. Overall, our work will allow us to better understand the role of starch metabolism in fruit which is understudied.

Going Electric in a Bike-Loving Town: An Economic Investigation of the SPIN Bike and Scooter Program at Davis

Sonora Slater
Sponsor: Katrina Jessoe, Ph.D.
Ag & Resource Economics

Economics is often associated with things like cryptocurrency and men in suits evading taxes. But really, economics is about decision-making when there are a lot of factors at play — and if applied right to city design, it should be used to make life better for those in the community. One of Davis' more recent attempts to move in this direction was launching 200 shared-use Spin e-scooters and 400 e-bikes at the beginning of the fall 2023 quarter. Theoretically, the scooters and bicycles have the potential to make students' lives easier: allow them to get to class on time when they're running late, travel faster when it's late at night for safety reasons, zip through the city streets when it's raining. But they're being tested for the first time, so as always, there's room for improvement. My thesis explores what factors most impact ridership of these vehicles: day of the week? Time of day? Weather? In accordance with my findings, I will suggest pricing changes that would reflect the demand decisions of students, and explore the social reasons for whether or not UC Davis/SPIN should adopt these pricing changes.

Adolescent Loneliness and Chronic Stress: Insights from Hair Cortisol Concentration

Nicholas Smith-Holmes
Sponsor: Camelia Hostinar, Ph.D.
Psychology

Loneliness is a worldwide epidemic that has worsened with the Covid-19 pandemic (Twenge et al, 2021). Previous research has shown that loneliness in adolescence contributes to worse mental and physical health outcomes (e.g., Caspi et al, 2006). Stress has been implicated as a potential mechanism connecting loneliness with these negative outcomes (Steptoe et al. 2004). Understanding the consequences of chronic loneliness in early adolescence has important repercussions on future research and decision-making. The current study aims to examine the association between adolescent loneliness and hair cortisol concentration as a measure of chronic stress. We will be examining associations between self-reported loneliness and hair cortisol levels from a sample of 150 children aged 11-15 years old. Loneliness was assessed using a shortened version of the UCLA Loneliness scale (Russel et al, 1978;) and the LACA measure of loneliness (Goossen et al, 1987). We hypothesize there will be a significant positive association between hair cortisol concentration and the level of loneliness reported. These results can inform current theories about the biological pathways by which loneliness contributes to poor physical health outcomes.

Association of Plasma Neurofilament Light and White Matter Hyperintensity on Memory: Differential Findings across *Apolipoprotein E* Risk Groups in Normal Aging

Mae Yue So
Sponsor: Shraddha Sapkota, Ph.D.
MED: Neurology

Neurocognitive trajectories are a result of synergistic associations of multiple risk domains. We study blood-based, neuroimaging, and genetic biomarkers on memory. Specifically, we examine (1) plasma Neurofilament Light (pNfL) and white matter hyperintensity volume (WMHV) on episodic memory (EM), (2) pNfL on WMHV, and (3) synergistic model with pNfL and WMHV to predict EM, independently and as stratified by *Apolipoprotein E* (*APOE*). We used an ethnically diverse cohort of cognitively normal older adults from the University of California, Davis-Alzheimer's Research Center (*n*=299). Statistical analyses included latent growth modeling, and regression analyses. *APOE* genotype was examined as ε4-/ε4+. We observed higher pNfL and WMHV was associated with EM, and higher pNfL was associated with WMHV. In the combined model, we observed similar findings. Specifically, when stratified by *APOE*, higher pNfL and WMHV were associated with steeper EM decline only in the ε4- group. However, higher pNfL was associated with higher WMHV across ε4- and ε4+ groups. We observed that the association between pNfL and EM, and WMHV and EM are modified by APOE genotype. However, the relationship between pNfL and WMHV is present regardless of genetic risk. Examining biomarkers across multiple domains may lead to effective clinical interventions in diverse populations.

Neural Correlates of Empathy in Preschoolers

Amanda Soeth
Sponsor: Lindsay Bowman, Ph.D.
Psychology

Empathy, the ability to understand and share other's feelings, is fundamental for navigating the social world and promotes helping, sharing, and comforting behaviors. There is extensive behavioral research on empathy in preschoolers, but little work has explored how empathy is supported in the brain during this period of critical development. While some prior work has examined children's neural responses to static images of distal body parts (e.g., hands/feet) experiencing pain or not, this work is limited in its ecological validity and its ability to capture empathy's complex, multifaceted nature. This study addresses these limitations by collecting electroencephalography (EEG) as 3-to-5-year-old children participate in a live, naturalistic interaction with an experimenter feigning both emotional and physical 'distress'. We compare preschoolers' neural correlates during these conditions to a 'baseline' condition, wherein children interact with the experimenter before they experience 'distress'. We target an EEG signal implicated in social reasoning (e.g., children's perspective-taking and mentalizing) that is theoretically and empirically related to empathy– 6-9 Hz 'alpha' suppression in frontal and temporoparietal scalp regions during 'distress' relative to 'baseline'. This study will provide ecologically valid evidence of the neural correlates of empathy in preschoolers at a time of critical development in this foundational skill.

Sustainable Therapeutic Protein Production in Microalgae

Gaia Soldano
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

The production of therapeutic proteins is currently dominated by a few chassis organisms including *E. coli*, *S. cerevisiae*, CHO cells, and some plants. However, synthetic biologists have, of late, been working to develop alternative chassis organisms that may provide advantages over these traditional chassis. Microbial photosynthesizers, or microalgae, are currently one interesting alternative. By only requiring light, trace minerals, buffer, and a nitrogen source, microalgae provide a potentially low-cost platform for therapeutic protein production that is also ecologically sustainable due to fast growth and photosynthetic ability. The microalgae *Chlamydomonas reinhardtii*'s physiology is well-documented and has been shown to synthesize stable mammalian proteins, making it a prime research candidate as a photosynthetic chassis organism. One of the biggest barriers to using *C. reinhardtii* as a chassis organism is performing a high-efficiency transformation. Our research strives to develop a transformation protocol that can efficiently integrate transgenic DNA into the *C. reinhardtii* genome using exponential electroporation. This transformation protocol can then be applied to a synthetic biology context to produce different therapeutic proteins, reducing the cost both financially and environmentally. Here, we present our recent work to improve transformation protocols for *C. reinhardtii*.

Effects of Scent-Infused Enrichment on Behavior of Commercial Sows

Jocelyn Solorio
Sponsor: Kristina Horback, Ph.D.
Animal Science

California's Proposition 12, the Farm Animal Confinement Initiative, requires all breeding gilts and sows to be placed in group housing rather than individual gestation crates. While this housing change does increase the freedom of movement for the animals, it still does not address issues related to the behavioral needs of the sows. The aim of this study is to evaluate the effects of scent-infused enrichment on sow behavior during their early stages of gestation. Four sows were observed one hour per day for five days, over three weeks: no-enrichment, rope-only, and scent-infused rope. By placing scent-infused enrichment, sensory and environmental enrichment are incorporated therefore increasing mental stimulation in an otherwise barren enclosure. The ability to incorporate scent as enrichment into a pig's daily life may be able to satisfy their natural instinct to explore and root. It is hypothesized that sows will be more active and display fewer abnormal or aggressive behaviors in the enriched pens as compared to a non-enriched pen. Rope enrichment could enhance the welfare of group-housed gilts and sows by allowing the performance of species-specific oral behaviors.

Examining the Impact of Face Concern on Self-Disclosure among a Multicultural Sample

Astha Soni
Sponsor: Nolan Zane, Ph.D.
Psychology

Face concern is a multidimensional concept wherein people of all cultures try to maintain and negotiate face in interpersonal communication revolves around the delicate balance individuals strive to maintain in preserving their self-image. Individuals attempt to maintain face to preserve their own self image. As such, face concern can affect the way we behave in society, including in therapeutic or clinical settings. The current study involves the transcription, review, and analysis of videotaped interactions between participants of varying ethnic backgrounds and a trained research assistant (confederate) to determine the impact of face concern on self-disclosure tendencies. Study participants (N = 372) completed a "Brick Test," a test for cognitive abilities, and were randomly assigned to receive either "fake" negative or neutral feedback about their performance on the test. The feedback process was recorded, and we are currently transcribing the audio recordings. We will conduct a thematic analysis of the qualitative transcripts this spring to generate initial codes and identify common themes. The implications of our qualitative results include gaining a deeper understanding of interactions between face concern and self-disclosure patterns among ethnically diverse patients, thus, empowering mental health professionals to develop more efficient and effective therapeutic intervention protocols for these patients.

Inversion Submersion: Analyzing chromosomal inversions of *Zostera marina* along a depth gradient

Nadia Sparenberg
Sponsor: Rachael Bay, Ph.D.
Evolution & Ecology

Chromosomal inversions are a mutation where a segment of DNA is reattached to a chromosome in reverse orientation. Eelgrass is a foundation species. In Tomales Bay, a large inversion has been identified. Preliminary data indicates that the inversion may be related to temperature, but there have been no studies investigating frequencies of allelles along a depth gradient. I sampled plants from one population to see (1) if inversion genotypes vary across depth and (2) whether seeds carry expected inversion genotypes based on parental genotypes. There are three divisions of labor: field work, lab work, and analysis. During field work, myself and a small team traveled to Tomales Bay, collecting plants from different depths. Afterward, I genotyped each plant and its seeds in the lab. While results haven't been fully analyzed, variation in genotype frequencies across depths will indicate that there is selection for the inversion following a depth gradient. Comparison of seed genotypes to their expected ratios will indicate whether selection is happening at this stage. Together, these analyses will help us build knowledge on the scale and development at which the inversion contributes to selection.

Too Hot To Handle: Do Warming Ocean Temperatures Change Ability of Isopods To Control Seagrass Wasting Disease?

Nadia Sparenberg
Sponsor: Anya Brown, Ph.D.
Evolution & Ecology

Eelgrass is a foundation species whose populations are declining due to seagrass wasting disease (SWD). Because warming can increase disease, it is important to understand how the dynamics of SWD will change with rising temperatures. Common seagrass grazer, *Pentidotea resecata*, preferentially feeds on diseased tissues implying they may reduce disease severity. The relationship between grazing, disease, and temperature is unknown. We hypothesized that disease severity (area of disease lesions on a blade) and grazing show a unimodal relationship with temperature, where severity is highest when grazing is lowest. To test this, we exposed eelgrass blades with and without isopods to five temperature treatments. Grazing was highest between 14-16°C and lowest at 10°C. To test whole plant response to grazing and temperature, we exposed diseased plants and grazers to an ambient and elevated temperature treatment and measured plant growth, grazed, and diseased area on blades. At ambient temperatures, plants expended more energy into growth when grazers were present. At higher temperatures, grazing did not affect plant growth. Disease was not significantly affected by grazing or temperature. These experiments suggest that high and low temperatures limit grazing, which can influence the effects grazers have on eelgrass growth, but minimally affects disease severity.

Fishing for Rare Diseases

Madison Sparks
Sponsor: Ian Korf, Ph.D.
Molecular & Cellular Bio

Rare genetic diseases are often neglected for very good reasons: not many people have them, so they are not a public priority and not likely to generate profits for a company. There are two very good reasons to study rare genetic diseases: (1) it is emotionally taxing for the rare disease community to be neglected and (2) there is a lot of very interesting biology to discover when studying rare diseases. A powerful way to study gene function is through orthologous genes in model organisms. For example, the chihuahua gene in zebrafish is orthologous to COLA1 in humans, which is associated with the human disease osteogenesis imperfecta. This project aims to connect rare human genetic diseases to zebrafish genotypes through shared phenotypes. Previous research has identified orthologous genes for select diseases in different model organisms. While unethical in humans, series of gene knockouts allow for in-depth analysis of associated phenotypes with higher confidence due to controlled experiment conditions and larger sample sizes compared to humans. This research aims to establish this connection between genotype and phenotype in zebrafish to extend it to humans, potentially predicting human genes responsible for genetic diseases given observed phenotypes and establishing a tool for diagnosis.

Gender Disparity in Microfinance Loan Recipients

Nandhini Sridhar
Sponsor: Erich Muehlegger, Ph.D.
Economics

Microfinancing has become one of the main ways that the world's most low income populations have gained access to credit. However, while there is a plethora of experimental research regarding the impacts of micro credit on different groups, not much work has looked at the supply side of microfinance. I look at the supply of micro credit using the World Bank's MIX Market dataset to analyze how a change in a lending institution's gross loan portfolio impacts who receives loans. Specifically, I look at the percentage of female borrowers and the fraction of the gross loan portfolio that goes to women and how they change based on changes to the gross loan portfolio over time. Overall I find that while at the institution level, supply does not impact the percent of female borrowers or the fraction of funds to female borrowers, but across countries and regions, institutions with larger gross loan portfolios tend to lend to a lesser percentage of women and lend a smaller fraction of their portfolio to women. My research sheds light on how loans are determined in a side of microfinance for which not many experiments have been conducted.

Genetic Diversity Influences of *Botrytis cinerea* Infection on Cucurbit and Common Bean

Karishma Srinivas
Sponsor: Dan Kliebenstein, Ph.D.
Plant Sciences

Botrytis cinerea is a necrotrophic pathogen that can infect many agriculturally significant plants. However, the success of infection is highly variable across genetically diverse isolates of *Botrytis* and its many hosts. To better understand the role of genetic diversity in virulence and the high generalism of *Botrytis*, we performed detached leaf assays where isolates of *Botrytis* were infected onto different genotypes and species of Cucurbitales and Fabales plants. The size of the lesions were similar to previous studies done. We utilized a genome-wide association study (GWAS) to identify specific genomic regions that were likely to affect the virulence of *Botrytis* when infecting the plants. By identifying single nucleotide polymorphisms (SNPs) associated with virulence across the 72 isolates, we were able to map the SNP effect size across the genome. Other studies done on different species revealed that the interaction was highly polygenic which is the expected result for this experiment as well. Further work will assess the role of transcriptome plasticity in virulence by performing host and pathogen RNAseq during infection.

Investigation of the Domains of LET-99 Required for its Role in Asymmetric Cell Division of the *C. elegans* Embryo

Dharshini Sridharan
Sponsor: Lesilee Rose, Ph.D.
Molecular & Cellular Biology

Asymmetric cell division is a mechanism by which daughter cells of different compositions are produced, causing them to follow different cell fate pathways. Such divisions are used by all animals to generate cell type diversity during development. During asymmetric divisions, a polarity axis is established that has an uneven distribution of cell fate components; then, the cleavage plane must be oriented, in response to the mitotic spindle position, so that components are differentially inherited by the daughter cells. The PAR polarity proteins regulate asymmetric division in many organisms. This project focuses on spindle positioning in the embryo of the nematode *C. elegans*. Here, the PAR proteins control the localization of the LET-99 protein, which in turn regulates the spindle positioning machinery. Mutations in the *let-99* gene cause defects in spindle orientation. The goal of this project is to identify the specific parts of the LET-99 protein that are needed for its normal localization and for its role in spindle positioning, by examining mutants with deletions of regions of the LET-99 protein.

Identifying Autophagy Pathways Protective Against Neurodegenerative Disease

Sejal Sripadanna
Sponsor: Kenneth Kaplan, Ph.D.
Ag Molecular & Cellular Bio

Alpha-synuclein is a protein associated with neurodegenerative disease (ND) that can cause proteotoxic stress in cells. Evidence in both animal and cell model systems supports a protective role for autophagy in ND. Autophagy is a membrane trafficking pathway in cells that targets damaged organelles or protein aggregates for degradation in the vacuole/lysosome. We hypothesize that the primary protective role of autophagy in protecting cells from the toxic effects of a-synuclein is through a nuclear ER-phagy pathway that depends on the nuclear-vacuolar junction proteins, Nvj1 and Vac8. To test this, we are analyzing deletions of the corresponding genes *NVJ1* and *VAC8*, as well as the general autophagy pathway genes *ATG1* and *ATG7*. Preliminary results suggest that *nvj1?* mutants have an impairment in growth rate similar to that of *atg1?*, implying that nER autophagy is critical for recovery from cellular disease states. This result supports our hypothesis that nER autophagy is critical for suppressing toxicity from a-syn over-expression.

Comparative Analysis of Extracellular Matrix Remodeling in Aging and Duchenne Muscular Dystrophy

Sathvik Sriram
Sponsor: Lucas Smith, Ph.D.
MED: Physical Medicine & Rehab

Duchenne Muscular Dystrophy (DMD) is a degenerative genetic disorder, primarily affecting males, characterized by progressive muscle degeneration leading to fibrosis, an accumulation of extracellular matrix (ECM) components such as collagen. This disorder results in alterations in ECM content and architecture. Aging similarly alters the ECM, contributing to this disease's progression. The D2.*mdx* mouse, a model for DMD, exhibits similar symptoms to what is seen in humans. Using wild-type and D2.*mdx* mice, we investigated if changes in the ECM were similar between DMD and aging. Muscles from year-old wild-type and D2.*mdx* mice were collected and ran through qPCR to assess ECM-related gene expression, focusing on collagen content and organizational genes since collagen is a primary component of the ECM. Our results show increased expression in the genes for Collagen 3a1 and Lysyl Hydroxylase 2 in D2.*mdx* mice, demonstrating an increase in collagen and ECM remodeling and cross-linking in the aged D2.*mdx* mice compared to aged wild-type. Future investigations will delve into additional ECM-related genes and compare findings across age groups. This study sheds light on the progressive ECM remodeling in DMD versus healthy aging, and provides insights into this disorder's progression.

Predicting ERP Responses to Selectively Attended Speech-in-Noise Using Cognition-Attention Interaction in Mixed Effects Modeling

Tyler Statema
Sponsor: Lee Miller, Ph.D.
MED: Otolaryngology

Speech-in-noise listening is a complex auditory process that involves many brain functions, yet few studies have examined the relationship between cognition, attention, and neural responses together in the context of speech listening. To fill this gap, we explored how a cognition-attention interaction could predict neural responses evoked by speech. Specifically, we measured subjects' event-related potentials (ERPs) while they completed a multi-talker spatial attention speech-listening task. Subjects were also measured on several cognitive tasks (e.g. Flanker, Stroop, etc), results from which were entered into a principal components analysis (PCA) in order to estimate general cognitive performance across the tested domains. We then constructed mixed-effects models, using as predictors the first component of this PCA, an attention condition variable, and an interaction between the two in order to predict attention-directed neural encoding in the auditory cortex. We found this cognition-attention interaction to be associated with the P1b amplitudes from our subjects' ERP waveforms. Specifically, a higher cognitive score was associated with higher amplitudes in response to attended speech, when compared to unattended speech. This finding indicates that including cognitive measures in assessments of hearing function could provide greater insight into individual differences in hearing outcomes.

Application of Spent Mushroom Substrate as a Biosolarization Amendment

Brooke Stehle
Sponsor: Christopher Simmons, Ph.D.
Food Science & Technology

Soil fumigation is a common process done with synthetic chemicals to control the growth of weeds and soilborne pathogens. To offset the negative environmental impact of these chemicals, we are researching an alternative that uses spent mushroom substrate (SMS) as a natural pesticide and potential fertilizer in the process of soil biosolarization (SBS). To determine if SMS is a viable alternative, phytotoxicity assays were conducted using biosolarized soil treatments. The treatments included soil amended at rates between 0.5-2.0% with SMS, compost, or rice bran (RB) as a positive SBS control, and a solarization control with no amendment. The soil was incubated for 8 days to mimic biosolarization and tested 0 days and 14 days post-SBS after a remediation period. All treatments were used to germinate radish seeds and radicles of the germinated seeds were measured after a 72-hour incubation. All SMS treatments at Day 0 obtained a germination index (GI) below 80%, indicating the presence of phytotoxic substances and a potential for SMS to be used for the inactivation of weeds. At Day 14, the SMS treatments had the largest increase in GI values, indicating the potential of SMS to be used for fertilization post-SBS.

Article 26 Backpack: Bridging the Digital Divide in Higher Education for Refugee and Displaced Students

Natalia Stehlin
Sponsor: Keith Watenpaugh, Ph.D.
Religious Studies

Article 26 Backpack aims to make the promise of the 26th article of the Universal Declaration of Human Rights achievable: quality higher education, accessible to everyone. Backpack, which currently supports over 4500 displaced students, was developed to meet the needs of displaced Syrian students pursuing higher education in neighboring countries, not only provides crucial document storage to students who may have limited safe places to store personal information, but also a wealth of scholarship and employment opportunities, free academic credentialing, and test vouchers. As a result of our experience working directly with refugee communities and alongside college counselors with lived experience of displacement, Article 26 Backpack has extensive knowledge of the barriers displacement presents to pursuing higher education. Our presentation will address Backpack's key findings over its seven years of work, examining programming models and survey results from Rwanda to Afghanistan to identify key points of difficulty that hamstring refugee students on their pursuit of higher education, among them the severe financial strain of application prerequisites and limited digital literacy and wifi access.

Advancing Western Blotting Techniques – Exploring pH, Salt Composition, and Transfer Stack Sizes

Vanessa Su
Sponsor: Aldrin Gomes, Ph.D.
MED: Physiology & Membrane Biol

Over the last 40 years, Western blotting – used to detect and quantify sample proteins – has become an increasingly prevalent lab technique. Due to the current method's susceptibility to variation and error, this proposal explores three adjustments to traditional protocol: (1) comparing sodium chloride (NaCl) and potassium chloride (KCl) in Tris-buffer, (2) adjusting the pH of Tris-buffered saline with Tween 20 (TBST), and (3) varying the filter-paper stacks during protein transfer. As the buffer's salt-composition influences protein binding to the membrane and other proteins, comparing Tris-buffers composed of NaCl and KCl allows us to deduce which salt more effectively enhances Western blot performance. Similarly, pH affects the efficiency of protein binding and antibody interactions; varying TBST's pH allows us to determine the optimal pH to maximize protein retention on the membrane while minimizing non-specific binding. Lastly, adjusting the size and distribution of filter-paper layers used during protein transfer helps us identify the ideal combination that reduces incomplete transfer or uneven protein distribution. In order to analyze these factors independently, individual experiments are being conducted for each alteration, ensuring precise observations of the effects of the targeted changes. Overall, this project seeks to refine standardized conditions that promote consistent, reliable Western blots.

Effect of the Immigration and Nationality Act of 1965

Fangyi Su
Sponsor: Erich Muehlegger, Ph.D.
Economics

On October 3, 1965, President Lyndon B. Johnson enacted the Immigration and Nationality Act of 1965, a landmark legislation that has since been recognized as a pivotal moment in the reform of migration policy. This legislation instituted a preference system, prioritizing immigrants with specific skills and familial ties to U.S. citizens or residents, while abolishing the national origins quota system, thereby eliminating ancestry as a determinant for immigration. By removing this discriminatory barrier, the Act fostered a more diversified immigrant population, offering a fairer chance for individuals to obtain visas for entry into the United States. The post-1965 immigration system has significantly impacted the U.S. economy by facilitating the influx of skilled labor and fostering familial reunification, both of which contribute to economic growth and innovation. Furthermore, the Act has led to varying patterns of immigrant distribution across states in the U.S., with factors such as economic opportunities, existing immigrant communities, and regional preferences influencing immigrants' geographical choices. Through comprehensive data collection and rigorous analytical methods, including comparative analysis and linear regression, the effect of the Immigration and Nationality Act of 1965 on the behavior of new immigrants can be systematically studied and elucidated in academic research.

Aggression of Dark-eyed Juncos (*Junco hyemalis*) in Post-Wildfire Forests

Ryann Su
Sponsor: Thomas Coombs-Hahn, Ph.D.
Ag Neurobiology, Phys & Behav

Large-scale wildfires are catastrophic disturbance events that not only threaten organisms' immediate survival but lead to prolonged habitat changes, such as resource exhaustion and ecological community disruption. In this study, we sought to investigate how Dark-eyed Juncos (*Junco hyemalis*) in post-wildfire habitats might possess differences in behavior, physiology, and morphology compared to those from undisturbed habitats. Dark-eyed juncos are generalists and are able to settle in burnt coniferous forests shortly after a fire. In burnt and unburnt forests, we conducted playback experiments on male juncos by playing conspecific male song recordings to them and counting the number of aggressive responses (e.g., songs, swoops, etc.) they gave. The birds' fecal samples (awaiting analysis results) and body measurements were also collected. Our findings showed that male dark-eyed juncos in post-fire areas were significantly more aggressive towards the playback recording than those in undisturbed areas. However, there were no differences in morphological body measurements, such as body size and plumage, between juncos from the two habitats. Ongoing research will seek to investigate whether the elevated aggression is induced by the burnt environment or is because more aggressive birds prefer burnt habitats when establishing territories.

Associations of Marital Status and Depressive Symptoms Among the Oldest-Old Population

Simone Subedi
Sponsor: Rachel Whitmer, Ph.D.
MED: Neurology

Previous studies investigating relationships between marital status and depression suggest that married individuals often report lower levels of depression compared to their unmarried counterparts. This association is important for older adult populations who are at risk for depression due to social isolation and loneliness which may be exacerbated by spousal loss. Research within the oldest-old, ages 90+, remains limited. We investigated proportions of marital status and depressive symptoms in a cohort of individuals aged 90 and older in the Life After 90 Study. Participants self-reported marital status (widowed, married, separated, never married). Depressive symptoms were assessed using the Geriatric Depression Scale with categories of no, mild, or moderate/severe depression. Of 647 participants (mean age 92.4±2.3), 23% reported mild depression and 4% moderate/severe. Widowed participants were overrepresented among those with mild depressive symptoms (69% vs 60% overall). Separated participants were overrepresented among those with moderate/severe depressive symptoms (13% vs 9% overall). Those with mild (77%) or moderate/severe (67%) symptoms were less likely to report having a confidante compared to those without depressive symptoms (82%). Understanding depression and marital status may help in identifying those in need of emotional or social support in among oldest-old populations.

Attribute Perception in Hiring Scenarios

kaavya subramaniam
Sponsor: Jeffrey Sherman, Ph.D.
Psychology

Behavior in the workplace can be heavily impacted by the way information is both presented and perceived. This study aimed to test whether hiring decisions can be influenced by the fact that attention is drawn to information that is unique. Houston et al. (1989) showed that when comparing two people, each person's unique features are weighed more heavily than shared features. In this study, we examined these implications on hiring decisions. Specifically, we tested whether job candidates' unique positive and negative attributes were particularly impactful in hiring decisions. We hypothesized a difference in preference and hiring decisions for applicants based on whether the pairs of applicants share unique-good features or unique-bad features. Participants learned about pairs of candidates that either had unique good or bad traits and then made judgments about which candidate they would favor, associate with, and hire. Our findings show that participants' impressions and hiring decisions were largely based on the valence of the candidates' unique features and the order in which these attributes were presented.

Epicatechin Circulating Metabolites Exert Multigenomic Modifications in TNF-Alpha Stimulated Human Aortic Endothelial Cells: Molecular Mechanisms Underlying It Health Properties

Jeetu Sujith
Sponsor: Dragan Milenkovic, Ph.D.
Nutrition

Aortic blood vessels are lined with endothelial cells that regulate blood flow. Their dysfunction constitutes a crucial event in the physiopathology of atherosclerosis and cardiovascular disorders. Epicatechin, a polyphenol found in cocoa, apple or grapes, was observed to have capacity to prevent or delay the development of these diseases. However, molecular mechanisms of epicatechin on aortic endothelium are still unexplored. The objective of this study was to investigate the biologenomic effects of phase 2 and gut microbiome-derived metabolites of epicatechin in TNF-α-stimulated human aortic endothelial cells at low (nM) concentrations by evaluating their multi-omic modification (expression of mRNA, microRNA, and long non-coding RNAs). We observed that metabolites are biologically active and can modulate the expression of protein-coding and non-coding genes. In silicon 3D docking analyses revealed potential strong interaction between epicatechin metabolites and transcription factors. Integrative bioinformatics analysis of obtained data revealed complex networks of genomics modifications by acting at different levels of regulation. Metabolites modulate cellular pathways including cell adhesion, cytoskeleton organization, focal adhesion, signaling pathways, pathways regulating endothelial permeability, and interaction with immune cells. This study demonstrates multimodal mechanisms of action where epicatechin metabolites could preserve aortic endothelial cell integrity, presenting mechanisms of action underlying epicatechin's cardioprotective properties.

The influence of at home pet experience on infant looking behavior in visual search arrays

Yilin Sun
Sponsor: Lisa Oakes, Ph.D.
Psychology

Given that infants learn about their environment through looking, a crucial research goal is understanding the influences that shape where and how long they look. Previous literature supports infant's tendency to look at familiar stimuli compared to unfamiliar ones, such as maintaining longer visual attention to the faces of their racial group (Kelly et al., 2007) or to dogs and cats when infants have previous pet experience (Hurley, 2010). However, we currently know little about how familiarity may affect looking behaviors during a visual search array with several images. We are testing this in an ongoing study with 8-month-old infants, some with pets at home and others without. We record infants' eye movements as they view arrays of four animals. One of the animals is a dog or cat and the other animals are less familiar. We will measure infants' preference for pets by calculating the proportion of first looks and the relative proportion of looking time to each animal category. We hypothesize that infants with pets at home will show greater proportion of first looks and more overall looking time towards pets, demonstrating that infants' familiarity with pets at home influences how they direct their attention in this task.

Microbial Methanogenesis and Methane Metabolism Dynamics Throughout Wet and Dry Seasons in an Amazonian Wetland

Mavis Sung
Sponsor: Jorge Mazza Rodrigues, Ph.D.
Land Air & Water Resources

The Amazon Rainforest contributes ~8% of the global methane (CH_4) budget due to its biological and microbial diversity. As global warming becomes an increasing threat to Earth, determining changes in microbial activity across seasons have become essential for modeling the consequences of increased CH_4 emissions. This study aims to determine how wet and dry seasons affect CH_4 production, the microbial groups responsible for CH_4 cycling (methanogens and methanotrophs), and available metabolites. In 2019, 44 sediment samples were collected in the wet and dry seasons across four sampling sites along the Amazon and Tapajos rivers intersection in the Arapixuna region, State of Pará, Brazil. Microbial communities were characterized through 16S RNA sequencing analysis and metabolomics, and further categorized into generalists, methanogenic and methanotrophic specialists, and rare. We then compared the shared and distinct metabolic composition of the wet and dry samples. Finally, CH_4 flux measurements were correlated with methane-related taxa to determine the most prolific contributors to methane production and consumption across the samples. Ultimately, the anoxic environment during the wet season provided optimal conditions for methanogens, increasing methane production and contributing to global warming. These findings hold significance in developments mitigating climate change and forming sustainable environmental policies.

The Impact of the Affordable Care Act on Smoking Cessation and Health Outcomes In Pregnant Women

Sloka Suresh
Sponsor: Melanie Dove, M.S.
MED: Public Health Sciences

Smoking during pregnancy is associated with adverse infant and maternal health outcomes and can increase the risk of sudden infant death syndrome, ectopic pregnancy, and placental complications. In 2010, the enactment of section 4107 of the Affordable Care Act(ACA) guaranteed Medicaid coverage for smoking/tobacco cessation treatment without cost-sharing for pregnant women. This systematic review aims to evaluate the impact of section 4107 of the ACA on infant health outcomes and smoking behaviors among Medicaid-insured pregnant women. The systematic review of qualitative and quantitative studies was conducted per PRISMA guidelines. PubMed, Google Scholar, and PsychInfo were searched for relevant articles. 11 articles were identified and included in this review. In several states, section 4107 broadened the range of smoking cessation treatments covered to include both medication and counseling. Additionally, a larger percentage of women in the preconception period gained access to smoking cessation treatment. However, despite expanded access, smoking cessation treatment remains significantly underutilized by pregnant women with no substantial changes observed in quit rates or infant health outcomes. While access to smoking cessation treatments has expanded, their underutilization suggests that merely broadening coverage is insufficient to achieve the desired health outcomes

Cognitive Improvement Associated with Curcumin Exerting Multigenomic Modifications in Hippocampal Brain Microvascular Endothelial Cells in Mice on a High-Glycemic Diet

Rithwik Swarnkar
Sponsor: Dragan Milenkovic, Ph.D.
Nutrition

Dysfunction in the regulation of brain microvascular endothelial cells (BMECs) compromises the blood-brain barrier, increasing the risk of cognitive disorders and neurodegenerative diseases. Research shows curcumin's anti-inflammatory properties, prevention of endothelial dysfunction, and reduction of atherosclerosis. However, the mechanism of curcumin in BMECs remains poorly understood. This study thoroughly investigated curcumin's effects on hippocampal BMECs in mice on high glycemic diets. Wild-type male mice were split into three groups and fed for 12 weeks: low glycemic diet without curcumin (LGD, 12% sucrose/weight), high glycemic diet without curcumin (HGD, 34% sucrose/weight), and HGD with curcumin (0.02% in diet). Hippocampal BMECs were isolated using microlaser dissection, total RNA was extracted, and global gene expression was assessed by Affymetrix microarray. Curcumin impacted both protein-coding and non-coding genes, significantly modulating global hippocampal microvascular gene expression. Bioinformatic analyses revealed gene expression modulation of non-coding RNA target genes involved in regulating BMEC permeability, including functions like cell cytoskeleton, cell-cell interaction, anti-inflammatory response, and cell signaling. In-silico 3D docking suggested interaction between curcumin metabolites and transcription factors. These findings partly corrected changes induced by high glycemic stress, revealing novel actions of curcumin in BMECs associated with decreased endothelial permeability and BBB integrity maintenance.

Ventilation, Microclimate, and Nest Success in Wood Duck (*Aix sponsa*) Nestboxes

Joe Sweeney
Sponsor: John Eadie, Ph.D.
Wildlife & Fisheries Biology

Climate Change has been linked to countless negative impacts on wildlife across the globe. One local species, the Wood Duck (*Aix sponsa*) is particularly vulnerable to higher temperatures due to its long incubation period (30 days), and temperature dependent offspring development. Additionally, high temperatures may have negative reproductive consequences for nesting hens, such as skewed sex ratios in ducklings and lower overall hatch success. Given the Central Valley population's reliance on man-made nest boxes, creating science-informed management decisions is especially critical to the species' survival. Our study builds on a twenty year data set conducted on nesting Wood Duck populations across multiple private ranches in Yolo County, California. Ventilation is a commonly used method to reduce nest box temperatures for other bird species, but the effectiveness of this method has not been investigated for cavity nesting waterfowl. We predicted that ventilated boxes would be cooler during heat waves and increase nest success later in the season. Preliminary analyses have shown that ventilation was successful in reducing temperatures, but likely was not enough to mitigate its adverse impacts on Wood Duck reproduction. In our presentation, we will discuss potential reasons for this, and its management implications.

CPU-Auth: Power Side-Channel Based Device Fingerprinting

Ryan Swift
Sponsor: Muhammad zubair Shafiq, Ph.D.
Engr Computer Science

Lack of effective authentication has resulted in numerous security and privacy breaches, including unauthorized access to protected information, identity theft, and fraud. One approach to mitigating such attacks is Multi-Factor Authentication (MFA), in which users must provide multiple pieces of information for authentication. Some secondary authentication factors include SMS text verification codes, biometrics, and tokens. Each contains at least one notable flaw: SMS is notoriously insecure; biometrics rely upon access to sensitive personal data; and tokens require dependence on third-party providers (e.g. OAuth providers). The first major contribution of this work is the exploration of CPU-Auth, a novel authentication mechanism based on unique variations in the physical characteristics of the CPU of a computing device. By measuring the behavior of the Dynamic Voltage and Frequency Scaling (DVFS) governor remotely from within a browser, unique properties of the CPU can be leveraged to establish a hardware-based device fingerprint for use in CPU-Auth. One of the significant challenges facing CPU-Auth is maintaining the ability to accurately identify and distinguish between devices as hardware becomes increasingly similar. As another major contribution, this work provides a granular breakdown of the changes in accuracy of CPU-Auth at varying levels of hardware homogeneity.

Assessing Neuropathological Changes Caused by Traffic-Related Air Pollution Exposure in a Transgenic Rat Model of Alzheimer's Disease

Shanlea Tabofunda
Sponsor: Pamela Lein, Ph.D.
VM: Molecular Bio Sciences

Alzheimer's disease (AD) is the most common form of dementia worldwide. Both epidemiological and clinical studies have indicated a strong association between traffic-related air pollution (TRAP) and AD. Using a novel TRAP exposure paradigm with real-life TRAP exposures, this study aims to explore the differential effects of chronic exposure to different TRAP components including particulate matter (PM) and/or gas, from either light-duty vehicles (LDV) emissions only or both LDV and heavy-duty vehicles (HDV) on AD pathogenesis. We hypothesized exposure to TRAP will increase the severity and/or time-to-onset of the two main pathological hallmarks of AD: amyloid beta (Aβ) plaques and neurofibrillary tangles, compared to filtered air controls. Using transgenic AD-model rats that express human genetic risk factors for AD, we performed immunohistochemistry using anti-amyloid antibody, and the fluorescent dye thioflavin S that recognizes both neurofibrillary tangles and plaques. We observed increased amyloid plaque size in 9 month females exposed to both LDV/HDV emissions (gas and PM) as compared to filtered air.

NYT MEDIA PROJECT: New York Times Depiction of Muslim Men in the 1940s

Nour Taha
Sponsor: Suad Joseph, Ph.D.
Anthropology

How are Muslim Men in the 1940s depicted by the New York Times? The evidence of the New York Times analysis shows a severe caution and attentiveness of the political mobilization of Arab Muslim men in particular. In order to effectively answer this question, I screened 1,061 New York Times articles with 'Muslim Men' as the keyword in the period of the 1940s, of which 132 were relevant. A depiction of 'fanatic' and 'extremist' Arab nationals who mobilize in protests and new political movements. Such analysis is also emphasized when compared with the Western/Western aligned forces that the Arab Muslim men are mobilizing against, or even when compared with the non-Arab Muslim men such as the Muslim political movements in India. This pattern of representation is critical in shaping American foreign policy for decades to come, specifically the view that much of the American media has on the Arab world. This research is part of a long-term analysis project of the NYT from 1850 to the present from the Suad Joseph Lab. The project analyzes the representation of Islam and Muslims over 150 years.

Low-Cost Microfluidic Device for Single-Cell Isolation and Cloning

Jennifer Tah-Espens
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

The Microfluidics Research Team in the BioInnovation Group is developing a low-cost microfluidic chip, known as a single-cell capture (SCC) device, to study heterogeneous cellular populations. We expect this device and methodology to enable the capture, cloning, and analysis of single cells from heterogeneous populations without the use of cell surface markers. Monoclonal cell lines cultured *on-chip* can then be extracted and studied in applications such as tissue regeneration. We based our initial device design on examples from literature that used photolithography to create masks for PDMS casting. However, the cost of photolithography limits access to these tools. We propose that common and affordable 3D printing technologies can be used as an alternative to photolithography to create SCC devices that will perform nearly as effectively. Our current device achieves a SCC rate of 35%, comparable to devices created using photolithography (60% capture rate) at 1% of the upfront cost. Our current focus is optimizing cell culturing and proliferation of various mammalian cell types to perform functional assays *on-chip*. Here we report the development of surface treatment techniques to promote growth and the design and testing of a 3D printed container for environmental control.

Using Submitochondrial Particles To Understand Mitochondrial Electron Transport Chain Function

Hannah Camille Tan
Sponsor: James Letts, Ph.D.
Molecular & Cellular Bio

In cellular respiration mitochondria generate the most energy, in the form of ATP, through the activity of the electron transport chain (ETC). The ETC consists of four enzymes named complex I, II, III, IV, functionally linked by electron carriers. These enzymes and electron carriers work together to "consume" molecular oxygen (O_2), reducing it to water, and generating a proton gradient powering ATP synthesis by complex V, the ATP synthase. What we know about the structures of the ETC complexes come from enzymes that have been solubilized out of their native membrane. Hence, the ETC structures have not been studied in their native state. However, using sub mitochondrial particles (SMPs), where the ETC complexes remain in their native membranes, we will be able to better understand how the ETC works. SMPs are protein-lipid vesicles derived from the inner mitochondrial membrane and contain the ETC complexes and electron carriers. My project aims to make SMPs from porcine liver mitochondria that maintain ETC function. To test the viability of the SMPs, I have optimized a protocol to measure their oxygen consumption activity. Studying the ETC in its native membranes will allow us to better understand how it works in our bodies.

Textile Designs and Construction Techniques with California Water Hyacinths

Kelly Tan
Sponsor: Gozde Goncu Berk, Ph.D.
Department Of Design

Water hyacinths are an invasive species and an aquatic weed in California/U.S. They have caused major issues like removing biological oxygen demand and nutrients around the area, blocking water flow/water traffic, degrading the habitat, and making the water quality undrinkable. At extreme levels, it can threaten California's agriculture production. This research aims to offer a potential solution for managing the infestation of the invasive species in the Sacramento-San Joaquin Delta while providing an alternative plant fiber for textiles, fashion, and new material applications, contributing to sustainable practices for future generations. In this research project, the dried characteristics of an invasive plant species were examined through various processes, including blending, dyeing, plain weaving, and twining. These processed materials were integrated into existing biomaterial recipes, exploring their potential applications. Drawing inspiration from crafting practices in countries like Ghana and Thailand, where similar plant species have been utilized for coasters, twine, and fabric, my study investigates the feasibility of incorporating water hyacinth into diverse biomaterial samples and wearable products. For the final product, I designed 2 wearable bustiers to showcase the individual sample's qualities and functions.

Declarative and Procedural Memory Contributions to Argument Structure and Word Order Learning

Katelin Tan
Sponsor: David Corina, Ph.D.
Linguistics

This study, grounded in the Declarative/Procedural Hypothesis, seeks to disentangle the learning processes underlying verbal argument structure and basic word order within an artificial language paradigm as a model of second language acquisition. According to the Declarative/Procedural Hypothesis, learning a new argument structure should recruit long-term declarative memory, while learning a new word order should recruit long term procedural memory. Participants will undergo assessment across four memory procedures of declarative and procedural memory. Furthermore, participants will engage in learning sessions featuring sentence structures that are unconventional to English. Grammaticality judgment tasks, administered twice, will gauge participants' ability to distinguish between grammatical and ungrammatical sentences of the artificial language. Ungrammatical sentences will be strategically manipulated to reflect English syntax. Pilot data will be presented, leveraging multiple linear regression. We will analyze response metrics, including reaction time and accuracy as a function of memory measures. By elucidating the intricate interplay between memory systems and grammatical learning, this research promises nuanced insights into language acquisition processes, and paves the way for a deeper understanding of the cognitive mechanisms underlying acquisition of syntax.

Monitoring Sub-annual Seasonal Climate Variations Using Drip Water From High Elevation Karst Cave

Bangran Tang
Sponsor: Isabel Montanez, Ph.D.
Earth And Planetary Sciences

Speleothems, cave mineral deposits that form from drip water that flows from the surface to the cave (e.g. stalagmites), record aspects of what the environment was like as they grew. They serve as important archives for understanding paleoclimate information, such as temperature and precipitation. However, speleothem chemistry can be influenced by multiple environmental factors, complicating the interpretation of past climate patterns. Therefore, Studies of geochemical variability in drip water samples from modern cave systems can help us better interpret the speleothem data. In this study, I present geochemical data of drip water samples collected every four days from October 2022 to June 2023 from a cave in Southern Sierra Nevada. These geochemical data provide information about vegetation activities, water-rock contact time, the amount and sources of precipitation. In the fall of 2020, a fire complex burned through the forest above the cave, followed by an exceptionally rainy winter in 2022, making this site a prime candidate for studying the hydrogeochemical response of karst systems to extreme climate events. This study aims to create an accurate interpretation of the modern system (drip water), which will supplement other ongoing speleothem analyses in this cave and contribute to standardizing future speleothem studies.

Identification of Bacterial IAA Sensing Protein Through the Construction of Two-Component Hybrid Receptors

Conrad Tang
Sponsor: Johan Leveau, Ph.D.
Plant Pathology

The phyllosphere, or plant leaf surface, is a microbial habitat accommodating a diverse community of microorganisms. Many bacterial colonizers of the phyllosphere can produce, consume, and/or swim towards the plant growth hormone indole 3-acetic acid (IAA). The strain *Pseudomonas putida* 1290 can do all of these things. Lab Leveau is investigating the mechanism that *P. putida* 1290 uses to detect IAA in its environment. On the *P. putida* 1290 genome, we identified over 20 genes that code for transmembrane receptors. We hypothesize that one or more of these are involved in the recognition of IAA. Using Gibson assembly, we have been creating hybrid receptors fusing the predicted binding domains of each *P. putida* 1290 receptor to an *Escherichia coli* signaling domain which allows us to measure LacZ reporter output in response to IAA and other compounds. This approach offers an opportunity to catalog the 'sensome' of *P. putida* 1290 in general and to validate the chemoreceptors underlying IAA sensing and chemotaxis specifically.

Health Implications of Vaping with 4th Generation E-Cigarettes

Alejandro Tapia
Sponsor: Kent Pinkerton, Ph.D.
VM: Anat Physio & Cell Biology

E-cigarettes have replaced traditional cigarettes as the preferred method of nicotine uptake and have gained popularity over the last decade among teens and adolescents. As the newest e-cigarette device on the market, there is minimal available research on the lung health implications of vaping with a 4th generation e-cigarette device. To investigate this a 4th generation e-cigarette exposure system was created with a e-liquid composed of 50/50 propylene glycol/vegetable glycerin with a 2% nicotine salt using benzoic acid. 24 BALB/c mice female/male were exposed in an e-cigarette exposure chamber or housed separately as filtered aired controls for 3 hours per day, 3 days total, with a 3sec puff twice a minute. Daily aerosol and nicotine concentrations were measured. Mice were euthanized following the last day of exposure with lung tissue and bronchoalveolar lavage fluid (BAL) collected. The average aerosol concentration was 601 mg/m^3 and the average nicotine concentration was 6.3 mg/m^3 during the study. No statistical significance in inflammatory response or cell differentials were noted between controls and vaped mice. This preliminary data suggests short-term exposure to e-cigarette vapor does not result in a notable inflammatory response in the lungs. Longer-term exposure may elicit a more adverse response.

How Diverse Institutions Can Foster Feelings of Acceptance for Marginalized Communities: A Case Study with Hijabi Identifying University Students

Sara Tareen
Sponsor: Ariana Valle, Ph.D.
Sociology

For years, Muslims within the United States have faced oppression as a marginalized identity. Hijabi women, as visible representations of this community, are often at the forefront of this discrimination. In order to understand how this oppression operates on an institutional level, I am conducting an experiment on college-age Hijabi women in order to understand their day-to-day life and the ways in which they experience oppression at the structural level. I am conducting this study by interviewing nine Hijabi college-going women using an in-depth and qualitative approach. My project is currently in progress, however my findings show that although Hijabi women do feel othered within social settings, they find that diverse institutions do accept them at a larger scale than expected. These findings point to how diversity within an institutional setting fosters feelings of acceptance and safety for marginalized individuals who have otherwise been ostracized within different sectors of society.

End Effector and Computer Vision System for an Automated Mushroom Harvester

Rachel Tas
Sponsor: Ali Moghimi, Ph.D.
Biological & Ag Engineering

With consumer diets becoming more healthy, the demand for mushrooms has increased due to the excellent health benefits mushrooms provide. Despite mushrooms being a multi billion dollar industry, mushroom farmers struggle to find workers amidst the declining agriculture workforce. To combat this, robotics are being implemented across all areas of agriculture, including harvesting, but automated harvesting of mushrooms is under-explored, with current solutions often resulting in a lower quality product. Our research investigated the integration of mushroom-specific end effector and fine-tuned a computer vision model to the FarmBot, an open-source CNC (Computer Numerical Control) farming robot. After evaluating different end effectors for FarmBot integration, a pneumatic suction cup proved optimal. A vacuum system was found to minimize mushroom bruising during picking. The fine-tuning of our computer vision model involves a two-stage process which significantly improves processing time and accuracy: first, applying image segmentation technique using deep learning model, YOLOv8, to locate mushrooms in real time, followed by classification using MobileNet to determine mushroom ripeness. In conclusion, our research evaluated a cost effective robotic mushroom harvesting system that can ease the labor shortage while maintaining a similar quality of product to manual harvesting.

"Aquí Había Mejores Oportunidades": Migration Reasons and Language Use Between Mexican American Parents and Children

Nereyda Tavira-Virelas
Sponsor: Yuuko Tonkovich, Ph.D.
Education

In the US, almost half of the parents of children 0-10 are immigrants. Spanish is the top language spoken in immigrant households. Spanish language attrition is common among bilingual children. It is necessary to gain understanding of Spanish-speaking parents' language choices and children's expressive vocabulary. This mixed-methods study investigates reasons for migration among Mexican American (MA) parents, their opportunities, and language use in interactions with their children. A group of 66 MA families participated in the quantitative phase. Children (3-5 years old) completed language assessments, parents completed questionnaires. Semi-structured interviews were conducted with four parents. Results showed that MA parents migrated to the US for family reasons (34.85%), better educational/job opportunities (16.67%), or both family/better opportunities (48.48%). Children's Spanish vocabulary was positively correlated to Spanish exposure at home and frequency of parent-child storytelling and reading in English. Thematic analysis allowed us to identify three themes. Parents found more job opportunities and resources that support their well-being. They were able to provide their children with valuable educational opportunities. Despite the language and cultural challenges faced, parents learned to utilize resources, showing their resilience. This study has implications for children' heritage language maintenance and cultural identity development.

Cyborg Biochar: Modifying Biochar with Iron to Increase Adsorption Capacity

Zane Taylor
Sponsor: Sanjai Parikh, Ph.D.
Land Air & Water Resources

Biochar is a carbon-rich material produced through the thermal conversion of organic waste. It can potentially reduce greenhouse gas emissions, and when added to soil, biochar can improve the water holding capacity, decrease bulk density, buffer pH, and increase soil carbon sequestration. Additionally, biochar is a sorbent and can be used to remediate pollutants and recover excess nutrients. Biochar can be chemically modified to increase its adsorption capacity. We applied three different modifications to two types of biochars derived from woodchip and walnut shell feedstocks. Experiments were conducted to examine the sorption capacity of phosphate, ammonium, nitrate, and dissolved organic carbon (DOC). The final concentrations of each supernatant were measured, and the amount of nutrients adsorbed was determined by the difference in the final and starting concentrations. This was used to create an isotherm curve to determine the maximum binding capacity of each biochar. Our data shows that iron-modified biochars were the most effective for binding nutrients. Modified biochar could be used in composting to reduce greenhouse gas emissions, stabilize carbon, and increase nutrient retention. The nutrient-rich biochar could then be applied to crops, simultaneously reducing nutrient pollution, improving soil health, increasing crop yields, and helping to mitigate climate change.

Investigating Mechanisms of Real-World Visual Search Using Virtual Reality

Cailey Tennyson
Sponsor: Joy Geng, Ph.D.
Psychology

Human visual search involves a tradeoff between speed and accuracy. One mechanism that prioritizes speed is Inhibition of Return (IOR), in which there is a temporary decrease in the likelihood of visually revisiting a location that has been previously attended. However, most visual search studies use 2D displays despite naturalistic search occurring across three dimensions. In this study, participants explore a virtual furniture store in Virtual Reality prior to a surprise goal-directed "shopping" task where fixations and body position are recorded. We hypothesize that when a participant erroneously exits a room containing a target before finding it, the return time (the IOR) will be positively correlated with the number of objects they fixated prior to leaving the room. This would demonstrate that, similar to 2D studies, there is a bias of attention away from previously explored locations, and that the strength of IOR is related to the initial amount of information acquired. Additional measures will be used to investigate the visual information that participants use to decide whether a target is not present in an area. This research aims to extend laboratory studies of visual search to better understand the mechanisms of naturalistic search behaviors.

Establishing LovHK Two-Component System Within Mammalian Cells for Immunotherapy

Aditi Thambala
Sponsor: Sean Collins, Ph.D.
Microbiology & Molec Genetics

Cell-based immunotherapy has shown remarkable potential for improving human health through methods like CAR T-cell therapy. Currently, most approaches are based on adapting human proteins which can lead to off-target effects. Cell engineering helps address this challenge by utilizing two-component systems (TCS). TCS are a diverse family of short signaling pathways made of a sensor and response regulator that mediates downstream responses. TCS uses a histidine phosphorelay mechanism, foreign to mammalian cells, solving the crosstalk problem. TCS can also be turned on and off by the same sensor, making them easy to introduce into human cells. We are using the LOV TCS as a proof of principle because it is activated by light. The LOV TCS is composed of three components: LovHK, PhyR, and NepR. We tagged NepR with a nuclear localization signal as a strategy to measure changes in where PhyR localizes. My hypothesis is when LovHK is activated, it will phosphorylate PhyR, increasing PhyR's affinity to NepR, thus localizing with NepR in the nucleus. Based on preliminary data, PhyR moves into the nucleus dependent on the presence of LovHK; however, the system appears to be always "on". Future directions include troubleshooting the "off" behavior of the LOV TCS.

Determining CLRV Response in Walnut Hybrid Genotypes

Mia Thom
Sponsor: Patrick james Brown, Ph.D.
Plant Sciences

California walnut orchards consist of English scions grafted onto black or hybrid rootstocks. English walnut scions are tolerant of cherry leaf roll virus (CLRV) and symptomless when infected. Blackline disease occurs when scions are infected with the virus, which travels down to the hypersensitive black or hybrid rootstock. This creates a necrotic blackline at the graft interface that ultimately kills the tree and can devastate a walnut orchard. The UC Davis Walnut Improvement Program has back-crossed black and hybrid genotypes again to English walnut to obtain rootstock candidates expected to segregate for tolerance. However, the virus response, and the gene location determining virus response, are unknown. To determine genotype tolerance, tissue cultures shoots were inoculated with CLRV-positive callus expressing *Agrobacterium* oncogenes, via an invagination grafting protocol. The shoots were sampled at monthly intervals. Green leaf tissue from each shoot was used for RT-LAMP testing to determine if virus was present. A positive sample, indicates a tolerant response, while consistent virus-negative results indicate hypersensitivity. Results will determine which genotypes are field-tested as virus-tolerant rootstock candidates. Once all hybrid genotypes are inoculated and tested, their genomic sequences will be analyzed to identify the possible gene(s) responsible for the hypersensitive response.

Newborn Blood DNA Methylation Correlates With Risk of Autism Spectrum Disorder in the Grandchild and Grandparental Cigarette Smoking and Alcohol Consumption During Pregnancy

Emily Thrall
Sponsor: Janine Lasalle, Ph.D.
MED: Medical Microbiology & Imm

Autism spectrum disorders (ASD) are a group of neurodevelopmental disorders characterized by deficits in social communication and interaction, restricted interests, and repetitive behaviors. Genetic and environmental risk factors can contribute to the development of ASD. Grandparental factors associated with risk for ASD in the grandchild have been suggested, including cigarette smoking and alcohol consumption during pregnancy, though the mechanisms transmitting risk are unknown. We are investigating newborn blood DNA methylation as a biological connection between grandparental smoking and alcohol consumption and risk of ASD in the grandchild using a unique three-generation human cohort from the Child Health and Development Studies (CHDS). We isolated DNA from 196 newborn blood samples (84 children later diagnosed with ASD and 112 typically developing children), then performed whole genome bisulfite sequencing (WGBS) and co-methylation analysis using a systems biology approach called Comethyl. We identified five co-methylation modules significantly correlated with ASD diagnosis in the grandchild; all five are also correlated with grandparental alcohol consumption and four with grandparental smoking. These co-methylation modules map to genes enriched for neuronal functions and abnormal development. These results show that DNA methylation can help us identify potential biological connections between grandparental risk factors and neurodevelopmental outcomes in the grandchild.

Putative Functional Variants of *PCDH19* for Equine Juvenile Idiopathic Epilepsy in Arabian Horses

Haoying Tian
Sponsor: Carrie Finno, D.V.M.,Ph.D.
VM: Population Hlth & Reprod

Equine Juvenile Idiopathic Epilepsy (JIE) is a heritable form of self-limiting epilepsy characterized by recurrent, tonic-clonic seizures in Egyptian Arabian horses. The goal of the study is to determine if previously identified putative functional variants in the gene *PCDH19* are significantly associated with equine JIE in a validation population of affected Arabian horses. Comprehensive genetic investigations have been conducted using Arabian horses that were definitely diagnosed with JIE, and 34 out of the 39 genetic variants that were identified in candidate genes for equine JIE were located within *PCDH19*. For this validation study, 15 horses were used for genotyping 8 single nucleotide polymorphisms (SNPs) within *PCDH19*. PCR and gel electrophoresis were used for primer optimization and DNA amplification, then SEQUENCHER was used for analyzing Sanger sequencing results. Through allelic-based Fisher's exact tests, we identified that none of these SNPs within *PCDH19* are significantly associated with the JIE phenotype in this validation cohort of horses. Thus, the gene *PCDH19* can be excluded as a candidate gene for JIE in Arabian horses.

A Computational Model Predicts Sex-specific Responses to Calcium Channel Blockers in Mammalian Mesenteric Vascular Smooth Muscle

Mindy Tieu
Sponsor: Colleen Clancy, Ph.D.
MED: Pharmacology

The function of smooth muscle cells in mammalian systemic arteries and arterioles is pivotal for regulating vessel diameter, thereby controlling blood flow and pressure. We introduce the 'Hernandez–Hernandez model', an in-silico framework for simulating electrical and Ca^{2+} signaling in arterial myocytes, incorporating new experimental findings that unveil sex-specific differences in murine resistance arteries. This model sheds light on the ionic mechanisms dictating membrane potential and intracellular Ca^{2+} signaling, essential for the establishment of myogenic tone in arterial vessels. It reveals that $KV_{1.5}$ channels predominantly influence male myocyte membrane potentials, while $KV_{2.1}$ channels play a crucial role in female myocytes, leading to significant sex-specific differences in cellular excitability and Ca^{2+} dynamics. Additionally, the model indicates a greater sensitivity of female arterial smooth muscle to Ca^{2+} channel blockers. Enhancing this foundational model, we aim to include pharmaco-mechanical interactions, focusing on signaling pathways such as Angiotensin II effects, purinergic signaling, alpha-adrenergic stimulation, and the influence of mechanical pressure on ion channels (TRPM4, TRPC6, TRPV4). This expansion seeks to offer a deeper understanding of vascular smooth muscle responses under pharmacological influences, aiding in the development of targeted antihypertensive therapies.

An Epidemiological Review of the Prevalence and Risk Factors for Canine Oral Neoplasms at a Veterinary Medical Teaching Hospital

Yash Tipirneni
Sponsor: Stephanie Goldschmidt, D.V.M.
VM: Surg/Rad Science

Oral neoplasia has a high tendency to metastasize and is severely detrimental to a patient's quality of life. However, early detection and intervention can result in long-term remission and may prevent the need for high-morbidity treatments. By employing an epidemiological approach, clinicians can be made aware of which patients are at a higher risk for developing these tumors. Although there has been extensive analytical work on human oral cancer, research in veterinary medicine has been lacking. The aim of this study is to identify risk factors for canine oral neoplasia. Patient data from the UC Davis Veterinary Hospital from 1993-2023 was bulk extracted with an artificial intelligence software to assess age, sex, breed, tumor type, periodontal disease stage, and home air quality. The periodontal disease stages and tumor type were evaluated by a board-certified veterinary dentist and pathologist, respectively, through the review of imaging and biopsies. The air quality index data was extrapolated from owners' addresses and the Environmental Protection Agency's database. Overall, there was a significant correlation between oral cancer and certain breeds, periodontal disease, and poor home air quality. These findings can aid general practice veterinarians in screening high-risk dogs and developing preventive strategies for oral cancer.

Quantification of Connexin36 Between Delta-Beta Cells Communication Through Gap Junction Coupling

Ramir Tirado
Sponsor: Mark Huising, Ph.D.
Neuro Physio & Behavior

Diabetes Mellitus is a lifelong condition that affects a large population worldwide causing inflammation and dysregulation of the pancreatic beta cells. Beta cells act in concert with alpha and delta cells, forming the Islet of Langerhans. Gap junctions between beta cells, synchronize insulin secretion on a larger scale increasing glucose reuptake and lowering blood glucose. Connexin36 is the dominant Isoform composing gap junctions in the islet; ions and hormones can pass through these to depolarize neighboring cells. Somatostatin secreted by delta cells plays a critical role in inhibiting beta cells to modulate insulin secretion. Delta-beta cell communication is up for debate. We would like to validate the abundance or absence of connexin36 between these two cell types. Here, the lab uses mTmG mice to label the cell membrane. In addition, Cryosectioning and immunohistochemistry allow us to observe the surface of delta cells in relation to neighboring beta cells. After further image analysis, we expect only a small population will display Connexin36 coupling between delta and beta cells proximal to one another. Thus, Paracrine signaling is used for delta-beta cell communication. Investigating the relationship between these two cell types can improve and assist in developing therapeutics targeting beta cell function.

Identification of Novel Marker for Differentiation-Committed Oligodendrocyte Precursor Cells

Annlin Titus
Sponsor: Fuzheng Guo, Ph.D.
MED: Neurology

Oligodendrocyte precursor cells (OPCs) play a crucial role in central nervous system development and function by giving rise to mature oligodendrocytes, which are essential for myelination. Differentiation committed OPCs (COPs) are intermediates between proliferating OPCs and newly formed oligodendrocytes (NFOLs) and play an important role in myelin repair. In this project, we aim to characterize Inositol 1,4,5-trisphosphate receptor, type 2 (ITPR2) for oligodendrocyte lineage cells, thus facilitating neuroscience research for cell population identification. Previous single-cell RNA-sequencing data indicates that ITPR2 is upregulated in both COPs and NFOLs. Markers currently used for identifying COPs and NFOLs rely on scRNA-sequencing, in addition to immunohistochemistry. ITPR2 would be a more efficient marker as it relies solely on immunohistochemistry methods to effectively label oligodendrocyte lineage cells. We will use different oligodendrocyte developmental stage-specific markers to show which cell subpopulation is enriched with ITPR2. This will refine our understanding of oligodendrocyte and myelin biology and can be applied to future research related to myelin-related disorders.

Testing and Validation of Attitude Determination and Control System Software for Low Cost Satellite Control Methods

Jacob Tkeio
Sponsor: Rich Whittle, Ph.D.
Mechanical & Aerospace Engr

We present the software testing and validation process for the Attitude Determination and Control Systems (ADCS) on REALOP, UC Davis' first undergraduate-led CubeSat mission. ADCS will orient the satellite in space using computer hard disk drives (HDDs), demonstrating their feasibility as a low-cost CubeSat control method. While in orbit, ADCS is susceptible to sensor malfunctions, software bugs, ground station communications issues, and control hardware malfunctions. We describe the various methods we use to mitigate these failures, both by preventing them before the mission and by planning responses to different failures in orbit. Prevention involves using ground tests to catch bugs in the software and simulating experiments to ensure we collect enough data to verify results and detect failures. We plan our responses to failures based on the minimum set of sensors and systems required to perform each experiment. By ensuring software reliability, we increase the likelihood of mission success for REALOP by proving the viability of HDDs as reaction wheels, thereby lowering the cost of entry to space for organizations around the world.

Neprilysin Knockout Mice as a Mouse Model for Dry Age-Related Macular Degeneration

Nicole Tng
Sponsor: Glenn Yiu, M.D.,Ph.D.
MED: Eye Center

Age-related macular degeneration (AMD) is the leading cause of vision loss in older patients, characterized by subretinal deposits called drusen. Amyloid beta (Aβ) has been found to be a component of drusen that is associated with AMD. Mutant mice lacking neprilysin (Nep) – an important Aβ degrading protein – exhibit increased accumulation of Aβ and may exhibit drusen-like phenotype with age, a potential mouse model of dry AMD. Here, we characterize *Nep* knockout mutant mice at multiple timepoints for up to 2 years, using multimodal imaging techniques including optical coherence tomography (OCT), fundus photography, and electroretinography (ERG) *in vivo*, and structural characterization using histology, immunohistochemistry (IHC), and electron microscopy. We also performed IHC with antibodies against Aβ and neprilysin on paraffin and cryo-sections. A subset of mutants received a high-fat diet, known to accelerate AMD-like pathology in other mice models. PCR and Sanger sequencing confirmed *Nep* knockout at Exons 5-7 in mutant mice. No differences were observed with OCT, fundus, or ERG between wildtype, mutants, and the high-fat diet subgroup at all time points. Similar results were shown with H&E staining and IHC. Our findings suggested that *Nep* knockout alone may not be enough to cause drusen or AMD-like features.

Beef Fat Naturally Enriched in Trans-Vaccenic Acid and Rumenic Acid PreventsHyperinsulinemia in High-fat fed Mice

Abigail Tolentino
Sponsor: Payam Vahmani, Ph.D.
Animal Science

Trans-vaccenic acid (TVA) and rumenic acid (RA) are naturally occurring trans-fats associated with reducing type 2 diabetes risk. This study's objective was to determine the effects of biofortified beef fat on glucose homeostasis in diet induced obese (DIO) mice. TVA+RA enriched tallow was sourced from steers fed 75% hay and 25% flaxseed-based concentrate. Control tallow originated from steers fed a grain-based diet. 48 male C57BL/6J mice were fed either a low-fat diet (LFD; 10% kcal fat) containing control tallow (LFD-C), LFD containing TVA+RA enriched tallow (LFD-E), high-fat diet (HFD; 45% kcal fat) containing control tallow (HFD-C), or a HFD with enriched tallow (HFD-E) for 12 weeks. Fed and fasted blood glucose and insulin levels were measured on week 10. Both HFDs increased body weight compared to LFD. However, weekly body weight gain was similar within LFD and HFD. HFD-C showed increased fed and fasted blood glucose, fasted insulin, and HOMA-IR compared to LFD; conversely, HFD-E had no significant effect compared to LFDs. Notably, HFD-E had significantly lower fasted plasma insulin and HOMA-IR compared to HFD-C. Our findings suggest that consuming beef fat naturally enriched in TVA and RA prevents hyperinsulinemia and insulin resistance in DIO mice.

Charging Meter: Leveraging Combinational Triggers for Trojan Attacks on Multi-turn Dialogue LLMs

Terry Tong
Sponsor: Muhao Chen, Ph.D.
Engr Computer Science

As Large Language Models (LLM) like ChatGPT become more prevalent, it is important to consider their security implications. In 2016, Microsoft's chatbot Tay was released for 16 hours before being taken down due to inflammatory and offensive tweets the bot began outputting. According to Microsoft, Tay was trained on its interactions with people, some of which Microsoft deemed as "trolls" who taught the bot malign responses by inputting poisoned / malign data. My research focuses on these types of data poisoning attacks. Because training a powerful model like ChatGPT requires a lot of computation resources, most companies who train LLMs make use of transfer learning-borrowing a pretrained model and fine-tuning it to meet their needs. This gives room for data poisoning in the fine-tuning stages. There has been much research on backdoor attacks in vision and single turn dialogue LLMs, but not multiturn dialogue LLMs like ChatGPT that are becoming more and more prevalent. My research implements a novel combinational prompt injection attack on multi-turn dialogue systems.

Investigating the Effects of Thermal Stress Between Subtidal and Intertidal Pacific Purple Sea Urchins

Isabella Torres
Sponsor: Rachael Bay, Ph.D.
Evolution & Ecology

Species living in intertidal habitats may be more resistant to environmental changes compared to their subtidal counterparts due to the differences in air exposure and temperature shifts experienced in the intertidal but not the subtidal. We address this through two experiments in which we investigate differences in behavioral, physiological, and morphological responses to thermal stress between intertidal and subtidal Pacific purple sea urchins. We looked at "righting behavior" (how quickly an organism can flip over after being flipped upside-down) and physiological responses to incremental increases in temperature to assess if, due to their historical exposure to temperature fluctuations, intertidal urchins are less impacted by thermal stress than subtidal urchins. We also collected morphological data from all of our urchins, and we expect larger subtidal than intertidal urchins as more energy is available in subtidal urchins to allocate to growth than for substrate attachment or varying temperature adaptations. Significant differences in thermal tolerance found between the two populations may help manage urchin populations in the face of climate change, as anthropogenic influences may impact subtidal and intertidal organisms unequally.

Morphometric Analysis of Pre-Contact Dogs in Alta and Baja California

Lillian Torres
Sponsor: Teresa Steele, Ph.D.
Anthropology

Prior to European contact, dogs played diverse subsistence and ritual roles in Native Californian cultures. After contact, dogs throughout the Americas, except for the Artic, experienced substantial genetic replacement by European dogs. The limited relevance of modern dogs to understanding pre-contact dog biology and behavior creates a significant gap in scientific knowledge about the global diversity of dogs. Knowledge of this diversity is especially lacking in California, making it particularly difficult to reconstruct the complex prehistory of Native dogs from the archaeological record. This project provides new methods to distinguish pre-contact Californian dogs from other canid species. We use traditional morphometrics to measure and differentiate the mandibles of domesticated dogs from that of wolves, foxes, and coyotes. Samples are sourced from museums or comparative collections within California. We compare our findings with published archaeological data, conducting statistical analyses to identify potential variations in morphology and size among species as well as trends over time.

Developing a Reliable Assay for Testing Armillaria mellea Susceptibility of Walnut Rootstock Candidates

Destiny Toska
Sponsor: Patrick james Brown, Ph.D.
Plant Sciences

Paradox rootstocks (black walnut x English walnut hybrids) are the primary rootstocks in California walnut orchards and are susceptible to *Armillaria mellea* root rot. Field trials to identify resistance in new rootstock candidates take years to complete and greenhouse testing has been unreliable. The goals of this project are: 1) to develop a method for inoculating and screening rootstock candidates using tissue cultured shoots, and 2) to identify walnut genotypes with potential field resistance. We are working with three genotypes that showed varying responses in previous work: RX1 (Texas Black walnut x English), AX1 (Southern California Black x English) and Chinese wingnut, (a closely related genus). Tissue cultured shoots are rooted in sterile peat substrate. Homogenized liquid cultures of *A. mellea* are prepared and used to inoculate small walnut sticks in vitro. These are cultured until rhizomorph development and inserted next to rooted shoots which are then observed for *A. mellea* growth. We are also developing a method to determine if shoots have been successfully infected internally, in order to identify which genotypes may be resistant or susceptible. Results of this work will help breeders identify resistant rootstock candidates that can be used in orchards to reduce tree losses.

Optimization of Heterologous *Solanum nigrum* Protein Expression in *E. coli*

Ethan Tran
Sponsor: Yann-ru Lou, Ph.D.
Plant Biology

Solanum nigrum, also known as the Black Nightshade, is an agricultural weed that disrupts the growth of many crops. Despite this, they produce inositol-based acylsugars as plant defense metabolites. These metabolites are often made in much lesser quantities in their cultivated relatives, such as tomatoes, eggplants, and potatoes; therefore, *S. nigrum* metabolites provide a good target for molecular engineering, breeding, and enhancing the survival of other plant species. While investigating the biosynthetic pathway of acylinositols in *S. nigrum*, we suspected that the initial enzyme negatively affects bacteria, thus hindering the protein purification process. In this work, I tested how different growth conditions affect the protein expression of an acylinositol acyltransferase candidate in *S. nigrum*. After determining that a 0.1% glucose culture yielded a significantly shorter lag phase on the growth curve, I further optimized protein expression by varying the optical density of the culture as well as the concentration of IPTG used to induce protein expression. The long-term goal of this project seeks to identify and engineer biochemical pathways for potent acylsugars, ultimately leading to efficient and sustainable crop production.

Evaluation of Chemoselectivity and Regioselectivity in the Hydrosilylation of Alkenoate Substrates

Wendy Tran
Sponsor: Annaliese Franz, Ph.D.
Chemistry

The synthesis of organosilicon molecules offers advantages in different medicinal applications as they can contribute to enhanced potency and increased pharmacological attributes. Hydrosilylation, the addition of Si-H bonds to unsaturated bonds, offers advantages of accessibility to these novel hydrosilane structures. This research project aims to compare combinations of alkene and silane substates, catalysts, and temperature on the selectivity of hydrosilylation products. Identifying optimal conditions for hydrosilylation of specific pairs of alkene and silane substrates in this project allows for the synthesis of specific organosilicon products that are relevant as precursors for the field of medicinal chemistry. We hypothesize that the alkene and silane substrates will have an effect on the regioselectivity of the hydrosilylation product. To test this hypothesis, we will synthesize two alkenoate substrates and screen them against four silane substrates and ten different catalysts at room temperature and seventy degrees celsius. To analyze the reaction, we will use NMR yields to determine the ratio of linear, branched, and dehydrogenative hydrosilylation products. Current work is focused on synthesis of the alkenoate substrate. Future work includes further screening of the various catalyst and silane substates against the alkenoate substrate.

ROS Go Boom: Absence of a Negative Regulator Creates Resistance Against Tomato Pathogens

Megann Tran
Sponsor: Gitta Coaker, Ph.D.
Plant Pathology

Tomatoes, *Solanum lycopersicum*, are a staple crop produced globally that amount to billions in economic value. Due to widespread cultivation of tomatoes, there are diverse disease-causing pathogens that cause millions of losses in revenue for tomatoes each year. Plants evolved immune responses such as the production of Reactive Oxygen Species (ROS) as a defense mechanism with the potential to deter pathogenic infection. One enzyme important for ROS production in tomatoes is RBOHB. The protein PIRE regulates the accumulation of RBOHB through ubiquitination and degradation. Using gene editing, *PIRE* was knocked out in the M82 tomato variety. The *pire* mutant exhibited increased ROS production compared to the wild type M82 tomato variety. To further test the hypothesis that tomatoes overproducing ROS have enhanced pathogen resistance, we inoculated our genome edited tomatoes with bacterial pathogens *Pseudomonas syringae* pv. tomato *DC3000* and *Xanthomonas campestris* pv. vesicatoria. The bacterial infection assays showed significantly increased resistance in the mutant tomatoes. Further assays were conducted using a fungal pathogen *Fusarium oxyspororum f. Sp. Lycopersici* which will also be presented here. This research provides evidence of increased disease resistance in tomato in the absence of *PIRE,* which has promise for developing genetic approaches for pathogen control.

Aberrant Mitochondrial Morphology in Age-Related Macular Degeneration

Huy-An Tran
Sponsor: Cecilia Giulivi, Ph.D.
VM: Molecular Bio Sciences

Age-Related Macular Degeneration (AMD) is a retinal disease that leads to central vision loss. The disease manifests as an accumulation of lipid and proteins plaque in the form of extracellular lipid deposition known as drusen or intracellular lipid accumulation presenting as punctate lesions, culminating in macular degeneration. Primates are the only mammals to possess maculae essential for sharp central vision, making them crucial models for AMD research. The macula, rich in mitochondria, is susceptible to environmental influences (such as sunlight exposure and dietary habits) and genetic factors that may contribute to mitochondrial damage, influencing the onset and progression of degeneration. To investigate, we analyzed mitochondrial morphology in retinal pigment epithelial cells of healthy rhesus macaques versus those with drusen or punctate lesions. Our findings revealed disrupted mitochondrial morphology in AMD samples, particularly those with drusen or punctuated deposits, exhibiting blunted fusion, a more circular shape, and diminished content compared to normal animals. These observations shed light on the potential role of mitochondrial dysfunction in AMD. Understanding this mechanism could guide the development of future treatments and preventive strategies targeting mitochondrial aspects of AMD.

The Importance of Social Novelty, Age, Consecutive Testing Days in a Social Dyad Testing Paradigm

Trish Tran
Sponsor: Melissa Bauman, Ph.D.
MED: Dean's Office

Alterations in species-typical social behavior is a common outcome measurement in rodent models of neurodevelopmental disorders. Rats are highly social animals that engage in reciprocal social interactions throughout development. Here we explore how previous experience between rat social partners may influence social interactions. To do this, researchers carried out a social dyad test, during which a pair of experimental rats were placed into an arena and their interactions were recorded for ten minutes. Social behaviors were then scored and categorized into self-grooming, social investigation, play, and nonsocial investigation behaviors. We compared social interactions between pairs of familiar (N=24) versus novel (N=16) partners. The rats were also tested over two consecutive days; consequently, we will examine the differences within the same treatment groups between different testing days. Lastly, we will compare a subset of animals (N=16) that were tested at two different postnatal days (PND) (PND36 and 103 +/-1 day). We expect to find differences in the levels of behaviors, particularly play behaviors, dependent on the conditions the animals were tested under. Results will help ensure that variations in testing protocol do not influence the accuracy of preclinical animal models in researching human neurodevelopmental disorders.

The Effects of Ergotheionine on Naphthalene in Proximal and Distal Airways of Male Juvenile Mice

Brandon Tran
Sponsor: Laura Van Winkle, Ph.D.
VM: Anat Physio & Cell Biology

Wildfires in the western United States released large amounts of naphthalene (NA) into the environment. NA is detrimental to human respiratory health, especially in children because NA injures Club cells in lung epithelium. The damage varies in the airway tree, so proximal and distal airways are being compared. Anti-oxidant Ergothioneine (ET), found in mushrooms, is hypothesized to combat NA's harmful effects. The goal of this experiment aims to see if pretreatment with ET reduces NA damage to the tissue in male juvenile mice. Mice were treated with either 70 mg/kg of ET or SA (saline) by gavage for 5 consecutive days, followed by one 150 mg/kg ip dose of NA or corn oil (CO). This resulted in four treatment groups: SA/CO, SA/NA, ET/CO, and ET/NA. Pulmonary tissue was embedded in araldite, sectioned, and stained with methylene blue. Unbiased stereology was utilized to ensure complete randomness while gathering data and to compare the amount of cellular damage from NA exposure. Preliminary results indicate ET is effective in protecting proximal airway cells against NA. Therefore, consuming ET may mitigate naphthalene-induced toxicity, which is beneficial for juveniles with developing lungs that are sensitive to NA toxicity.

The Health Highlight Student-Run Podcast: Identifying Inequities in Modern Healthcare Systems

Andrew Tran
Sponsor: Talitha van derMeulen, Ph.D.
Neuro Physio & Behavior

Insufficient or inaccessible healthcare is a prevalent issue for many underrepresented groups in the United States. *The Health Highlight* student-run podcast aims to educate pre-health students about the needs of the populations they will provide for in the future, in order to pre-emptively help eliminate barriers to good healthcare many disadvantaged groups face. Examples of underrepresented communities that will be covered include rural communities, ethnic minorities, and the LGBTQIA+ population. Co-hosted podcast episodes will feature providers from multiple professions (medicine, dentistry, pharmacy, etc.) speaking about their experience with inequity in healthcare. Providers will also be asked what they believe are potential solutions to many of the systemic issues in their fields. Research will be conducted to enrich the podcast findings, and the additional information will be listed for listeners to delve further into each discussed topic. Podcast episodes will be published on the Spotify audio platform, with supplemental information and citations posted in each episode's notes. University pre-health students are the target audience for the podcast, and social media and advertising materials will be created to raise awareness. Drawing attention to the issues addressed on the podcast is the key to better health outcomes for underrepresented groups.

Characterizing novel peptide *NHIP* in relation to oxidative stress and gene expression

Taylor Tran
Sponsor: Janine Lasalle, Ph.D.
MED: Medical Microbiology & Imm

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by repetitive behaviors, restricted interests, and social communication impairments. It is caused by a combination of genetic and environmental factors. The LaSalle lab recently discovered a novel gene, *NHIP* (neuronal hypoxia-inducible, placenta), encoding a long non-coding RNA and a NHIP micropeptide expressed at lower levels in ASD brains compared to neurotypical brains. *NHIP* may have evolved recently in the primate lineage with the expansion of brain size and neuronal activity. Immunofluorescent studies show that NHIP localizes to the nucleus and *NHIP* overexpression leads to genome-wide changes to transcription, suggesting a role in gene regulation. We hypothesize that NHIP acts as a protective factor that blocks protein-protein interactions to counter oxidative stress from primate brain development. To test this hypothesis, we used the HEK293T cell line and wild-type undifferentiated LUHMES which express low levels of endogenous *NHIP*, and treated both cell lines with exogenous NHIP peptide. We then measured changes in reactive oxygen levels. We further measured the changes in oxidative stress genes in response to NHIP in HEK293T cells. Fully characterizing *NHIP* function and its role in protecting against oxidative stress may contribute to potential treatments for neurodevelopmental disorders including ASD.

Alpha-Synuclein Expression Compromises Energy Metabolism at the Nucleus-Vacuole Junction Under Acute and Gradual Glucose Exhaustion

Julie Tran
Sponsor: Kenneth Kaplan, Ph.D.
Ag Molecular & Cellular Bio

There has been a long established connection between neurodegenerative disease and defects in energy metabolism. In Parkinson's disease (PD), evidence suggests that the elevation of alpha-synuclein results in endoplasmic reticulum (ER) stress. In the Kaplan lab, we have used yeast as a model system for studying the cellular impacts of alpha-synuclein expression at the nucleus-vacuole junction (NVJ). The NVJ is the site of lipophagy, an autophagy pathway that targets lipid droplets for degradation in the vacuole. We hypothesize that alpha-synuclein will alter the ability of cells to carry out lipophagy, thus compromising energy metabolism. To test this, we will use two conditions of glucose exhaustion: (i) gradual glucose exhaustion where cells are unable to induce lipophagy and (ii) acute glucose exhaustion where lipophagy becomes activated. We predict that the NVJ protein, Nvj1, will become enriched during acute but not gradual glucose exhaustion. We further predict that overexpression of alpha-synuclein will affect the enrichment of Nvj1-mCh fusion, ultimately preventing efficient lipophagy. We will test this by creating a fusion between Erg6 and GFP to monitor its trafficking into the vacuole, an event that occurs during lipophagy. We anticipate that these events will shed light on energy metabolism defects in neurodegenerative disease.

Analysis of Pistachio Fruit and Kernel Width in Relation to Endocarp Dehiscence

Phuong Tran
Sponsor: Georgia Drakakaki, Ph.D.
Plant Sciences

Pistachio is an important agricultural crop in California for its nutritional value and drought and salinity tolerance. The pistachio fruit consists of a hull (exo-mesocarp), shell (endocarp), and kernel (seed). An ideal fruit will have a split shell (endocarp dehiscence) for ease of consumption and an intact hull for protection against pests and pathogens. Notably, higher split rate is one of the USDA requirements for higher grade pistachios. Previous studies reveal a strong association between kernel width and endocarp dehiscence. Within two commercial cultivars, Golden Hills, which has a wider kernel width, exhibits higher rates of endocarp dehiscence than Kerman. The data suggests that shell split is initiated by an increase in kernel width when the fruit width remains unchanged. We studied the fruit and kernel size dimensions of three commercial cultivars with different split rates (Golden Hill, Lost Hill, and Kerman) and germplasm collection from Wolfskill Experimental Orchard (USDA). Contrary to our hypothesis, Golden Hills (high shell split) increased both in kernel width and fruit width. Lost Hills and Kerman with (lower split rate) had an increase in kernel width while fruit width remained unchanged. Future work from Wolfskill Experimental Orchard will be used to confirm our hypothesis.

Association between Extracurricular Activities and Depressive Symptoms Among College Students: Moderated by Number of Friends

Chloe Tran
Sponsor: Adrienne Nishina, Ph.D.
Human Ecology

Research suggests that participating in extracurricular activities (e.g., organized sports, clubs) is linked to fewer depressive symptoms in college students. Individuals who spend more time socializing in extracurriculars may have more opportunities to make friends and lower depressive symptoms compared to those who do not socialize in extracurriculars. We hypothesized that (1) more hours in extracurricular activities lowers depressive symptoms and (2) having more friends would strengthen this association. Data were drawn from US college students (N = 418; 54% Female, 45% Male, 1% Other; 32% White/Caucasian, 23% Mexican American/Latino(a)/Hispanic, 24% Asian/Asian American, 17% Multiethnic, 3% African American/Black, 1% Native American/Alaskan Native), who reported hours spent in extracurriculars, number of friends, and depressive symptoms. Increased extracurricular hours were not related to fewer depressive symptoms (β = -.053, *SE* = .006, p = .54). Although more friends were directly related to fewer depressive symptoms (β = -3.21, *SE* = .008, $p < .001$), number of friends did not moderate the association between extracurricular hours and depressive symptoms (β = -.132, *SE* = .001, p = .13). College administrators should consider more social events where students can connect with peers. In future research, other factors, such as social anxiety, could be explored.

Acute DFP Intoxication Causes SRS and Altered Hippocampal Theta Oscillations in Juvenile Rats

Izzy Triana
Sponsor: Gene Gurkoff, Ph.D.
MED: Neurological Surgery

Acute intoxication with organophosphates, a nerve agent, can cause status epilepticus and spontaneous recurrent seizures (SRS). Theta oscillations, measured via local field potentials (LFP), are implicated in SRS. Children are more susceptible to organophosphate acute intoxication, but there are no long-term data. We hypothesize that acute intoxication with diisopropylfluorophosphate (DFP), a model organophosphate, will result in chronic reductions in hippocampal theta oscillations and SRS in juvenile rats.??On post-natal-day (PND) 23, Sprague Dawley rats were surgically implanted with a depth electrode in the hippocampus to record LFP. On PND 28, animals were injected with 3.75 mg/kg DFP, 0.1 mg/kg atropine-sulfate, and 25 mg/kg pralidoxime. Over 21 days, theta power was evaluated pre and post-intoxication on days 1,3, 7,14, and 21. SRS were quantified across the entire period. 44% of the animals developed SRS in 5.3 ± 0.7 days on average. The recorded seizures significantly decreased comparing days 16-21 with days 4-9 following DFP ($p<0.05$). Seizures were significantly longer on days 11-21 compared with days 1-10 ($p<0.001$). A significant reduction in theta frequency (6-10 Hz) power was observed on day 1 ($p<0.05$). The neurotoxic effects of DFP in a juvenile model highlight the need for additional studies to better understand chronic complications.

Sensitivity of Bacterial Strains to Variants of Nisin, an Antimicrobial Peptide With Therapuetic Potential

Quynh Trosien
Sponsor: Maria Marco, Ph.D.
Food Science & Technology

Microbiome-targeted therapies are emerging opportunities to treat and mitigate disease. One notable option is using antimicrobial peptides, known as bacteriocins, that selectively target human pathogens. Nisin is a bacteriocin made by the food-grade microbe *Lactococcus lactis* that targets lipid II in sensitive bacteria. Recent studies showed that nisin may be useful to treat oral cancer. Before applying nisin as a therapeutic, it is important to understand the extent to which bacteria are sensitive to the bacteriocin. Therefore, I investigated two strains of *L. lactis,* MG1363 and IL1403, for their capacity to grow in the presence of nisin A and nisin Z, variants of nisin with one amino acid difference (H and N at position 27). I found that nisin Z is ~20 times more inhibitory than nisin A (0.29 µM nisin Z was needed to prevent growth compared to 5.96 µM nisin A). Comparisons between MG1363 and IL1403 showed that *L. lactis* MG1363 was more sensitive to both nisin A and nisin Z compared to *L. lactis* IL1403. These findings are important for testing the assays with different oral pathogens, investigating nisin resistance mechanisms, and applying nisin to improve the oral microbiome.

Exploring Parental Stress Through the Lens of Acculturation: Family Social Support as Moderator

Kimberly Truong
Sponsor: Leah Hibel, Ph.D.
Human Ecology

Ethnic minority individuals living within the United States are influenced by both the dominant US culture and their own heritage culture, a process called acculturation. Many of these individuals struggle to reconcile the dominant US culture and their native culture which can cause stress in other areas of life, including parenting. However, emotional support from family members can buffer the effects of acculturation on parental stress. This research examines the impact of acculturation on parental stress, focusing on how family support among Mexican-American parents can be a moderating factor. Data are drawn from a longitudinal study of the development of self-regulation in roughly 200 young Mexican American children. As part of the study, mothers completed a battery of questionnaires, including the Acculturation Rating Scale for Mexican Americans, the Parenting Stress Index, and the Post-Partum Social Support Scale. We hypothesize that mainstream or native Mexican orientation will be associated with parental stress. Further, familial social support will have a buffering effect.

Impacts of ABC Transporter Expression on Okadaic Acid Bioaccumulation in Mytilus Seafood Species

Tina Truong
Sponsor: Sascha Nicklisch, Ph.D.
Environmental Toxicology

Sessile, filter-feeding organisms, like marine mussels, are chronically exposed to toxic marine compounds that potentially bioaccumulate. Okadaic acid (OA) is a potent biotoxin produced by dinoflagellates, one of the major algal species forming harmful algal blooms in California coastal waters. When OA bioaccumulates in edible mussels, such as Mytilus, it causes diarrhetic shellfish poisoning in humans. Mussels possess cellular defense proteins, including ABC-type multixenobiotic-resistance (MXR) efflux transporters, which immediately recognize and eliminate xenobiotics before accumulation and prevent harm in organisms. Recent studies suggest ABCB1 (i.e., P-glycoprotein) is involved in OA elimination in shellfish. However, life-stage dependent patterns of these transporters in edible mussels and their impact on effective biotoxin elimination remain elusive. My project will test three key MXR transporters, ABCB1, ABCC1, and ABCG2, for their relative contribution to OA detoxification in two commonly foraged mussels: The Blue Mussel (*Mytilus edulis*) and the California mussel (*Mytilus californianus*). Mussels will undergo five-day uptake and fifteen-day depuration periods of OA. The relative expression of transporter genes and OA concentrations in mussel gills and digestive glands will be evaluated using qPCR and LCMS/MS. I aim to exemplify OA elimination mechanisms, facilitating safe foraging practices post-algal blooms and recommending more resilient mussel species.

Developing the Hno Two-Component System to Make Novel Tools for Immunotherapy

Sabrina Truong
Sponsor: Sean Collins, Ph.D.
Microbiology & Molec Genetics

The development of cell-based immunotherapies has rapidly evolved in the past few decades and has shown remarkable potential for advancements in human health. However, these new approaches are based on engineering mammalian proteins, which can lead to crosstalk with endogenous signaling networks and off-target effects. These challenges can be avoided by developing two-component systems (TCS) as tools. This diverse family of short signaling pathways consist of a histidine kinase sensor and a response regulator that mediates a downstream response such as transcription and avoids crosstalk by using a histidine phosphorylation mechanism not found in humans. Therefore, I am using molecular cloning tools to establish TCS in mammalian cells. Specifically, I am using the Hno TCS responsive to nitric oxide (NO), a signaling molecule used in humans to flag sites of inflammation. The Hno TCS is composed of a two-part sensor HnoX and HnoK, and a response regulator HnoC. Preliminary data shows HnoC alone activates transcription in human cells. I hypothesize in the absence of the HnoX regulator, HnoK will be constitutively active and continuously phosphorylates HnoC, thus repressing transcription. Future directions include constructing a FRET biosensor for NO based on HnoC that can be used to measure immune cell responsiveness.

Development of a Quality Control Method for Isolation of Extracellular Vesicle for Early Diagnostic Applications

Anastasia Trushchankova
Sponsor: Randy Carney, Ph.D.
Biomedical Engineering

Extracellular vesicles (EVs) are heterogenous nanoparticles secreted by all cells, with great potential as liquid biopsy biomarkers for diagnosis and monitoring of cancer. However, there are challenges in isolating EVs. One common method of isolating EVs from contaminating protein in patient biofluids is size exclusion chromatography (SEC), which can be automated to quickly obtain EVs for downstream assays searching for early-signs of cancer. Currently SEC lacks a quality control (QC) method necessary for application in complex clinical environments. My project is to develop a simple QC method for SEC to ensure EVs are eluting as expected from SEC column by tracking fluorescent microsphere beads spiked into the EV solution. I have verified this approach by confirming that candidate microbeads in a bovine serum albumin solution (simulating proteins present in biospecimens) elute in EV fractions during SEC isolation. I next developed and applied a preliminary version of this QC assay to assess variability of isolation across an automated SEC procedure. Initial results do show high variance in bead elution across columns, further motivating the need for the proposed QC system. Next steps are to spike-in beads to already-isolated EVs and then real patient biofluids towards a viable assay.

Vowel Coarticulation and Expansion Across Styles: Comparing Adults Varying in Age

Alexander Tse
Sponsor: Georgia Zellou, Ph.D.
Linguistics

This study investigates how adults of different age groups adapt their speech in response to varying communicative contexts. Previous research indicates that speakers modify their speech to enhance intelligibility, employing strategies such as reducing coarticulation (or segmental overlap of speech sounds) and expanding vowel space (making their vowels more distinct). 129 participants, ranging from 18 to 60 years, engaged in an experiment online. Stimuli consisted of 18 target words, produced in the frame "I say [target word] again". They produced target sentences in three style conditions with two repetitions each: clear (produced for individuals with hearing challenges), casual (produced for close friends/family), and fast (produced as if an auctioneer). The sentences were transcribed in Praat, the vowels were segmented with the Montreal Forced Aligner then hand-corrected. Next, we took vowel measurements with FastTrack and Praat scripts. We predict there will be age-related variation in the patterns of vowel expansion and coarticulation across different communicative styles. This research contributes to our understanding of the dynamic interplay between age, communication styles, and speech production strategies.

Assessing Olive Maturity and Ripening in Orchards Under Different Irrigation Regimes

Muyun Tsen
Sponsor: Barbara Blanco-Ulate, Ph.D.
Plant Sciences

Authors include: Muyun Tsen, Paula Guzman-Delgado, Emily Santos, Valeria Imperiale, Taylor Synstelien, Jullia Souza, Amrit Pokhrel, Giulia Marino, Bárbara Blanco-Ulate. In 2021, California accounted for all of the U.S. production of olives, and acreage is expanding. Amid climate change and droughts, optimizing water use during drought-resistant stages of olive maturation is crucial. However, more information is needed on how different irrigation practices impact olive quality at harvest. Thus, this research aimed to assess the effect of three different irrigation practices during the spring and summer seasons on olive maturation and ripening. The evaluations were conducted on 'Arbequina' olives from two orchards in California. Olive maturity was determined based on fruit physical characteristics, including pulp softening, color change from green to purple, and increases in size and weight. Initial results suggest that reducing water applications during the spring with no change in the summer improves olive size and weight depending on location. We preliminarily found no difference or an increase in maturation between the irrigation practices, suggesting deficit irrigation will not decrease olive production. These findings shed light on water management strategies to maximize yield while conserving water, holding significance for olive growers, and promoting sustainable practices in olive production.

Effects of Bioactive Fatty Acids on Differentiation and Lipid Metabolism in Bovine Primary Preadipocytes

Maykal Tsonov
Sponsor: Payam Vahmani, Ph.D.
Animal Science

The objectives were to examine the effect of conjugated linoleic acid (CLA) and trans-18:1 isomers, ruminal biohydrogenation-derived fatty acids, on differentiation and lipogenesis in bovine primary preadipocytes from subcutaneous (SC), kidney (KF) or intramuscular (IM) fat depots. Differentiated with 10μM of trans-10,cis-12 conjugated linoleic acid (t10,c12-CLA), c9,t11-CLA, t10-18:1, t11-18:1, or bovine serum albumin (BSA), lipid accumulation was quantified using Oil Red O staining. Cells were analyzed for fatty acid composition using gas chromatography and lipogenic gene expression (PPARγ, ACC and SCD1) via qPCR. Lipid content was similar between SC- and IM-derived adipocytes, although PPARγ expression was higher in SC-derived adipocytes. T10-18:1 reduced ($P<0.01$) fat accumulation compared to BSA-control across cell types. Neither t10-18:1 nor t10,c12-CLA influenced ($P>0.10$) gene expression. Compared to BSA-control, t10,c12-CLA reduced ($P<0.01$) SCD1 activity indices (c916:1/16:0 and c9-18:1/18:0) in IM-derived (-32% and -37%) and SC-derived (-19% and -36%) but not in KF-derived adipocytes. T10-18:1 had no such effects. Given marbling fat accumulation in feedlot cattle is highly dependent on SCD1 activity, excessive ruminal outflow of t10,c12-18:2 may negatively impact beef quality.

Determining Antiferromagnetic Moment Orientations from Domain Images by Pixel-by-Pixel Analysis

Nathan Tsui
Sponsor: Yayoi Takamura, Ph.D.
Materials Science&engineering

In the modern world of technological devices, the increased focus for improving power optimization, storage capacity and processing capabilities has been the center of attention to advance antiferromagnetic (AFM) spintronics. Through the usage of AFM La0.5Sr0.5FeO3 (LSFO) / ferromagnetic (FM) La0.7Sr0.3MnO3 (LSMO) heterostructures, AFM moments can be reoriented with applied magnetic fields on the scale of tenths of a tesla utilizing spin-flop coupling, (i.e., perpendicular coupling between FM and AFM moments). In order to probe the AFM and FM domain structure in this heterostructure system, photoemission electron microscopy was performed on LSFO/LSMO heterostructures grown on (001)-oriented (LaAlO3)0.3(Sr2TaAlO6)0.7 substrates. Extended domains are observed parallel to one of the in-plane <100> substrate directions and the FM and AFM moments within each domain display perpendicular orientation, consistent with spin-flop coupling. Pixel-by-pixel analysis performed on AFM domain images acquired with the E-vector of the linearly polarized x-rays rotating from s- to p-polarization can be used to reveal the population and orientation of the AFM moments. Understanding AFM domain population and moment orientation is crucial for conducting AFM spin transport measurements, bringing us closer to AFM spintronics.

Survival and Fitness of *Listeria monocytogenes* on Different Commercial Gourmet Mushrooms During Growth and Storage

Tianyi Tu
Sponsor: Luxin Wang, Ph.D.
Food Science & Technology

To address the knowledge gap regarding mushroom safety and gain better understanding of how foodborne pathogens behave on pre-harvest and post-harvest mushrooms. This study characterizes the survival and fitness of *Listeria monocytogenes* (LM) on three different types of gourmet mushrooms: Royal Trumpet (BL), Alba Clamshell (W) and Brown Clamshell (BS) during both the growth and storage stages. The harvested mushrooms were kept in Ziploc bag and stored under 4 °C. The growing mushroom were incubated in Mella mushroom fruiting chamber. The result show that for harvested mushrooms, after 7 days of storage, 1.09, 1.45 and 1.63 Log CFU/mushroom reduction of LM was observed on BL, BS, and W. This indicates the persistent nature of LM on mushrooms at refrigerated temperature. For the growing mushroom, the LM population dropped below limit of detection (1.48 Log CFU/ml) on Day 3 for both types of mushrooms. There is LM detected after enrichment in W after 7 days, whereas negative LM enriched for BS and BL after Day5. These findings suggest the presence of antimicrobial mechanisms in growing mushrooms, contributing to self-defense against LM. Further study on the fitness of *Salmonella* spp. on mushroom is in progress.

The Microbiome and Cancer Treatments

Sweta Tummala
Sponsor: Sarah Faye, M.A.
University Writing Program

This literature review focuses on how the microbiome can be used in conjunction with cancer treatments to fight against cancer, in hopes that a cure can finally be found for all types of cancers. This review includes primary research articles published within the last five years on PubMed and focuses on different cancers, different cancer treatments, and different effects of the microbiome. The wide range of effects of the microbiome were observed and it was discovered that gut microbiomes are correlated with treatment responses for CAR-T cell therapy. It was also found that fecal microbiota transplants in conjunction with anti-PD-1 therapy is helpful in making anti-PD-1 therapy more effective in fighting cancer. Moreover, probiotics help reduce the side effects of various cancer treatments for various cancers. The findings of this study show promising results, but much more research is needed in this area to learn more about how the microbiome and cancer treatments fight cancer, before the microbiome can be used in conjunction with cancer treatments.

Sustainable Therapeutic Protein Production in Microalgae

Sky Tuse
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

The production of therapeutic proteins is currently dominated by a few chassis organisms including *E. coli*, *S. cerevisiae*, CHO cells, and some plants. However, synthetic biologists have, of late, been working to develop alternative chassis organisms that may provide advantages over these traditional chassis. Microbial photosynthesizers, or microalgae, are currently one interesting alternative. By only requiring light, trace minerals, buffer, and a nitrogen source, microalgae provide a potentially low-cost platform for therapeutic protein production that is also ecologically sustainable due to fast growth and photosynthetic ability. The microalgae *Chlamydomonas reinhardtii*'s physiology is well-documented and has been shown to synthesize stable mammalian proteins, making it a prime research candidate as a photosynthetic chassis organism. One of the biggest barriers to using *C. reinhardtii* as a chassis organism is performing a high-efficiency transformation. Our research strives to develop a transformation protocol that can efficiently integrate transgenic DNA into the *C. reinhardtii* genome using exponential electroporation. This transformation protocol can then be applied to a synthetic biology context to produce different therapeutic proteins, reducing the cost both financially and environmentally. Here, we present our recent work to improve transformation protocols for *C. reinhardtii*.

The Space and Place of Dissent: Exploring the Impact of University Architecture on Student Protests

Amarachi Ugwu
Sponsor: Thomas (tom) Beamish, Ph.D.
Sociology

This study explores the relationship between university campus architecture and student protests by analyzing how student protesters interact with their university's space and place. Literature concerning student activism sporadically acknowledges the role of the built environment, while literature focused on university architecture and design seldom addresses the social movements that occur within campuses, thus this study bridges the gap between the two schools of thought. Using archival data from university and city newspapers alongside oral histories, Protest Event Analysis (PEA) is performed on three case studies of student protests on three University of California (UC) campuses to examine how university architecture enables or constrains student demonstrations. Findings indicate that a university's space and place play an important role in shaping the nature and short-term and long-term outcomes of student protests. Beyond the realm of university campuses, the implications of this study can be applied to other locations to further understand the interplay between social movements and the built environments they unfold within.

LupBook: An Open Source Interactive Textbook Framework

Russell Umboh
Sponsor: Joel Porquet-Lupine, Ph.D.
Engr Computer Science

LupBook is an open source interactive textbook framework designed to enhance the teaching of programming languages through enabling readers to experiment with concepts in real-time as they learn them. Unlike existing platforms that rely on server-based code execution, LupBook operates entirely on the client's side, enabling offline usage. The project introduces a virtual machine, emulating a minimal RISC-V based system with a full but minimal Linux-based software stack. This approach allows code components within the interactive textbook to be executed locally, fostering a continuous learning experience. In this poster, our student team will present our contributions to the project which include: a set of new interactive components and navigational features. We've worked on various interactive components that improve the learning experience available for users. The development of multiple-choice questions, matching exercises and parsons exercises, ensure that book authors have flexibility in choosing question types for their specific needs. We've also added an improved user experience, created through the development of seamless navigation, integrating features such as a table of contents and settings bar, facilitating font adjustments and dark mode for enhanced readability. LupBook represents a significant advancement in interactive textbook technology, empowering educators to create engaging and customized learning experiences.

The Effects of Parity on Specialized Cells in the Mammary Glands of Mice

Annie Urman
Sponsor: Russ Hovey, Ph.D.
Animal Science

Specialized cells exist in the mammary glands of mammals during late gestation and lactation, although their functions are largely unknown. A major determinant of mammary gland development and lactation success is the number of parities that a female experiences. We examined how parity affects the percentage of specialized cells in the mammary glands of mice. Sixteen nulliparous, female BALB/c mice were housed in groups of three, each with one sire. The onset of pregnancy was defined as the presence of a copulatory plug. Mammary glands were collected at necropsy between days 6-8 of lactation of the designated parity (1, 2, or 3), then were enzymatically digested to create cell suspensions. Cells were stained with zombie green, cytophase violet, and anti-EpCAM prior to flow cytometry. The average frequency of specialized cells in mammary glands from mice in parities 1, 2, and 3 was 39.5% ± 6.91, 52% ± 3.49, and 45.3% ± 1.96, respectively. These data indicate that parity may affect the incidence of different unique cell populations in the mammary glands of mice.

Extracellular Electrophysiological Response of Rat Cortical Tri-Culture to Amyloid Beta Exposure

Nidhi Vadulas
Sponsor: Erkin Seker, Ph.D.
Elect & Comp Engr

Recent studies have hypothesized that amyloid-β (Aβ) exposure modulates electrophysiological activity of neurons via influence on synaptic transmission and overall neuronal viability. Microglia, resident immune cells of the central nervous system, play an important role in both of these potential mechanisms. Therefore, an *in vitro* tri-culture (neurons, astrocytes, and microglia) model from rat primary cortical cells was established and plated over multiple electrode arrays (MEA) to monitor changes in extracellular electrophysiological activity of tri-culture neurons under exposure to Aβ particles. We were able to collect and analyze electrophysiological data to study spike intervals, burst frequencies, and neuronal synchronization. Additionally, both co-cultures (neurons and astrocytes) and tri-cultures were used to reveal the important role of microglia on neurons upon the exposure to Aβ. Our preliminary observations include alteration of neuronal signals after Aβ exposure. We expect that this platform will have utility in studying the neuro-glia response to stimuli such as Aβ and serve as a screening platform for toxins and pharmaceuticals.

Parenting Styles and Depression Within Immigrant Families Before and During the COVID-19 Pandemic

Stephanie Valdovinos Sanchez
Sponsor: Yuuko Tonkovich, Ph.D.
Education

This study investigates (1) immigrant parents' parenting styles and self-reported levels of depression before and during the COVID-19 pandemic, and (2) the associations among bilingual children's heritage language, parenting styles, and depression levels before and during the pandemic. Due to school closures, parents were challenged to help children with their homework. Parent-child interactions became more crucial as they spent more time together. This affected the home dynamics and parent-child interactions. A total of 109 parent-child dyads participated in this study. The participants were low-income, Mexican American and Chinese American immigrant families living in Northern California. This longitudinal study focused on children ages 3-5 prior to the COVID-19 pandemic (2018-2019) and ages 5-7 during the pandemic (2020-2021). T-tests revealed no significant differences between parents' depression levels before the pandemic and during the pandemic. However, significant differences were found in parenting styles. On average, parents reported being more authoritative and less authoritarian during the pandemic. Correlations revealed negative relationships between parents' depression levels and authoritative styles, and parents' depression levels and children's heritage language. The pandemic brought many uncertainties to families. Yet, our preliminary results suggest that parents adjusted their parenting styles and became more empathic and understanding with their children.

Infants' attention to and learning of faces

Mariel Shanaya Valeroso
Sponsor: Lisa Oakes, Ph.D.
Psychology

From birth, infants learn about their worlds through the faces in their environment. Specifically, faces convey information about language, emotions, gender, and much more. Moreover, different features of faces become informationally relevant across development. For example, Oakes and Ellis (2013) showed that younger infants (4 to 6 months) focused more on the eye region while viewing a photograph of a face. In contrast, older infants (8 to 12 months) focused their attention more broadly, presumably reflecting differences in cognitive development. Despite these developmental differences, attention to the eye region has been primarily linked to infants' *learning* of faces. Bolhuis et al. (2015), for example, showed that infants who preferentially looked to the eye region showed stronger memory for that face compared to infants who focused their attention more broadly. Moreover, DeBolt et al. (2023) showed that 6 to 9-month-old infants similarly formed memories for masked and unmasked faces, suggesting that the eye region was sufficient for their learning of the faces. The current study explores how attention to different facial regions and features is related to learning. We focus on a broad developmental range (5 to 12 months) to understand how different attentional strategies may translate to different learning outcomes.

Investigation of a Missense Mutation in the *KCNE4* Gene on Equine Anhidrosis

Lexie van der Graaf
Sponsor: Carrie Finno, D.V.M.,Ph.D.
VM: Population Hlth & Reprod

Anhidrosis is defined as a decreased or absent ability to sweat in response to heat and exercise. In horses, this incurable condition is dangerous as it can increase the risk of inducing hyperthermia, a life-threatening condition. Past studies have suggested that anhidrosis occurs more frequently in stock-type equine breeds. In 2021, a published study suggested that this condition results from a missense mutation in the Potassium Voltage-Gated Channel Subfamily E Regulatory Subunit 4 (*KCNE4*) gene at position rs68643109. In this report, a case-control (n=200) genome-wide association study identified an association between the *KCNE4* region and equine anhidrosis. Our goal for this project was to validate this genetic association in another population of well-phenotyped horses. We phenotyped 50 horses within the UC Davis Center for Equine Health herd for anhidrosis, using a series of intradermal terbutaline injections, and genotyped the target region within *KCNE4* for each individual. As all the horses tested negative for anhidrosis and all three genotypes were present in the population, the observed presence of the missense mutation within the *KCNE4* gene is unlikely to be responsible for equine anhidrosis.

Spatial Analysis of College Choice and Access: Case Study of 76 Unified School Districts in San Joaquin Valley

Brittany Vang
Sponsor: Noli Brazil, Ph.D.
Human Ecology

The San Joaquin Valley (SJV) in California is renowned for its agricultural prowess but grapples with economic hardships and geographic disparities that disproportionately impact educational outcomes. Offering insights into educational (in)equity, my study examines college choice and access of high school students at the SJV unified school district level for the 2018-19 academic cohort. Key questions addressed are: (1) What factors impact college choice for students from the SJV? (2) How does the spatial composition of college enrollment for students from SJV reflect its geographic attributes? The outcome variable is the proportion of college-bound students, categorized by college type (UC, CSU, CCC, private, and out of state). Four broad types of explanatory variables are considered, including demographic and socioeconomic conditions, school district related characteristics (e.g. free and reduced-price meals), built neighborhood facilities (e.g. public libraries and head start centers), and spatial access to postsecondary institutions as determined by distance and count per district. I employ multivariate fixed effects ordinary least squares (OLS) regression models to examine the association between variables. By understanding the factors impacting college enrollment, this research contributes to informing interventions and policies for enhanced college access in SJV, fostering inclusivity in higher education.

An EEG Examination of Working Memory as a Mechanism for Attentional Modulation of Neural Activity to Speech in Noise

Audrey Vargas
Sponsor: Lee Miller, Ph.D.
MED: Otolaryngology

In noisy environments, individuals with clinically normal hearing exhibit diverse listening capabilities. One possible mechanism for this is differences in working memory capacity, allowing certain individuals to process more information at a given time. Prior work has shown that working memory ability correlates with speech-in-noise comprehension, but little is known about the neural mechanisms responsible. We aim to evaluate the relationship between visual working memory performance, using a computerized Reading Span Task, and attentional modulation of neural activity in 25 adult listeners. We used electroencephalogram (EEG) recorded auditory late latency response (LLR) of event related potential (ERP) collected during a spatial auditory attention task using multi-speaker continuous speech. We chose to use LLR waveforms because the majority of high level speech processing happens during late latency ERP time points. We found a correlation between working memory performance and attentional modulations of LLR ERP component morphology. We observed better working memory performance correlated with greater amplitude difference between an attended and unattended stimuli for P1, P1b, and N1 components. This shows that working memory may play an important role in speech processing and could partly explain why people with healthy hearing have diverse listening abilities of speech in a noisy environment.

Vowel Coarticulation and Expansion Across Styles: Comparing Adults Varying in Age

Lilly Vanhoy
Sponsor: Georgia Zellou, Ph.D.
Linguistics

This study investigates how adults of different age groups adapt their speech in response to varying communicative contexts. Previous research indicates that speakers modify their speech to enhance intelligibility, employing strategies such as reducing coarticulation (or segmental overlap of speech sounds) and expanding vowel space (making their vowels more distinct). 129 participants, ranging from 18 to 60 years, engaged in an experiment online. Stimuli consisted of 18 target words, produced in the frame "I say [target word] again". They produced target sentences in three style conditions with two repetitions each: clear (produced for individuals with hearing challenges), casual (produced for close friends/family), and fast (produced as if an auctioneer). The sentences were transcribed in Praat, the vowels were segmented with the Montreal Forced Aligner then hand-corrected. Next, we took vowel measurements with FastTrack and Praat scripts. We predict there will be age-related variation in the patterns of vowel expansion and coarticulation across different communicative styles. This research contributes to our understanding of the dynamic interplay between age, communication styles, and speech production strategies.

The Relationship Between Childhood Trauma, Disclosure of Childhood Trauma, and Sleep in Mexican-Origin Mothers

Amandine Velten
Sponsor: Leah Hibel, Ph.D.
Human Ecology

Trauma describes a disturbing event that can cause a long-lasting negative effect on a person's attitudes, behavior, and other aspects of functioning. Trauma during childhood can lead to decreased sleep quality, potentially due to circadian dysregulation, elevated cortisol, and social mechanisms, contributing to future mental and physical health challenges. Disclosure of such experiences may have an impact on these health outcomes in adulthood. This study establishes whether childhood trauma, as well as non-disclosure of this trauma, is related to sleep quality indicators among Mexican-origin (MO) mothers, a group in which this association may be greater due to racialized and gendered disparities. Data will come from the California Babies Project, a longitudinal study of the development of self-regulation in low-income, MO children. Data from MO mothers were also collected, including actigraph data from 8 nights of sleep, and a battery of questionnaires, including the Childhood Trauma Questionnaire, which assesses mothers' traumatic experiences during childhood, and if they confided in others about these events. Using Linear Regression models, we will test the association between childhood traumatic experiences, non-disclosure of these experiences, and maternal sleep quality. We hypothesize that both childhood trauma and non-disclosure will be associated with decreased sleep quality.

Progress Towards the Cryo-EM Structure Determination of Adenosine Deaminase Acting on RNA (ADAR)

Srinidhi Venkatesh
Sponsor: Andrew Fisher, Ph.D.
Ag Molecular & Cellular Bio

Adenosine Deaminase Acting on RNA (ADAR) is an enzyme that carries out A to I editing within double-stranded RNA (dsRNA). Because inosine (I) base-pairs with cytosine (C), it functions equivalently to guanosine (G) in cellular processes such as splicing, translation, and reverse transcription. Among catalytically active ADARs - ADAR1 and ADAR2 - my focus is directed towards human ADAR1. Notably, ADAR1 differentiates itself with the presence of a previously unknown second zinc binding domain that is crucial in maintaining the conformation of the 5' binding loop that is suitable for RNA substrate recognition and editing activity. Studies have unveiled the potential of this recognition site as a promising target for small molecule inhibitor development, particularly for cancer, where ADAR inhibition improves efficacy of immune checkpoint inhibitor therapy. Although the X-ray crystallography structure of human ADAR2 bound to different duplex RNAs has been solved, there is currently no high-resolution structure of ADAR1 due to considerable challenges posed by its lack of reproducibility, low expression and aggregation issues. My research focuses on the expression and purification of the ADAR1 protein, alongside optimization of various buffer conditions, grid types, freezing and blotting parameters for Cryo-EM studies.

Gender Diversity and Identification with Gendered Experiences of Adults with Intellectual Disability

Ember Venkatesh
Sponsor: David Hessl, Ph.D.
MED: Psychiatry & Behav Sci

There is growing evidence to support a link between gender diversity and autistic traits. However, much of this research has been conducted with participants who do not have a co-occuring intellectual disability (ID). Additionally, the majority of current literature surrounding the subjective experiences of adults with intellectual disabilities does not utilize self-report measures, relying instead on parent-reports or other proxy measures. Our study aims to explore the benefits and potential limitations of using self-report interviews to gather information about the gendered experiences of adults with ID. Additionally, we aim to investigate whether significant differences in gendered experiences exist between participants with ID and their typically-developing siblings. Gendered experiences were assessed using a questionnaire created for this study, which was administered to participants as a structured interview. Participants were asked about different aspects of gender identity and gender expression, including questions about their self-perception and preferences regarding clothes, pitch of voice, personal grooming standards, complements and pronouns. We expect that participants with ID will be able to effectively engage with and answer questions about their gender. We also expect that participants with ID will differ significantly from their typically developing siblings in terms of conformity and ambivalence to a gender binary.

Protecting Overseas Filipino Workers: Conditions of Negotiation for Bilateral Labor Agreements

Olivia Victa
Sponsor: Jeannette Money, Ph.D.
Political Science

The Philippines maintains a long history of labor migration, and today, Filipino labor migration is expansive with 1.96 million Overseas Filipino Workers employed globally. The Philippine government plays an important role in labor export utilizing international agreements to facilitate labor migration and worker protections. However, international labor migration agreements are understudied. My research seeks to contribute to this area of study by researching the influence of overseas Filipino workers (OFWs) on bilateral labor agreements (BLAs) between the Philippine government and labor-receiving states. I ask what are the conditions under which the Philippines would enter into a BLA? I hypothesize that: 1) the Philippines is more likely to pursue an agreement with labor-receiving countries that have a large population of OFWs; 2) the Philippine government is more likely to pursue negotiations if there is greater political pressure to address failed OFW protections; and 3) when host states experience a labor market demand that they cannot fill themselves, they are more likely to negotiate an agreement with sending countries. I evaluate my hypothesis by employing an original data set. I utilize qualitative and quantitative methods, a case study and logistic regression analysis respectively, to discuss my findings.

Beyond Couture: Design, Fashion, and the Storytelling of Women

Anika Vikash
Sponsor: Rosemary Kelly, M.A.
Department Of Design

Fashion serves as a potent storytelling medium, transcending aesthetics to express diverse women's narratives and advocate for inclusivity. Designers, using garments as canvases, narrate tales of resilience and strength, each piece recounting personal journeys. This narrative in fashion is crucial for future generations, fostering a deeper understanding of women's lives and celebrating diversity. Storytelling becomes a tool for empowerment, allowing women to reclaim narratives and challenge societal norms, inspiring a ripple effect reshaping attitudes for generations. Beyond aesthetics, art, design, and fashion significantly contribute to improving life quality, offering outlets for self-expression and resistance against societal pressures. Engaging in art and design empowers women, providing platforms to communicate emotions and aspirations, fostering a sense of agency and belonging. The therapeutic benefits of art and design offer avenues for stress relief, personal reflection, and community building, becoming transformative tools for resilience and confidence. Fashion's role in storytelling, alongside broader art and design realms, is crucial for shaping a more inclusive world, amplifying women's voices, challenging norms, and paving the way for a future where women's stories are embraced and celebrated.

The Safety and Efficacy of Psilocybin Treatment in a Mouse Model of Postpartum Depression

Srinidhi Viswanathan
Sponsor: Danielle Stolzenberg, Ph.D.
Psychology

One in 8 mothers experience peripartum depression, which negatively affects mom and increases depression in offspring by 64%. Mouse models can help us uncover mechanisms underlying peripartum mental illness and test the safety and efficacy of therapeutic interventions in mom and offspring. Psilocybin has emerged as a fast-acting, long-lasting and efficacious treatment for depression. However, its safety and efficacy in postpartum people is unknown. This study investigated psilocybin effects in mothers and offspring using a mouse model of postpartum depression. Here, we used social stress to induce postpartum depressive-like behaviors in maternal mice. Moms were then treated with psilocybin or saline following social stress or control conditions on postpartum day 7. In adulthood, offspring outcomes were assessed using standard behavioral tests designed to measure cognitive, social and emotional behavior. This 2x2 design allowed us to (1) assess the effects of stress-induced postpartum depressive-like behavior on offspring outcomes, (2) evaluate the efficacy of psilocybin treatment in restoring maternal care and/or improving offspring outcomes, and (3) gauge the impact of early life psilocybin exposure through breast milk and/or alterations in maternal care in the absence of stress-induced postpartum depressive-like behavior.

Aberrant Mitochondrial Morphology in Age-Related Macular Degeneration

Aldo Vorkapich
Sponsor: Cecilia Giulivi, Ph.D.
VM: Molecular Bio Sciences

Age-Related Macular Degeneration (AMD) is a retinal disease that leads to central vision loss. The disease manifests as an accumulation of lipid and proteins plaque in the form of extracellular lipid deposition known as drusen or intracellular lipid accumulation presenting as punctate lesions, culminating in macular degeneration. Primates are the only mammals to possess maculae essential for sharp central vision, making them crucial models for AMD research. The macula, rich in mitochondria, is susceptible to environmental influences (such as sunlight exposure and dietary habits) and genetic factors that may contribute to mitochondrial damage, influencing the onset and progression of degeneration. To investigate, we analyzed mitochondrial morphology in retinal pigment epithelial cells of healthy rhesus macaques versus those with drusen or punctate lesions. Our findings revealed disrupted mitochondrial morphology in AMD samples, particularly those with drusen or punctuated deposits, exhibiting blunted fusion, a more circular shape, and diminished content compared to normal animals. These observations shed light on the potential role of mitochondrial dysfunction in AMD. Understanding this mechanism could guide the development of future treatments and preventive strategies targeting mitochondrial aspects of AMD.

Studying Molecular Players involved in Cell Plate Development during Plant Cytokinesis

Emily Vo
Sponsor: Georgia Drakakaki, Ph.D.
Plant Sciences

Without cytokinesis completing the final stage of cell division, proper proliferation of new cells and development of tissues and organs could not occur. To dissect the molecular mechanism of cytokinesis, we rely on observing the formation or disruption of a new cell plate by the application of a chemical inhibitor Endosidin 7 (ES7).ES7 is known to inhibit callose deposition during cell plate formation resulting in incomplete cell division and hence effecting plant developmental processes such as slow root growth. Using β-1,3- glucanase mutant lines of callose hydrolase genes, we analyzed the effect of ES7 on root growth to find out if these genes contribute to ES7 tolerance. To further understand the signaling mechanism that regulates cell plate development, we have performed gene expression analysis of cytokinin responsive genes in ES7 treated seedlings. The current study would aid in advancement of our understanding on molecular mechanism of cell plate development during cytokinesis.

The Use of qPCR in Quantifying Phages

Elijah Vu
Sponsor: Francisco Arsuaga, Ph.D.
Molecular & Cellular Bio

qPCR is an invaluable tool in DNA quantification, allowing researchers to obtain accurate measurements of DNA concentrations based on emitted fluorescence values. In phage growths and experiments, researchers occasionally employ plaque assays as a qualitative method of determining the concentration of a phage in a given sample by visualizing areas of bacterial death on a culture plate. These areas are then counted and used to calculate the concentration of phages in the sample. However, plaque assays fail to account for non-viral phages, such as phages missing a tail or phages with extremely high degrees of DNA knotting. Additionally, low phage concentration samples are unable to be visualized on a plaque assay. Through the use of qPCR, we should be able to accurately determine the concentration of all phages, both infectious and non-infectious, and make some general statements regarding the accuracy of plaque assays and the amount of infectious phages in a sample.

The Effect of Smoking Status on Pro-Inflammatory Cytokine Production in Human Bronchial Airway Epithelial Cells

Vivian Vu
Sponsor: Nicholas Kenyon, M.D.
MED: Int Med Pulmonary (sac)

Wildfire particulate matter with diameter ≤ 2.5μm (PM2.5) is known to cause severe lung diseases. Smokers are at higher risk of developing diseases such as asthma and COPD following toxicant exposures. There are no current studies on the pathogenesis from wildfire PM2.5 exposure and no treatments for those who have been exposed to PM2.5. Wildfire events are occurring more frequently due to climate change. It is important we study the pathogenesis of lung diseases due PM2.5 exposure. I hypothesize human airway epithelial cells (hAECs) from smokers will produce more pro-inflammatory cytokines after exposure to wildfire PM2.5 compared to non-smokers. In my study, primary hAECs from upper bronchial airways will be cultured under air-liquid interface (ALI), an ideal technique that models human airway physiology. After differentiation, hAECs will be treated with wildfire PM2.5 and incubated for 8 or 24 hours at 37°C. Pro-inflammatory cytokines, IL-6 and IL-8, production will be measured via ELISA. I expect to see enhanced cytokine production in smokers with and without asthma compared to non-smokers. Findings from this study may provide insight on potential therapeutic targets for lung diseases worsened by wildfire PM2.5 exposure.

Electrophysiological Study of Haptic Stimulation: Implication for Cross-Modal Plasticity

Andrew Vuong
Sponsor: David Corina, Ph.D.
Linguistics

The neurophysiological theory of cross-modal plasticity (CMP) predicts the reallocation of unused brain structures to aid in the processing of active structures. In the case of congenitally deaf children, CMP has been shown to occur between the active visual cortex and inactive auditory cortex. Specifically, responses to visual stimuli were reported in the auditory cortex. The extent to which CMP is maladaptive and negatively affects future speech perception in developing children is controversial. Here we extend the investigation of CMP to the less-well studied somatosensory domain. Our pilot program explores somatosensory evoked potentials in adults in response to vibratory stimulation. Using an odd-ball paradigm we evaluate the mismatch-negativity response (MMN). The MMN is an electrophysiological brain potential that registers the occurrence of a wide class of stimuli (visual, auditory, haptic). We use an Arduino and vibratory coin motor setup to deliver haptic stimuli to the index and pinky finger of subjects and measure the magnitude of the MMN. Here we report preliminary results in typically hearing adults. Our long term plan is to use this paradigm to examine CMP in CI using children.

Analysis of the Relationship Between Outer Hair Cell Health in the Cochlea and Speech-in-Noise Perception

Nina Wade
Sponsor: Lee Miller, Ph.D.
MED: Otolaryngology

Existing audiology clinical practices often struggle to explain speech processing challenges in noisy environments for individuals with clinically "normal" hearing. One method that is commonly used is distortion product otoacoustic emissions (DPOAEs) which are produced in response to two simultaneous tones of different frequencies in the inner ear, and serve as a measure of outer hair cell health and cochlear function with the aim to detect early hearing loss. The goal of this study is to determine whether DPOAEs are also associated with higher levels of audiological function like speech perception in noise. We collected DPOAEs among other audiological tests and measured behavioral performance on a continuous multi-talker speech spatial attention task for a cohort of 25 young adults with normal hearing. The relationship between DPOAE measures and speech listening abilities was analyzed using linear regression. Preliminary results show an association between outer hair cell health and performance on a speech-in-noise auditory attention task. These results can provide valuable insights into the clinical applicability of DPOAEs and their implications for understanding complex auditory processes in challenging listening conditions.

Identification of Bacterial IAA Sensing Protein Through the Construction of Two-Component Hybrid Receptors

Clarissa Wahyudi
Sponsor: Johan Leveau, Ph.D.
Plant Pathology

The phyllosphere, or plant leaf surface, is a microbial habitat accommodating a diverse community of microorganisms. Many bacterial colonizers of the phyllosphere can produce, consume, and/or swim towards the plant growth hormone indole 3-acetic acid (IAA). The strain *Pseudomonas putida* 1290 can do all of these things. Lab Leveau is investigating the mechanism that *P. putida* 1290 uses to detect IAA in its environment. On the *P. putida* 1290 genome, we identified over 20 genes that code for transmembrane receptors. We hypothesize that one or more of these are involved in the recognition of IAA. Using Gibson assembly, we have been creating hybrid receptors fusing the predicted binding domains of each *P. putida* 1290 receptor to an *Escherichia coli* signaling domain which allows us to measure LacZ reporter output in response to IAA and other compounds. This approach offers an opportunity to catalog the 'sensome' of *P. putida* 1290 in general and to validate the chemoreceptors underlying IAA sensing and chemotaxis specifically.

Control of Tiltwing Hover via Trailing Edge Slipstream Deflection and Prop-Rotor Cyclic Pitching

Andy Wang
Sponsor: Camli Badrya, Ph.D.
Mechanical & Aerospace Engr

Tiltwing is a type of VTOL (vertical take-off and landing) aircraft configuration that achieves thrust vectoring by rotating the propulsion-wing element. Such configuration features lower noise and drag in hover, along with shorter transition time compared to other vectored thrust methods. Historically, experimental tiltwings like CL-84 and Vertol VZ-2 had achieved stability in hover by incorporating thrust at the tail to control pitch, but a tailrotor adds complexity and weight. It is also known that tiltwing has limited yaw control, as it is susceptible to gusts and in hover. The implementation of trailing edge flaps and cyclic articulation of the rotors can be a simpler system that provides control in hover. The stability of a tiltwing scale model in hover will be studied by coupling these two mechanisms; the extent to which this system can provide control will be explored by modeling of the flight mechanics and demonstrated with a scaled flight test vehicle.

Somatic Variant Calling on High Depth Bulk RNA Sequencing Data From the Prefrontal Cortex

Kevin Wang
Sponsor: Gerald Quon, Ph.D.
Molecular & Cellular Bio

While germline mutations have been more thoroughly investigated, the role of somatic mutations particularly in brain tissue and neurodevelopment has been less pronounced. This project intends to compare somatic mutation patterns from prefrontal cortex genomic data collected in a large case-control study of psychiatric disorders. This is a group project with fellow undergraduate Aruna Nanapaneni: I am analyze high depth bulk RNA sequencing data, and she analyzes matched single nucleus RNA sequencing data from the same regions and patients. I apply a somatic variant calling pipeline developed by Pablo et. al at Stanford's Fraser Lab using snakemake--a dependency-based python package; the pipeline maps sequences by aligning input reads to the reference genome and calls mutations through filtering germline cells and other artifacts (blacklisted regions, RNA edits, and other filters) to retrieve only somatic mutations. We intend to analyze patterns of somatic allele frequencies to reconstruct the developmental history of the prefrontal cortex, similar to how cancer genomics data can be leveraged to make inferences of tumor clonal evolution. Ultimately, these inferred developmental histories can be compared between cases and controls to test the hypothesis that there are differences in the developmental histories of the cases and controls.

Do Social Categorization Models Affect Essentialist Beliefs Differently?

Zhizhou Wang
Sponsor: Jeffrey Sherman, Ph.D.
Psychology

The present research examines the influence of different social categorization models on essentialist beliefs. Evidently, racial disparities continue to manifest in various societal domains such as legal, educational, organizational, and social contexts. Addressing these disparities, researchers are delving into the effects of various categorization models to mitigate biases, stereotypes, and improve intergroup relationships. Essentialist beliefs about race, wherein racial groups are perceived as having inherent, biologically based, immutable characteristics, are prevalent in society. This study not only compares and contrasts the impacts of different categorization models on these beliefs but also aims to understand how these models influence perceptions and interactions within diverse societal structures. By examining these models, the research seeks to contribute to the development of more effective strategies for promoting social equality and understanding the roots of racial biases. Additionally, the study aims to inform educational and policy initiatives designed to address and reduce racial prejudice and discrimination, thereby fostering a more inclusive and equitable society.

Larval Rockfish Otolith Response to Maternal Size and the Combined Effects of Hypercapnia and Hypoxia

Junhan Wang
Sponsor: Nann Fangue, Ph.D.
Wildlife & Fisheries Biology

Otoliths are calcium carbonate structures within the fish inner ear responsible for balance and hearing, and their concentric rings are used to estimate age and growth rates. The "Big Old Fat Fecund Female Fish" hypothesis suggests better maternal conditions enhance offspring survival by producing larger larvae, and later studies found larvae with larger otolith-at-hatch had greater survival and growth rates. More recently, otoliths exhibit accelerated growth under hypercapnia (high CO2 low pH), whereas hypoxia (low O2) slows their biomineralization – potentially complicating this life history metric. Here, pregnant gopher rockfish (*Sebastes carnatus*) were exposed to three environmental treatments (Ambient: pH 7.8, dissolved oxygen (DO) 8.0 mg/L, High: pH 7.4, DO 3.5 mg/L, Extreme: pH 7.3, DO 2.8 mg/L) at Moss Landing Marine Laboratories. Otoliths (N=227) from 0-day old larval rockfish were dissected then analyzed by three readers. Results suggest maternal exposure to combined hypercapnia and hypoxia stunted larval growth rate, and significantly reduced larval otolith size. Moreover, mothers with greater liver weight (indicator of energetic storage) produced larvae with significantly larger otolith-at-hatch. This suggests otolith biomineralization is more impacted by hypoxia than by hypercapnia, and that maternal feeding condition can greatly influence the early life success of larval rockfish.

Effects of Exercise and Furosemide on Left Ventricular Internal Diameter in Thoroughbred Racehorses

Ryleigh Webb
Sponsor: Jessica Morgan, D.V.M.,Ph.D.
VM: Medicine & Epidemiology

Hypo-hydration from diuretics, such as furosemide, have been shown to alter heart size in horses. Additionally, exercise induced dehydration has been associated with a decrease in the left ventricular diameter in horses. We hypothesize, horses that receive furosemide before exercise will have a larger decrease in left ventricular internal diameter than horses who do receive furosemide. Point of care ultrasounds were performed before and after exercise on 100 Thoroughbred racehorses. Preliminary analysis of 16 horses (8 with furosemide treated and 8 controls) was performed with a student's T-test. Exercise resulted in a significant difference in the left ventricular internal diameter in diastole for horses that received furosemide ($P<0.02$) and for horses that did not ($P<0.0001$). Mean internal diameter pre workout (11.66±1.12) decreased to (10.40±1.05) post workout in furosemide treated horses, while mean internal diameter went from (11.61±1.12) to (10.40±0.39) in untreated horses. There was no significant difference in the change in left ventricular diameter between horses that received furosemide and those that did not ($P=1.0$). In conclusion, furosemide showed no significant impact on the change in left ventricular diameter in horses after exercise.

Chemoenzymatic Strategies for Highly Efficient Gram-Scale Synthesis of Human Milk Oligosaccharides (HMOs)

Yijun Wei
Sponsor: Xi Chen, Ph.D.
Chemistry

Human milk oligosaccharides (HMOs) play a crucial role in the development of the brain and a healthy immune system of breast-fed infants. More than 100 HMO structures have been identified but their individual roles have not been elucidated. The project objective is to develop efficient methods that combine chemical derivatization of lactose and enzymatic extension of the glycan chains using one-pot multienzyme (OPME) strategies for several HMO targets production in gram-scales to support the functional studies of HMOs. Small-scale reactions were conducted to optimize reaction conditions before large-scale synthesis was carried out. Sugar nucleotide donors including UDP-GlcNAc and UDP-Gal donors were pre-generated, and used together with appropriate glycosyltransferases in a Stepwise One-Pot Multienzyme (StOPMe) synthetic platform for producing the target in a single reaction container. Thin-layer chromatography (TLC), Ultra High Performance Liquid Chromatography (UHPLC), and High-Resolution Mass Spectrometry (HRMS) were used for monitoring reaction processes. Tetrasaccharide and pentasaccharide targets were produced in 222 mM and 190 mM concentrations, in the reaction mixture for 100 mg-scale synthesis. They will be purified and the process will be used to guide the synthesis of targets in gram-scales.

Structure-Function Analysis of the TXS Enzyme in Taxol Biosynthesis

Ethan Wendell
Sponsor: Philipp Zerbe, Ph.D.
Plant Biology

Terpenoids are specialized metabolites produced by plants under certain conditions. These compounds can be harnessed for medicine, but are expressed naturally at low abundances. Characterization of terpenoid biosynthesis is integral to engineer increased yields of these compounds. Here, we present research on Taxol, a chemotherapeutic naturally produced in the yew tree (*Taxus* spp.). We aim to identify active site amino acid residues of taxadiene synthase (TXS) enzymes that impact catalysis. We employed homology modeling and ligand docking of TXS to determine residues crucial to product formation. We tested 7 native TXS enzymes and moved forward with the T. brev TXS enzyme to create 66 mutants via site-directed mutagenesis, expressed in *E.Coli* to compare enzymatic activity of mutants against wildtype. A majority of mutants had reduced enzymatic activity with no change in product profile. However, both the mutants TXS:Y668L and TXS:Y688L/Y684L produce a novel product not found in native T. brev. TXS. Following purification, we will determine its structure through NMR analysis. Active site mutations on TXS have ranging results and they reveal the necessary residues for enzymatic function. Our research contributes to deeper understandings of terpenoid biosynthetic pathways, enabling enzymes to be engineered in Taxol Production.

Thermal Characterization and Modeling of a CubeSat in Low Earth Orbit

Zachary White
Sponsor: Rich Whittle, Ph.D.
Mechanical & Aerospace Engr

The Space and Satellite Systems (SSS) club's REALOP mission is to create a 2U CubeSat which is designed to deploy out of the ISS. As a sub-department of SSS, Structures Thermal Analysis' (STA) goal is to simulate the thermal environment of a transient low earth orbit around the Earth to verify CubeSat nominal temperatures. To create the simulations, STA utilizes Thermal Desktop to build a thermal model of the CubeSat. These simulations will help determine which components aboard the CubeSat need to be adjusted or reinforced thermally. The software CES Edupack is used to gather optical and thermophysical properties required to fully detail the CubeSat model. STA is in the process of modeling the entire structure with internal components to understand the temperature changes the CubeSat will undergo as it is exposed to the extreme space environment. This will showcase the effects of radiation on the external faces of the structural frame, as well as internal heat transfer between the inner components/faces of the frame. The overall goal of the STA team is to ensure the CubeSat stays thermally safe throughout its operational lifespan.

Using Non-Invasive Ultrasound Technology to Monitor Cardiac Activity In Cultured Red Abalone (*Haliotis Rufescens*)

Naomi Wiemken
Sponsor: Jason Gross, Ph.D.
Animal Science

Abalone (*Haliotis* spp.) are edible, herbivorous, marine snails with over 100 species found worldwide, seven species of which are located along the coast of California. All California abalone species are listed as endangered or critically endangered species by the International Union for Conservation of Nature (IUCN). Abalone conservation and restoration efforts for these abalone species have been implemented, including captive breeding and outplanting programs. Traditional abalone health assessments, such as cardiac exams, involve drilling into the shell to insert electrodes above the heart or require the attachment of sensors to the shell, causing excessive handling stress to the animal and as a consequence can lead to mortality of these endangered animals. The objective of this study was to reduce handling stress during routine cardiac assessments using non-invasive ultrasound technology under control conditions, during routine animal care, and other various potential stressors. In this study, cultured red abalone (*H. rufescens*) were used as a proxy for endangered black abalone (*H. cracherodii*) to assess cardiac activity. Monitoring cardiac activity using non-invasive ultrasound imaging technology can be a useful tool to inform abalone captive breeding and restoration programs to enhance animal welfare.

The Squeezing of Trapdoor Spider Populations on the California Coast

Colton Wiggins
Sponsor: Jason Bond, Ph.D.
Entomology/Nematology

The trapdoor spider *Aptostichus stephencolberti* is endemic to the fragile and shifting coastal dune ecosystems where they construct silken burrows into dune faces. These isolated and threatened coastal populations will likely experience intensifying coastal squeeze with predicted sea level rise and encroaching development. To understand their population dynamics and ecological role, population surveys were completed at two state beaches along the Central California coast during the 2022 and 2023 summer field seasons. Our main objective was to estimate population size and population density of *A. stephencolberti*. Our second objective was to determine if a relationship exists between spider density and native plant density. We took photographs of each sample plot and identified the plant species present and the percent plant cover. We then tested whether trapdoor spider burrow density was correlated with the presence of native versus non-native plants and plant density. These relationships could potentially inform future conservation strategies.

Do Bumble Bee Species Differ in Phenology?

Haylie Wilcox
Sponsor: Elizabeth Crone, Ph.D.
Ag Evolution & Ecology

Bumble bees provide crucial ecosystem services through pollination, with the timing of their activity determining the plants they pollinate. Despite this pivotal role, bumble bees are often grouped as a single taxon, disregarding the 25 species found in California alone. While some differences among species, like morphology, are well-documented, others, including activity periods, are less well-understood. We compared the timing of life cycle events, such as emergence, colony growth, and reproduction among nine bumblebee species. We then tested whether these differences were associated with traits. Our hypotheses included (1) larger-bodied bees would have narrower activity periods, (2) above-ground nesting bees would emerge earlier, and (3) tongue length would match flowering time for different-sized plants. To quantify phenology, we conducted weekly surveys from June to October at Sagehen Creek in the Sierra Nevada, recording bumble bee species, behavior, and available floral resources. The nine bumble bees differed significantly in mean activity dates and duration of their activity periods. This variation was associated with tongue length but not significantly with body size or nesting location. Through distinct activity periods, the differing species may facilitate prolonged pollination services throughout the growing season, underscoring the importance of species diversity, even within a single genus.

Microbially Mediated Weathering in the Basaltic Lava Caves of Lava Beds National Monument, CA

Caden Williams
Sponsor: Christen Grettenberger, Ph.D.
Environmental Toxicology

Cooled lava provides new sterile habitat for life to colonize and contains plentiful nutrients, however, these nutrients are initially difficult to access for most life. Weathering of the rock makes these nutrients more available. On Earth, weathering is controlled not only by wind and water, but also by life. It is important to distinguish the influence of living versus nonliving influences on rock weathering because this could serve as a sign of life in the rock record of Earth and potentially other planets. To understand the significance of life on weathering, we looked at microbial growths on lava cave walls in Lava Beds National Monument, CA. This dry environment reduces the amount of weathering done by water, and instead allows us to focus on weathering done by the microbial communities. We took samples from three lava caves that include the microbial communities, weathered rock, and unweathered rock. We will examine the chemical differences between altered and unaltered rock, and plan to identify the associated microbial communities in the future. We expect that the rock directly beneath the microbial communities will have more accessible nutrients than the unaltered rock.

Applying Geometric Characteristics Allowing Single Sheet Two Dimensional Materials to Take a Structurally Apt Three Dimensional Form Through Simple Cut and Fold Manufacturing/ Assembly Processes

Anika Williams
Sponsor: Christina Cogdell, Ph.D.
Department Of Design

By incorporating and manipulating multiple geometric cutting patterns within a single sheet of material, I seek to create more complex forms and mechanical properties (such as bistability, auxetic properties, or increased stiffness and rigidity) that can be rapidly fabricated through cutting and folding processes alone. I utilize laser cutting rather than other fabrication methods such as 3D printing or molding for its ability to be rapidly executed, modified with ease, and accommodating of a larger range of materials. Additionally, due to the constraints that laser cutting must occur on a flat, single sheet of material, final products can be transported efficiently, and quickly assembled in place due to the knowledge of assembly embedded within the materials cuts. The material homogeneity and lack of adhesives, may also ease disassembly and make recyclability more efficient. When selecting patterns to work with, scalability was invaluable as it implies these structures will be viable for use ranging from product design to architectural design. I've produced a familiar chair form as a demonstration of the utilization of this fabrication and assembly method.

Historical Ecological and Stable Isotope Research on Faunal Remains from CA-ALA-11

Moonlily Winokur
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

CA-ALA-11 is an ancestral Ohlone site located in the modern-day city of Alameda, and primarily dates between 3000 and 1400 BP, or the Early through Middle Phase 2 periods. Excavations ahead of a major redevelopment of the Alameda Marina resulted in a large assemblage of fauna. With support from the MLD, we conducted C, N, and S stable isotope analyses on a selection of fauna with the goal of examining the historical ecology of several key species, including otter, deer, elk, and canids (including coyote and dog). Results show clear isotopic partitioning between species, indicating unique foraging niches. We also compare isotopic signatures of bone tools vs. unmodified faunal remains for elk, deer, and canid. Results show overlapping isotopic ranges, suggesting bone tools were made from the same pool of animals as those that were unmodified, which supports local on-site production of bone tools from locally procured animals.

Identifying Rumen Microbes Involved in Milk Fat Depression

Lynn Wolfe
Sponsor: Timothy Hackmann, Ph.D.
Animal Science

The dairy cattle industry has been negatively affected by milk fat depression, a nutritional disorder that decreases milk fat yield by margins up to 50% and thus reduces economic profit. During the biohydrogenation process, ruminal microbes convert unsaturated fatty acids to saturated fatty acids, producing unique intermediates that inhibit milk fat synthesis. Our hypothesis is that many ruminant microbes are responsible for producing these unique fatty acids despite the failure of traditional methods to identify them. We aim to identify and characterize the ruminant microorganisms which produce the unique fatty acid intermediates. Our experimental method involves a targeted approach of searching for microbes via isolation and culturing through thin-layer chromatography (TLC) and gas chromatography (GC). We will then characterize the microbes by measuring their growth. We expect to discover microbes, including AP1 and C1.1 strains, which produce detrimental fatty acid intermediates such as *trans*-10, *cis*-12 conjugated linoleic acid. Identification of microbes involved in the biohydrogenation process of milk fat depression will help advance treatment options for affected cattle and improve economic profit for dairy farmers.

AI-Enhanced Precision in Identifying Sentinel Lymph Node Metastases in Breast Cancer Patients

Ian Wong
Sponsor: Mohsen Mesgaran, Ph.D.
Plant Sciences

The prognosis of breast cancer is critically dependent on the presence of metastases in sentinel lymph nodes (SLN). Traditional histopathological examination of these nodes, while standard, is labor-intensive and may miss small metastatic occurrences. Recent advances in pathology have seen the rise of convolutional neural networks (CNNs) as a transformative tool, particularly in automating the analysis of whole-slide images (WSIs). This study focuses on assessing the effectiveness of a CNN-based model in identifying lymph node metastases in breast cancer patients. The study utilized a public dataset from the PatchCamelyon (PCam), and a total of 80,000 patches of healthy tissue and 80,000 patches of metastatic tissue were assessed in the training set, while 57,458 patches of pathological tissue were evaluated in the test dataset. Considering the classification by board certified pathologists as a reference, the trained deep net showed high accuracy (0.937), precision (0.971), validation AUC (0.979), and a low validation loss of 0.016. Our data show that a deep learning system can be trained to recognize metastatic cancer, outperforming pathologists under time constraints (mean AUC of 0.810), showcasing its potential for clinical application.

The Effects of Persistent Habitat Fragmentation on Californian Narrow-faced Kangaroo Rat (*Dipodomys venustus*) Haplotype Diversity

Alyssen Wong
Sponsor: James Statham, Ph.D.
Veterinary Genetics Lab

The Narrow-faced Kangaroo Rat (*Dipodomys venustus*) is a rodent species endemic to California which can be further separated into three subspecies: *Dipodomys v. venustus, Dipodomys v. elephantinus,* and *Dipodomys v. sanctiluciae*. Each subspecies has a different listing pertaining to their endangerment status, thus, an improved understanding of *D. venustus* phylogeny and diversity would help direct conservation efforts. I received tissue samples from the general Santa Cruz area and extracted DNA from each individual. Mitochondrial DNA was sequenced to identify each species. Haplotypes were assigned to investigate the phylogenetic relationship between individuals using MEGA and Networks. The phylogeny includes BLAST sequences of *Dipodomys simulans*, an outgroup species. Three clades were produced within the range of *D. venustus*. The substructure of the northernmost clade is consistent with the named subspecies, *D. v. venustus.* and *D. v. sanctiluciae.* Two clades in the south were phylogenetically closer to *D. simulans*, possibly indicating that the field samples are not truly *D. venustus*. If this relationship is upheld with nuclear DNA, then these findings would suggest an update to range maps for *Dipodymus* species in the area. This data is foundational for future experiments aiming to clarify the assignment of subspecies statuses within the Genus *Dipodomys*.

Maternal Mortality Analysis: Insights from Nepal and Neighboring Nations

Michelle Wong
Sponsor: Danielle Harvey, Ph.D.
MED: Public Health Sciences

Maternal mortality is a critical indicator of population health, providing insights into the well-being of mothers during and post-childbirth, while also serving as a crucial metric for evaluating a nation's overall health infrastructure. Given the financial challenges associated with conducting a complete census, countries often turn to survey sampling for a pragmatic approach. This study employs Nepal's 2016 Demographic Health Surveys to calculate various Maternal Mortality Rate (MMR) indicators, with a particular focus on age and region stratification. Conducted during an internship with the Indian Health Services (IHS), the project addresses the need for accurate measurement of maternal mortality indicators among indigenous populations. Analyzing responses from 12,862 individuals, the study provides valuable insights into trends at both national and subnational levels. The analysis revealed an Age Adjusted Pregnancy Related Mortality Rate (AAPRMR) of 221 deaths per 100,000 live births, with Province 2 being the highest. These findings underscore the importance of policy initiatives to improve maternal health outcomes, particularly in regions with higher mortality rates, and we will apply this methodology to other nearby countries' Demographic Health Surveys, to enrich our understanding of maternal health around the globe.

Identification of Novel Marker for Differentiation-Committed Oligodendrocyte Precursor Cells

Evelyn Wong
Sponsor: Fuzheng Guo, Ph.D.
MED: Neurology

Oligodendrocyte precursor cells (OPCs) play a crucial role in central nervous system development and function by giving rise to mature oligodendrocytes, which are essential for myelination. Differentiation committed OPCs (COPs) are intermediates between proliferating OPCs and newly formed oligodendrocytes (NFOLs) and play an important role in myelin repair. In this project, we aim to characterize Inositol 1,4,5-trisphosphate receptor, type 2 (ITPR2) for oligodendrocyte lineage cells, thus facilitating neuroscience research for cell population identification. Previous single-cell RNA-sequencing data indicates that ITPR2 is upregulated in both COPs and NFOLs. Markers currently used for identifying COPs and NFOLs rely on scRNA-sequencing, in addition to immunohistochemistry. ITPR2 would be a more efficient marker as it relies solely on immunohistochemistry methods to effectively label oligodendrocyte lineage cells. We will use different oligodendrocyte developmental stage-specific markers to show which cell subpopulation is enriched with ITPR2. This will refine our understanding of oligodendrocyte and myelin biology and can be applied to future research related to myelin-related disorders.

CRISPR-Mediated Base Editing for Freezing Tolerance in Lettuce

Dylan Wong
Sponsor: Richard Michelmore, Ph.D.
MED: Medical Microbiology & Imm

During the winter, frost damage is prevalent in several lettuce growing regions. C-repeat binding factors (CBFs) are transcription factors that activate the expression of genes useful to counteract many abiotic stressors, including freezing. The majority of lettuce cultivars have a premature stop codon in the CBF7 gene, leading to frost susceptibility, whereas freezing-tolerant cultivars contain the full-length version of the gene. Utilizing a Cas9 nickase engineered to have a flexible PAM site fused to an adenine deaminase, we aimed to change the premature stop codon (TAG) into a tryptophan (TAA) creating a full-length CBF7 gene in domesticated cultivars 'Cobham Green' and 'Salinas'. We recently confirmed four plants of Cobham Green that have the correct nucleotide change and are currently screening 'Salinas' to determine whether any of those have been successfully edited. The next steps involve analyzing gene expression levels of the CBF7 target gene, LsGols1, which should be upregulated in response to cold if the edited CBF7 gene is functional and conducting freezing tests on the edited lines. This research is pioneering the new frontier of base editing in lettuce: through the usage of similar constructs we hope to induce tolerances to other abiotic stressors such as drought and herbicides.

Delivery of mRNA with Lipid Nanoparticles to Cerebral Ventricles In Utero Leads to Global Brain Transfection

Jessica Wong
Sponsor: Aijun Wang, Ph.D.
Biomedical Engineering

In utero mRNA-based treatments offer promising care for treating central nervous system (CNS) disorders before disease onset but there is a lack of safe and effective delivery vehicles. We demonstrate that densely PEGylated lipid nanoparticles (ADP-LNP) can serve as a platform for development of in utero mRNA-based therapeutics. ADP-LNPs containing Cre-mRNA were administered to fetal Ai9 mice through in utero intracerebroventricular (ICV) injection and a cesarean section was performed 48 hours later. Flow cytometry showed that 29.3% of the fetal mouse brain cells were td-tomato positive and therefore had been successfully transfected. Additionally, immunohistochemistry (IHC) staining was performed and showed that the majority of edited cells are Sox2+, Nestin+, and Ki67+ neural stem cells. These results confirm the specificity and efficacy of ADP-LNP-mediated mRNA delivery to target progenitor cell populations within the fetal brain. These target cells have the potential to proliferate and expand to generate high levels of transfection as the brain develops, offering this as a promising treatment for neurodevelopmental disorders.

Defining the Estrogen Synthesis Pathway in the Zebrafish Ovary

Melinda Wong
Sponsor: Bruce Draper, Ph.D.
Molecular & Cellular Bio

The estrogen 17ß-estradiol (E2) is a key sex hormone involved in vertebrate female sex determination and reproductive function. There are two possible pathways for E2 synthesis in animals, but the pathway used by zebrafish is not known. Both pathways require Cyp19a1a as a key enzyme. In Pathway 1, Hsd17b3 converts androstenedione to testosterone which Cyp19a1a converts to 17ß-estradiol. By contrast, in Pathway 2, Cyp19a1a converts androstenedione to estrone (E1) which Hsd17b1 converts to 17ß-estradiol. Previous research in the lab found that *hsd17b1*, but not *hsd17b3*, is expressed in the ovary, leading to the hypothesis that the zebrafish ovary utilizes Pathway 2 for 17ß-estradiol production. To test this, we have produced *hsd17b1* mutants, and I have found that they all develop as males, showing that *hsd17b1* is necessary for female development. In future experiments I will determine if *hsd17b1* is sufficient for female development by producing a transgenic animals that over expresses this enzyme in developing gonads. These results will help better determine the genes necessary for regulating zebrafish sex determination.

Crossover Regulation in *C. elegans* Oogenesis and Spermatogenesis

Brian Wong
Sponsor: Joanne Engebrecht, Ph.D.
Molecular & Cellular Bio

Homologous recombination (HR) is an important pathway for the formation of crossovers, which are essential for proper segregation of homologous chromosomes. Errors in crossover formation and resolution are disastrous, often leading to nondisjunction and congenital defects. Thus, understanding the proteins involved in HR is key for better understanding genetic disorders.

Holliday junctions are intermediates formed during HR that must be resolved via crossover pathways to properly separate homologous pairs. In *C. elegans*, elevated counts of RAD-51 foci observed in *him-18* mutants indicate that HIM-18 has a role in damage repair during DNA replication and meiotic recombination. This suggests that HIM-18 serves as a platform for crossover-type resolution pathways.

The literature surrounding differential regulation of crossovers indicates that female meiosis is more error prone than male meiosis, but the mechanisms are still being investigated. Here, I used GFP marked COSA-1, a crossover associated protein, in *him-18* mutants to track the number of crossovers in spermatogenesis and oogenesis. I observed fluctuations in the number of COSA-1 foci in *him-18* oogenesis and am currently constructing strains to allow analyses of spermatogenesis. These studies will provide insight into the differences in crossover regulation between sexes, deepening our knowledge of how organisms regulate meiosis.

Word Learning in the Second Year of Life

Myra Wong
Sponsor: Simona Ghetti, Ph.D.
Psychology

The goal of this project is to investigate word learning in 18- to 23-month old toddlers. We administered a task in which infants *(N*= 48) were presented with three unique 3D printed objects that did not reflect common objects: the target object, was given a monosyllabic name (e.g., “stip”, “croy”); the unnamed object, was played with equally to the target object but was not named; and the novel object, which was not named nor given special attention. After learning the label for the target toy, participants were asked to identify which of the three toys corresponded to the target (i.e., “Can you give me the stip?”). Participants were tested immediately after one-week, and evaluated again after an additional opportunity to learn at the end of the one-week test. We expect toddlers to remember the word labels across all testing occasions, but we will examine factors such as age, duration of sleep, and SES which may be associated with individual differences in episodic memory. We also plan to evaluate whether there are age differences in the type of errors toddlers make (i.e., choosing the novel toy versus choosing the unnamed toy).

Identifying Epithelial-specific Cell-cell Fusion Proteins Using Viral Fusogen p14FAST

Cecelia Wong
Sponsor: Soichiro Yamada, Ph.D.
Biomedical Engineering

Cell-cell fusion has been observed in cancer development and proposed to play a role in carcinogenesis, cancer metastasis, and resistance to chemotherapy. Epithelial cells do not normally fuse, however, viral fusogen protein p14FAST can activate cell-cell fusion machinery in epithelial cells. So far, few endogenous proteins associated with the pathway of p14FAST-mediated fusion have been discovered. Using Biotinylation IDentification analysis (BioID), proteins proximal to p14FAST before and during cell-cell fusion were detected with mass spectrometry. Actin regulators were identified in pre-fusion cells while transmembrane proteins and membrane regulators were identified in fused and fusing cells. Top candidates were selected and over-expressed in fusing cells to test their effect on cell-cell fusion efficiency. If the candidate protein is involved, perturbation of the protein level may compromise or facilitate fusion efficiency. These newly identified epithelial-specific cell fusion regulators may play a role in cancer cell fusion. Therefore, our study provides the first step in understanding cell-cell fusion mechanisms and potentially determining the endogenous machinery used by cancer cells.

Top 3 Yeast Strains for Grape Pomace and Almond Hull Bioconversion to Saturated Fatty Acids

Glory Wongmahapaul
Sponsor: Kyria Boundy-Mills, Ph.D.
Food Science & Technology

This study aims to identify yeast strains within the UC Davis Phaff Yeast Culture Collection capable of converting almond hull and grape pomace into oil containing highly saturated fatty acids. The research was conducted in the Jeoh and Boundy-Mills labs, where the almond hull and grape pomace were processed, hydrolyzed, and ingredients identified. More than 300 yeast strains from the Phaff collection were tested with different carbon sources present in the almond hull and grape pomace hydrolysates to assess their ability to consume sugars and tolerate inhibitors within the hydrolysates. The majority of yeast strains grew on agar plates containing almond hull and grape pomace hydrolysates, indicating tolerance to growth inhibitors such as polyphenolics. However, only some yeasts can consume galacturonic acid, which makes up 30% of the almond hull hydrolysate.A heat map was utilized to select the top 20 yeast strains for the subsequent phase, according to their oil yield and composition. The Vahmani lab will perform analysis using GC-MS to determine fatty acid compositions.This study aims to highlight top 3 yeast strains in bioconversion processes, emphasizing their role in the sustainable production of saturated fatty acids through the utilization of upcycled ingredients.

Fish Bones from an Ancestral Ohlone Site in Fremont, CA

Hannah Wood
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

In preparation for a new housing development, archaeological excavations were conducted at a site in Fremont, California. A series of radiocarbon dates show that the site was occupied for a short period of time between 1350 and 1200 years ago. At that time, the site sat on the banks of a channel of Alameda Creek, and was about four to five kilometers from the bayshore. In collaboration with the local Ohlone group, further analyses of fish bones were conducted in the Archaeometry Lab at UC Davis to learn about paleo-ecology and how people occupying the site used local wetlands and/or bay resources. Species identified include Sacramento sucker, longjaw mudsucker, sculpin, silversides, herring, surfperch, and salmon. These results show that site occupants accessed species that inhabited both local freshwater creeks as well as San Francisco Bay. Measurements of bones allow us to estimate original fish lengths. Results of the measurements show that people harvested mainly small-bodied fishes during site occupation. A sample of bones are currently being prepared for future stable isotope analyses to examine paleo-ecological adaptations of particular species to local environmental conditions just before the onset of the Medieval Climatic Anomaly (ca. 1200 BP).

Genomic Diversity Within the Genus *Xiphophorus*

Jalena Wouters
Sponsor: Connie Champagne, Ph.D.
Educational Enrichment & Outre

Advances in genome sequencing have revolutionized our ability to understand genetic properties and evolutionary histories of species. One model system is the swordtail fish, genus *Xiphophorus*. Morphological variation makes *Xiphophorus* ideal for studying trait evolution, and hybrids are promising models for oncogene studies. Although *Xiphophorus* has the potential to advance research in biomedical research and evolutionary biology, little is known about the organization of *Xiphophorus* genomes. The objective of this study is to characterize differences in the genomes of nine *Xiphophorus* species. Heterozygosity, runs of homozygosity, and structural variants were quantified, and we constructed pairwise sequentially Markovian coalescent (PSMC) datasets to investigate demographic histories. Heterozygosity varied dramatically between species. Our results suggest that *X. cortezi* has the most genetic variation in heterozygosity in structural variants, consistent with the results of PSMC. In contrast, PSMC inference suggests a small, declining population of *X. malinche*, concordant with low rates of genetic diversity in this species. Preliminary satellite repeat interrogation suggests that *Xiphophorus* centromeres are composed of an 186 bp monomer. We successfully analyzed newly available *Xiphophorus* genomes. Our findings confirm known demographic trends between *Xiphophorus* species, characterize new complex regions of the genome, and serve as a quantitative resource for future investigations.

Exploring Genomic Control of Mutation Spectra in *Arabidopsis thaliana*

Sydney Wren
Sponsor: John Monroe, Ph.D.
Plant Sciences

Mutations are the balance between DNA damage and repair. Studying variation in mutation patterns across a population can give us insight into various contributions of different types of damage as well as reveal variation in the cellular response to said damage. The mutation spectrum refers to the relative frequencies of genetic mutation types, and can vary between and within species. Utilizing various bioinformatics tools, I was able to quantify the mutation spectra of singletons in 1001 *Arabidopsis thaliana* natural accession. I then conducted a genome wide association study (GWAS) on the varying proportions of each substitution type using GEMMA. This study identifies genetic loci association with different mutation types, generating future hypotheses for underlying mechanisms contributing to adaptation repair mechanisms. Eventually, I hope to study the relationship between climate variables and the mutation spectrum in *A. thaliana*. This research will contribute to a deeper understanding of plant evolution and adaptation.

The Effects of Social Stress on C-fos Activity in the Medial Prefrontal Cortex of *Peromyscus californicus*

Sophia Wright
Sponsor: Brian Trainor, Ph.D.
Psychology

It is unknown how acute social stress affects the activity of the medial prefrontal cortex (mPFC) during social behavior. We want to examine how social stress affects layers II/III and V/VI in the prelimbic (PL) and infralimbic (IL) cortexes of the mPFC. We hypothesized that higher neuronal activity in the mPFC will be associated with more socially anxious behavior. Mice (*Peromyscus californicus)* were randomly assigned to control or acute stress conditions. One hour after a behavioral social interaction test, mice were perfused and brains were collected. Immunohistochemistry was performed with a nissl/c-fos double stain to measure neuronal activity, and cell counting quantified c-fos expression in layers of the mPFC. Our preliminary findings suggest that there is no statistically significant difference in c-fos expression between control and stress groups in PL or IL. There was a positive correlation between c-fos expression and social approach in stressed males. This suggests activity in the IL cortex could drive higher social approach or that social interactions increase neural activity in the IL. We plan to repeat these experiments to see if correlations persist with a larger sample size and further investigate the IL cortex's role in modulating behavior in male mice.

In-Situ Densification of Ultra-High Temperature Ceramics for Hypersonic Flight

Justin Wu
Sponsor: Scott Mccormack, Ph.D.
Materials Science&engineering

Ultra-high temperature ceramics (UHTCs) are materials with melting points exceeding 3000 ºC. These materials possess significant potential for driving technological advancements in re-entry vehicles, nuclear thermal propulsion, and hypersonic applications. However, the effects of processing variables on the structural flaws of UHTCs are not well understood, and these flaws will serve as failure initiation points due to the brittle nature of these materials. This project aims to use in-situ micro-computed tomography (µ-CT) to analyze the structural evolution of ZrB2, a UHTC, during densification. The McCormack Lab has manufactured two lamp furnaces capable of interfacing with synchrotron x-ray sources and achieving temperatures capable of densifying ZrB2. Multiple ceramic samples were fabricated, and preliminary in-situ µ-CT was conducted at Lawrence Berkeley National Laboratory's Advanced Light Source (ALS) synchrotron. 3D image analysis software was used to characterize three-dimensional structural features. Additional samples will be fabricated to validate the temperature capabilities of the octopole lamp furnace for further in-situ studies. Future research involves µ-CT analysis with the octopole furnace at the ALS and the Cornell High-Energy Synchrotron Source (CHESS) to fully characterize the structural evolution of ZrB2. This work is funded by the Air Force Office of Scientific Research (AFOSR) under award: AFOSR 21RT0865.

Education's Role in Revealing Ability in the Labor Market

Evan Wu
Sponsor: Erich Muehlegger, Ph.D.
Economics

College education has long been considered a signal in the labor market: employees attend college to signal that they are skilled, and employers pay them higher wages upon receiving the signal. However, more recent research suggests that college instead directly reveals a worker's ability, allowing employers to pay them accurate wages initially, while employers must learn about the ability of non-college graduates over time. As such, college can greatly benefit minorities by allowing employers to see their ability directly, rather than relying on biases based on their demographic to guess potential performance. However, college graduation rates have risen drastically over the past few decades, and the nature of college itself has changed alongside it. By running regressions on the National Longitudinal Survey of Youth, a labor market survey conducted by the Bureau of Labor Statistics, I will be testing whether this revelation of ability model still holds in today's colleges and labor market. Initial findings reveal that this model holds inter-, but not intra-industry, suggesting that college now only reveals aptitude for a particular industry over others, but not how well one will perform in that particular industry.

Exploring Parental Gestures During Infancy

Zixian Wu
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Parents tend to speak with a high pitch and simple vocabulary when communicating with infants. Because language is multimodal, parents may also adjust their gestures for infants, similar to infant-directed speech. Previous studies showed that 10-month-olds understand parents' pointing. However, they do not understand representative gestures such as iconic gestures that depict aspects of a referent by adjusting hand forms (e.g., cupping hands depict a round shape for a ball) until 26 months. Little is known about whether parents adjust their gestures based on infants' communicative repertoire. This study explores how parents' representative and non-representative gesture types change based on infant age between 10-20 months. 46 parent-infant dyads (*M*age=14 months) participated in a 6-minute play session. We coded parents' gestures as deictics (e.g., pointing), iconic, conventional (i.e., thumbs up), and object manipulation (i.e., moving a toy back and forth). Considering the developmental milestones, we predict that parents will use more representative gestures (e.g., iconic) and fewer non-representative gestures (i.e., deictics, object manipulation) with older infants than with younger infants. These findings can enhance our understanding of whether infant-directed patterns extend beyond speech.

Parent-Child Touch and its Impact on Infants' Word Recognition

Judy Xiong
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Parental responsiveness is crucial for infants' language learning. Infants whose parents are attentive to their interests tend to know more words than infants whose parents are not. However, it is not well understood how touch in parent-child interaction benefits infants' word recognition. To fill this gap, we conducted a study of forty-eight 11- to 15-month-old infants engaged in book reading and toy-play activities with their caregivers. Both the books and toys included animals (e.g., cow, horse). Subsequently, infants participated in a looking-while-listening word recognition task for sets of animal items with 4 levels of familiarity: items that appeared in the book and toys, book only, toys only, or no prior exposure. Infants' performance on word recognition tasks is evaluated by measuring the proportion of correct looking time to a named animal (e.g., "Look at the cow."). We predict that the more frequent parent-child touch occurrences during the play and book sessions, the better the infant's performance at the word recognition test. These findings will shed light on the benefit of parent-child touch interaction on infants' lexical learning.

Characterization of an Autism-Associated Gene *WDFY3* in Zebrafish

Emily Xu
Sponsor: Megan Dennis, Ph.D.
MED: Biochem & Molecular Med

Autism Spectrum Disorder (ASD) affects approximately 1 in 36 children in the United States and the primary causes remain mostly unknown due to its genetic and phenotypic complexity. A subtype of ASD with disproportionate megalencephaly (ASD-DM) is associated with more severe cognitive impairments. Our lab recently identified 153 candidate genes carrying *de novo* loss-of-function mutations, including some well-known, high-confidence genes with validation studies in knockout animal models. Nevertheless, over 100 of these candidate ASD-DM genes remain functionally uncharacterized. To characterize the impacts of genes on neurodevelopment at scale, we propose performing CRISPR gene-editing in zebrafish larvae coupled with automated morphological phenotyping to identify impacts on brain size. To validate our method, we will start with a high-confidence ASD-DM, *WDFY3*, in which we expect to see an enlarged brain compared to controls as previously described in mouse models. Moving forward, we will test additional candidate genes using our zebrafish system. Ultimately, our objective is to develop a pipeline capable of identifying true ASD-DM candidate genes that can be further detailed in more expensive, lower-throughput mammalian model systems, aiming to increase our understanding of the etiology of this condition.

Roles of Essential DNA Polymerases and Flap Endonucleases in the Maturation of Crossovers During Meiotic Recombination

Zhenghua Xu
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

Crossing over during meiosis is essential for the accurate segregation of homologous chromosomes into gamete cells, and contributes to genetic diversity among progeny. Each pair of homologous chromosomes attains at least one crossover through the formation and biased resolution of double-Holliday junction (dHJ) intermediates. Although the steps leading to dHJ formation are well understood, how dHJs are resolved specifically into crossovers remains unclear. Our lab proposes a model in which MutLγ, a DNA endonuclease creates strand-specific nicks in dHJs to direct crossover-specific resolution. This model predicts the formation of immature crossover products containing single-stranded gaps and flaps that require DNA polymerases for gap filling and trimming by flap endonucleases to form a mature crossover outcome. Because these enzymes are crucial for early steps in recombination, we are constructing auxin-inducible degron alleles that enable real-time degradation of these proteins to study their roles. These experiments combine our degron alleles with a cell synchronization system to readily deactivate polymerases and endonucleases specifically at the time of dHJ resolution. This project seeks to confirm that immature crossover products are an intermediate in crossing over and to identify key factors in their processing, filling a significant gap in our understanding of meiotic crossing over.

The influence of at home pet experience on infant looking behavior in visual search arrays

Jing Xu
Sponsor: Lisa Oakes, Ph.D.
Psychology

Given that infants learn about their environment through looking, a crucial research goal is understanding the influences that shape where and how long they look. Previous literature supports infant's tendency to look at familiar stimuli compared to unfamiliar ones, such as maintaining longer visual attention to the faces of their racial group (Kelly et al., 2007) or to dogs and cats when infants have previous pet experience (Hurley, 2010). However, we currently know little about how familiarity may affect looking behaviors during a visual search array with several images. We are testing this in an ongoing study with 8-month-old infants, some with pets at home and others without. We record infants' eye movements as they view arrays of four animals. One of the animals is a dog or cat and the other animals are less familiar. We will measure infants' preference for pets by calculating the proportion of first looks and the relative proportion of looking time to each animal category. We hypothesize that infants with pets at home will show greater proportion of first looks and more overall looking time towards pets, demonstrating that infants' familiarity with pets at home influences how they direct their attention in this task.

A Comparison of the Natural Bobtail Variant between Domestic Dogs and Wolves

Claudia Xu
Sponsor: Anita Oberbauer, Ph.D.
Animal Science

The natural bobtail phenotype is when dogs have shortened tails from a mutation in exon 1 of the T-Box Transcription Factor T (*TBXT*) gene. This study aimed to determine whether wolves have the same variant that exists in domestic dogs. Thirty-one wolf tissue samples were collected from various regions of Alaska and Montana. Although there was no phenotypic information that accompanied the samples, 17 samples were from the Prince of Wales Island (POW) in Alaska, where wolves with short tails have been observed. DNA was extracted from the tissue samples. The 17 POW samples were tested for the *TBXT* variant at the UC Davis Veterinary Genetics Laboratory. These wolf samples did not have the natural bobtail variant. Three of the POW samples were then amplified with variant-specific primers for exon 1 using a standard PCR protocol followed by Sanger sequencing. The sequences were aligned with a sample from a known long-tailed dog and showed no differences throughout the exon. Future data collection will require phenotype verification from short-tailed wolves. Sequencing of the remaining *TBXT* exons may give insight to confirm if there is another variant in this gene that may be involved in wolf tail length.

Effects of Cell Immortalization on Protein N-glycosylation

Anirudh Yadlapati
Sponsor: Carlito Lebrilla, Ph.D.
MED: Biochem & Molecular Med

Biological experiments rely on *in vitro* models employing immortalized cells for their ease of handling. However, the process of immortalization, often involving the introduction of proliferation-promoting genes like CDK4, can have unpredictable effects on cell physiology. One physiological process affected by alterations is N-glycosylation, a post-translational modification crucial for modulating protein structure and function. Utilizing LC-MS/MS, we analyzed N-glycosylation patterns in a human lung cancer primary cell line (DTW75) and its corresponding immortalized cell line (GLC01) to elucidate phenotypic changes resulting from CDK4 transfection. Over a 31-day culture period, cellular N-glycans were analyzed at various time-points. Our nanochip-QToF LC-MS/MS analysis revealed variations in the expression levels of sialylated, fucosylated, and sialofucosylated N-glycans between the two cell types following transfection. Notably, immortalized cells exhibited higher abundance of complex-type fucosylated and sialofucosylated N-glycans, whereas primary cells displayed increased levels of hybrid- and complex-type sialylated N-glycans. Furthermore, we observed changes in the N-glycosylation patterns of immortalized cells over the 31-day culture, characterized by an increase in sialylated, fucosylated, and sialofucosylated N-glycans alongside a decrease in high-mannose N-glycans. Understanding these differences between primary and immortalized cells, along with alterations during cell culture, provides insights into the impact of immortalization on protein glycosylation.

Examining the Impact of Face Concern on Self-Disclosure among a Multicultural Sample

XINLEI YAN
Sponsor: Nolan Zane, Ph.D.
Psychology

Face concern is a multidimensional concept wherein people of all cultures try to maintain and negotiate face in interpersonal communication revolves around the delicate balance individuals strive to maintain in preserving their self-image. Individuals attempt to maintain face to preserve their own self image. As such, face concern can affect the way we behave in society, including in therapeutic or clinical settings. The current study involves the transcription, review, and analysis of videotaped interactions between participants of varying ethnic backgrounds and a trained research assistant (confederate) to determine the impact of face concern on self-disclosure tendencies. Study participants (N = 372) completed a "Brick Test," a test for cognitive abilities, and were randomly assigned to receive either "fake" negative or neutral feedback about their performance on the test. The feedback process was recorded, and we are currently transcribing the audio recordings. We will conduct a thematic analysis of the qualitative transcripts this spring to generate initial codes and identify common themes. The implications of our qualitative results include gaining a deeper understanding of interactions between face concern and self-disclosure patterns among ethnically diverse patients, thus, empowering mental health professionals to develop more efficient and effective therapeutic intervention protocols for these patients.

Beyond the Swipes! Social Media Usage and Student Mental Wellbeings

Yuxin Yang
Sponsor: Azra Jahanitabesh, Ph.D.
Psychology

In the contemporary landscape, social media has become an integral part of individuals' lives, significantly influencing daily routines. This research project investigates the multifaceted relationship between social media usage patterns and their impact on mental well-being, with a focus on self-esteem, identity, comparison, and depressive symptoms. The study examines variables such as the time spent on social media, types of activities engaged in (e.g., passive scrolling, active posting), and social identity among college students.Approximately 100 UC Davis undergraduates participated in a 15-minute survey, providing insights into perceived and actual social media usage, self-esteem levels, and depressive symptoms. The research employs linear regressions and mediation analyses to unravel the intricate interplay between social media habits, self-esteem, and depression symptoms. The main hypothesis posits that increased passive social media use will exhibit positive correlations with depressive symptoms and lower self-esteem.By delving into these variables, the study aims to contribute valuable insights into the nuanced dynamics between social media engagement, social identity, and mental well-being among college students. The findings may inform strategies for promoting healthier social media habits and ultimately enhance the overall mental health of this demographic.

New Approach to Monitoring Body Temperature

Anthony Yap
Sponsor: Fumika Hamada, Ph.D.
Neuro Physio & Behavior

Quality sleep is essential for maintaining health, as sleep deficiency heightens risks of injury and mortality, and decreases productivity. Our research aims to improve overall sleep quality by understanding how body temperature affects sleep. We use the common fruit fly, Drosophila, as a model system for human body temperature rhythm (BTR), as circadian rhythm is conserved across flies and humans. Specifically, both fly and human temperatures increase during wakefulness and decrease during sleep. To understand how BTR and sleep interact, we developed a method to monitor BTR and sleep which combines day-night video recording and open-source motion tracking to measure the frequency, length, and preferred temperature of sleep. Using past research that defines fly sleep as five minutes of inactivity, we selected flies with mutated clock genes (per01) and compared their sleep behavior to wild-type flies (w1118 and Canton-S) across a temperature gradient of 18-32°C. Results show that longer sleep is achieved early in the night before shorter sleep in conjunction with the anticipation period. Flies exhibit longer sleep bouts coinciding with lower body temperature and shorter sleep bouts with higher body temperature. This pattern correlates with the sleep-body temperature relationship in humans.

Analysis of the Representation of Iraqis in the 1960s by the New York Times

Mahir Yasar
Sponsor: Suad Joseph, Ph.D.
Anthropology

How does the New York Times represent Iraqis in the 1960s? Using ProQuest and confining my search to front page articles, editorials, and articles, I screened a total of 867 articles, of which 17 were relevant to my research. The research was initially focused on NYT's portrayal of Iraq's new Prime Minister Karim Qasim and his sympathies with the socialist politics of the Soviet Union, which had increasing influence over the Middle East at the time, or the capitalist economic models of so-called "Western" states like that of the United States and the United Kingdom. The research focus then shifted going into 1962 and Qasim's socialist tendencies waned, the representation of Iraqi politics transitioned from an underdeveloped, politically unstable nation allying itself with the USSR to orientalism prominent among representation of the Arab world at large. One such depiction commonly found in this stage is that of Iraqi men as a primitive, barbaric demographic that is easily prone to violence and disruption. This research is part of a long-term analysis project of the NYT from 1850 to the present from the Suad Joseph Lab. The project analyzes the representation of Islam and Muslims over 150 years.

Assessing 24-48 Month Old Visual Short Term Memory Using A Touch Screen Change-Localization Task

Jessica Ye
Sponsor: Lisa Oakes, Ph.D.
Psychology

Visual short-term memory (VSTM) is the component of working memory that temporarily stores visual information. VSTM is necessary for cognitive processes such as learning. In children, VSTM is typically measured through *change detection* or *change localization* tasks in which an array of different objects (e.g., colored shapes) is briefly presented and after a brief delay the array reappears with at least one randomly selected object changed. In previous studies, infants' and childrens' VSTM has been measured through their looking behavior. In an adaptation of a task used by Simmering (2012), the present study utilizes a *change localization* task on a touchscreen tablet. We presented 71 children between the ages of 24- and 48-months with trials including the following sequence: an array of three colored circles, then a 300-ms blank *delay*, and finally a *test array* in which one randomly selected circle has changed color. The child's task is to select which item has changed by touching it. Our analyses will compare children's responses to change (0.33 because there are three items in the array) and across age. These results will help us understand how VSTM develops in young children.

Coupling Traumatic Brain Injury and Tau Expression in *Drosophila melanogaster* To Determine a Timeline From Neuronal Hyperactivity to Neuronal Death

Cheryl Yee
Sponsor: Kassandra Ori-Mckenney, Ph.D.
Molecular & Cellular Bio

In the cell, microtubules provide structural support and serve as tracks for cargo transport. Within neurons, the mutated form of a microtubule-associated protein called tau tends to self-aggregate, leading to neurodegenerative diseases known as tauopathies. In humans, traumatic brain injury (TBI) can cause neuronal death and the development of the tauopathy Alzheimer's disease. There is evidence that TBI may lead to acute neuronal hyperexcitability, which drives tau pathology. However, it is unknown how neuronal excitability leads to eventual neuronal death. My project will serve to determine how TBI coupled with tau expression leads to increased neuronal activity on a cellular level and delineate the timeline from hyperactivity to degeneration. To do this, I will employ the calcium-based neuronal activity sensor, CaLexA-LUC (luciferase), in *Drosophila melanogaster*. After administering TBI on the tau-expressing flies, if increased neuronal activity is maintained 2 or 3 weeks post-injury, this suggests that tau could promote its own disease progression. Overall, I expect to see an increase in neuronal activity in the tau-expressing TBI flies followed by neuronal death. Therefore, if I can outline the time course from head trauma to disease, preventative and therapeutic strategies can be developed in the future to interfere with tau pathogenesis.

The Health Highlight Student-Run Podcast: Identifying Inequities in Modern Healthcare Systems

Jennifer Yee
Sponsor: Talitha van derMeulen, Ph.D.
Neuro Physio & Behavior

Insufficient or inaccessible healthcare is a prevalent issue for many underrepresented groups in the United States. *The Health Highlight* student-run podcast aims to educate pre-health students about the needs of the populations they will provide for in the future, in order to pre-emptively help eliminate barriers to good healthcare many disadvantaged groups face. Examples of underrepresented communities that will be covered include rural communities, ethnic minorities, and the LGBTQIA+ population. Co-hosted podcast episodes will feature providers from multiple professions (medicine, dentistry, pharmacy, etc.) speaking about their experience with inequity in healthcare. Providers will also be asked what they believe are potential solutions to many of the systemic issues in their fields. Research will be conducted to enrich the podcast findings, and the additional information will be listed for listeners to delve further into each discussed topic. Podcast episodes will be published on the Spotify audio platform, with supplemental information and citations posted in each episode's notes. University pre-health students are the target audience for the podcast, and social media and advertising materials will be created to raise awareness. Drawing attention to the issues addressed on the podcast is the key to better health outcomes for underrepresented groups.

End Effector and Computer Vision System for an Automated Mushroom Harvester

Aditya Yerrabolu
Sponsor: Stavros Vougioukas, M.D.,Ph.D.
Biological & Ag Engineering

With consumer diets becoming more healthy, the demand for mushrooms has increased due to the excellent health benefits mushrooms provide. Despite mushrooms being a multi billion dollar industry, mushroom farmers struggle to find workers amidst the declining agriculture workforce. To combat this, robotics are being implemented across all areas of agriculture, including harvesting, but automated harvesting of mushrooms is under-explored, with current solutions often resulting in a lower quality product. Our research investigated the integration of mushroom-specific end effector and fine-tuned a computer vision model to the FarmBot, an open-source CNC (Computer Numerical Control) farming robot. After evaluating different end effectors for FarmBot integration, a pneumatic suction cup proved optimal. A vacuum system was found to minimize mushroom bruising during picking. The fine-tuning of our computer vision model involves a two-stage process which significantly improves processing time and accuracy: first, applying image segmentation technique using deep learning model, YOLOv8, to locate mushrooms in real time, followed by classification using MobileNet to determine mushroom ripeness. In conclusion, our research evaluated a cost effective robotic mushroom harvesting system that can ease the labor shortage while maintaining a similar quality of product to manual harvesting.

A Low Prevalence of the *FMR1* Premutation Allele Amongst Thai Women With Infertility Complications

Daryl Yeung
Sponsor: Flora Tassone, Ph.D.
MED: Biochem & Molecular Med

Fragile X syndrome (FXS), the most common inherited cause of intellectual disabilities and autism, results from an expansion of CGG trinucleotide repeats located in 5'UTR of the *FMR1* gene. Individuals with an allele containing 55-200 CGG repeats, named premutation (PM) carriers, are at risk of developing several conditions, including fragile X-associated primary ovarian insufficiency (FXPOI), which causes infertility and early menopause amongst women with a PM. Approximately 15-20% of female PM carriers experience FXPOI compared to 1% in the general population. Therefore, early detection for *FMR1* expansion is imperative to women's reproductive health, their offspring, and extended families. To address this problem, we have screened, for the presence of a PM allele, 1,250 blood samples collected from females in Thailand experiencing infertility complications using PCR-based approaches. We identified two women carrying a PM allele, yielding a low prevalence of 1:625 relative to other studied populations. Confirmatory testing, including Southern blot and PCR analysis, is in progress. Genetic counseling, clinical follow-up of identified individuals, cascade testing, and knowledge of carrier status can prompt lifestyle changes and are relevant, especially for the reproductive choices that become available for those previously unaware of their risk of having offspring with FXS.

Cyborg Biochar: Modifying Biochar with Iron to Increase Adsorption Capacity

Kristen Yeung
Sponsor: Sanjai Parikh, Ph.D.
Land Air & Water Resources

Biochar is a carbon-rich material produced through the thermal conversion of organic waste. It can potentially reduce greenhouse gas emissions, and when added to soil, biochar can improve the water holding capacity, decrease bulk density, buffer pH, and increase soil carbon sequestration. Additionally, biochar is a sorbent and can be used to remediate pollutants and recover excess nutrients. Biochar can be chemically modified to increase its adsorption capacity. We applied three different modifications to two types of biochars derived from woodchip and walnut shell feedstocks. Experiments were conducted to examine the sorption capacity of phosphate, ammonium, nitrate, and dissolved organic carbon (DOC). The final concentrations of each supernatant were measured, and the amount of nutrients adsorbed was determined by the difference in the final and starting concentrations. This was used to create an isotherm curve to determine the maximum binding capacity of each biochar. Our data shows that iron-modified biochars were the most effective for binding nutrients. Modified biochar could be used in composting to reduce greenhouse gas emissions, stabilize carbon, and increase nutrient retention. The nutrient-rich biochar could then be applied to crops, simultaneously reducing nutrient pollution, improving soil health, increasing crop yields, and helping to mitigate climate change.

Antioxidant Potential of Walnut Skin Tisane

Shannon Yi
Sponsor: Selina Wang, Ph.D.
Food Science & Technology

Antioxidant content is an important measure for the food industry due to the marketability of potential health benefits. The skin of walnut kernels is a byproduct of the production of peeled walnuts, which are favored by some consumers. The skin contains natural phenolic compounds, some of which have antioxidant capabilities. The skin can be utilized for tisane, a beverage that is similar to tea. Tisane brewing conditions varied in time (30, 60, 120, 180s) and temperatures (80 and 99°C). The tisane was evaluated using the Folin-Ciocalteu assay for total phenolic content and the DPPH assay for antioxidant capacity. We found that brewing for longer times resulted in tisane with greater total phenolic content and higher antioxidant activity. Overall, phenolics in walnut skin tisane have a high antioxidant capacity. Upcycling walnut skin byproduct into tisane can create an environmentally conscious, value-added product to processors and reflect consumer demand for antioxidant-rich foods.

AI-Enhanced Precision in Identifying Sentinel Lymph Node Metastases in Breast Cancer Patients

Tianyi Yin
Sponsor: Mohsen Mesgaran, Ph.D.
Plant Sciences

The prognosis of breast cancer is critically dependent on the presence of metastases in sentinel lymph nodes (SLN). Traditional histopathological examination of these nodes, while standard, is labor-intensive and may miss small metastatic occurrences. Recent advances in pathology have seen the rise of convolutional neural networks (CNNs) as a transformative tool, particularly in automating the analysis of whole-slide images (WSIs). This study focuses on assessing the effectiveness of a CNN-based model in identifying lymph node metastases in breast cancer patients. The study utilized a public dataset from the PatchCamelyon (PCam), and a total of 80,000 patches of healthy tissue and 80,000 patches of metastatic tissue were assessed in the training set, while 57,458 patches of pathological tissue were evaluated in the test dataset. Considering the classification by board certified pathologists as a reference, the trained deep net showed high accuracy (0.937), precision (0.971), validation AUC (0.979), and a low validation loss of 0.016. Our data show that a deep learning system can be trained to recognize metastatic cancer, outperforming pathologists under time constraints (mean AUC of 0.810), showcasing its potential for clinical application.

Explainable Machine Learning Prediction of Soilcrete Unconfined Compressive Strength (UCS)

Martin Yossifov
Sponsor: Katerina Ziotopoulou, Ph.D.
Civil & Environmental Engr

Soilcrete is a ground improvement product that is created by mixing in-situ natural soil with grout to serve as a firmer building foundation, resist earthquake loading, or generally stabilize soils. A comprehensive Machine Learning (ML) pipeline was created to predict the Unconfined Compressive Strength (UCS) of soilcrete. Soilcrete UCS test data of two types (core and wet grab) was gathered from 15 Keller (a ground improvement company) soilcrete construction sites. Subsequent exploratory data analysis (EDA) identified necessary data transformations and scaling to refine our feature set. Utilizing these refined features, multiple regression techniques were then employed: linear, lasso, ridge regression, Random Forest, and XGBoost. SHAP (SHapley Additive exPlanations) Explainable ML was then applied to interpret the XGBoost and Random Forest models. Specifically, this included global summary plots to assess overall feature importance and individual force plots to unpack the predictive contribution of each feature, alongside dependency plots to investigate interaction effects, offering a comprehensive understanding of feature influence on UCS prediction results and accuracy. This research constitutes a significant step towards demonstrating the potential of and formalizing a cross-disciplinary field between ML and traditional ground improvement engineering.

Restoration of Choline Acetyltransferase in Mice via AAV9-mediated Gene Therapy

Jaime Young
Sponsor: Ricardo Maselli, M.D.
MED: Neurology

Congenital myasthenic syndromes (CMS) are disorders characterized by muscle weakness and fatigability. One CMS variant results from deficiency of the enzyme choline acetyltransferase (ChAT), which catalyzes the synthesis of acetylcholine at cholinergic synapses and at the neuromuscular junction. We used a conditional knock out model consisting of *LoxP* sites flanking *Chat* exons 4 and 5, and Cre-recombination activated by the estrogen agonist Tamoxifen (Tx). Mutant mice injected with Tx at P11 developed progressive weakness and with rare exceptions all died. We hypothesized that injecting an adeno-associated virus type 9 (AAV9) carrying human *CHAT* (AAV9-*CHAT*) at P28 would rescue this lethal phenotype. This was experimentally confirmed as 5 out of 5 mice injected with AAV9-CHAT survived while 13 out of 14 mice not injected died. Immunohistochemistry showed severe reduction of Chat expression in spinal motor neurons of mutants but almost complete restoration of expression in AAV9-injected mice. RT-qPCR demonstrated only mild reduction of Chat RNA in mutant mice, consistent with the interpretation that the impaired protein expression resulted primarily from an early termination codon induced by the *LoxP* recombination. Histopathological analysis showed no adverse effects. Thus, AAV9-mediated gene therapy may be effective and safe for treating humans affected with ChAT-CMS.

Characterization of Intraductal Papillary Mucinous Neoplasms in En1-deficient Pancreatic Cancer

Omar Younis
Sponsor: Changil Hwang, Ph.D.
Microbiology & Molec Genetics

Pancreatic ductal adenocarcinoma (PDA) is the third leading cause of cancer-related death in the United States. To this day, PDA resists all current chemotherapies; therefore, there is an urgent need to develop novel strategies targeting PDA. We previously showed that EN1, a neurodevelopment transcription factor, is responsible for aggressive PDA characteristics. In contrast to the traditional pancreatic cancer mouse (KPC) model, we observed EN1-deficient (KPEC) mice developed papillary lesions in the pancreas, resembling the intraductal papillary mucinous neoplasm (IPMN) phenotype. Given the pancreatobiliary subtype of IPMN is commonly associated with KRAS mutation, I hypothesize that EN1-loss results in the development of the pancreatobiliary subtype of IPMN, leading to PDA progression. To test the hypothesis, I performed immunohistochemistry (IHC) stains to detect proteins associated with different subtypes of IPMN using KPC and KPEC pancreatic tissue sections. I observed positive staining for the pancreatobiliary proteins (MUC1 and MUC5AC) and negative staining for both the intestinal and gastric subtype proteins (MUC2 and CDX2) in the KPEC mice pancreas. This study will shed light on the role of EN1 deficiency in establishing PDA precursors and provide a new therapeutic opportunity to target PDA.

Preschoolers In Outdoor Interaction: A Study at the UC Davis Early Child Development Lab Center

Caren Youssef
Sponsor: Emily Schlickman, M.S.
Human Ecology

This research delves into the sensory experiences of children aged 4-6 years old within the context of the UC Davis Early Childhood development Research Center. Which focuses on building a diverse set of classrooms by accepting children with unique and different backgrounds. The study aims to identify design elements that foster heightened engagement and contribute to children's development. Utilizing a multi-method approach, encompassing direct observations at the preschool, investigate the dynamic interplay between children and their play environments.

The findings provide nuanced insights into the role of sensory engagement in promoting positive development among youth, with a focus on the unique characteristics of the school Playscape. By examining the correlation between design elements and children's responses, this study offers valuable insights applicable to urban planning and child-friendly environments beyond the preschool Playscape context. The research underscores the importance of thoughtful design in shaping public spaces, particularly Playscapes, to positively influence children's well-being and development. Recommendations derived from this study aim to guide future Playscape designs, ensuring they contribute to enriched developmental experiences for children across diverse communities.

In utero exposure to tetrahydrocannabinol (THC) via inhalation in rats

Zhenmo Yu
Sponsor: Melissa Bauman, M.D.,Ph.D.
MED: Dean's Office

The impact of prenatal cannabis exposure on fetal neurodevelopment is a growing public health concern. Understanding the nuances of placental permeability to cannabinoids and their metabolites is critical for assessing the potential risks of prenatal cannabis exposure. This study used a novel e-cigarette technology-based system to deliver tetrahydrocannabinol (THC) vapor or vehicle vapor to pregnant rats during mid-gestation. The experiment measured the concentrations of THC and its metabolites, 11-OH-THC, and 11-NOR-COOH-THC in maternal plasma and fetal tissues from THC-exposed (N=6) and control (N=4) dams. Effective delivery of THC to rats *in utero* was confirmed in the THC-exposed fetuses (N=75) but not detected in control fetuses (N=62). Findings revealed a strong positive correlation for the levels of 11-NOR-COOH-THC between maternal plasma and fetal tissues, which was more substantial than that for THC, and also a notable correlation for 11-OH-THC, suggesting differences in how these substances traverse the placental barrier. These differences could reflect variations in molecular size, lipophilicity, and metabolic processing at the placenta. The implications of these findings are substantial for public health, as they contribute to a deeper understanding of the differential transfer of cannabis constituents across the placenta, potentially providing more targeted advice on cannabis consumption during pregnancy.

Patient Microbiome Outcomes in Human Clinical Trial of Transgenic Human Lysozyme Goat Milk

Mengzhi Yuan
Sponsor: Elizabeth Maga, Ph.D.
Animal Science

Genetically modified human lysozyme (hLZ) goat milk contains 68% of the hLZ found in human milk, and is efficacious in improving the consumer's intestinal microbiota and promoting intestinal health. Milk from hLZ goat's has been shown in previous studies and animal models to be effective in repairing damaged gastrointestinal (GI) tract barrier function and ameliorating a dysbiotic microbiota caused by *E. coli* infection. In an on-going randomized clinical human trial, hLZ milk is administered to patients undergoing therapy for leukemia who have damaged GI epithelia and a dysbiotic GI microbiota. Patients are enrolled for approximately 38 days, ingesting 300mL to 200mL of hLZ milk daily for the duration of their treatment. Patient stool samples were taken on days -8, 0, 7, 14, 21, and 30 and DNA extracted for microbiota analysis using 16S rRNA gene amplicon sequencing of the V4 hypervariable region. Amplicons were normalized, pooled and sequenced on Illumina MiSeq. Sequence reads were processed via QIIME2 and the amplicon sequence variants were exported and analyzed in R Studio, using the phyloseq package. Bacterial abundances and taxonomy will be modeled through the vegan and LefSe pipelines, with the ultimate goal of assessing broad changes to patient fecal microbiomes over the treatment timeline.

Relationship Between Anxiety and Academic Performance in College Students: Pre- and Mid-COVID-19

Abigail Yuen
Sponsor: Adrienne Nishina, Ph.D.
Human Ecology

Among U.S. college students, the increasing prevalence of anxiety impairs academic performance. The COVID-19 pandemic was a stressful, anxious period for many students, which may have then affected academics. We examine the relationship between general anxiety and academic performance (i.e., self-reported GPA). We hypothesized that (1) more anxiety would be associated with lower GPAs, and (2) there would be a stronger relationship pre-pandemic versus mid-pandemic, as students likely experienced additional anxiety due to COVID-19. California college students (N = 257; 74% female, 25% male, 1% other; 29% White, 41% Asian, 19% Latino, 1% Black, 10% Other) completed online surveys two years before the pandemic (2018) and during the pandemic (2020). Students completed daily reports on general anxiety across 5 days during a two-week period; these 5 reports were then averaged. We ran two separate linear regressions for pre- and mid-pandemic. Our results indicated there was no relationship between general anxiety and GPA pre-pandemic (β = -.06, *SE* = .48, *p* = .34) or mid-pandemic (β = -.004, *SE* = .42, *p* = .96). Overall, general anxiety and GPA were not related, perhaps because anxiety does not have a large effect on GPA long-term, or some teachers were more lenient during the pandemic.

Assessment of the relationship between vascular function and ellagitannin metabolism after freeze dried strawberry powder intake

Madelynn Yung
Sponsor: Roberta Holt, Ph.D.
Nutrition

In a 4-week controlled, double-blind, dietary intervention trial of a crossover design, we explored the cardiovascular benefits of freeze-dried strawberry powder (FDSP) consumption in twenty postmenopausal women. Strawberries contain ellagitannins (ET) as well as ellagic acid (EA), which are polyphenols that have anti-inflammatory properties. We hypothesized that the consumption of freeze-dried strawberry powder (FDSP) would improve vascular function compared to the intake of a control power without polyphenols. By random assignment, participants consumed either daily FDSP intake (39 g/day) or an isocaloric low-polyphenol powder for 4 weeks; followed by a 4-week washout period, and then a second intake period of the powder they did not consume during the first intake period. Vascular reactivity was assessed using peripheral arterial tonometry, with serum metabolomics and urinary urolithins analyzed by nuclear magnetic resonance spectroscopy and liquid chromatography-mass spectroscopy, respectively. Although there were no significant differences in urolithin excretion or vascular function, participants in the FDSP group showed improved vascular response compared to control during the second intake period. Ongoing assessments include exploring the impact of additional ET rich foods in participants' diets and the cumulative effect of ET-rich foods on study outcomes.

Multigenomic Modifications in Lipid-Stressed Human Aortic Endothelial Cells by Phase II and Gut-Derived Epicatechin Metabolites

Rhea Zachariah
Sponsor: Dragan Milenkovic, Ph.D.
Nutrition

Epicatechin can exert athero-protective effects through genomic modifications, however molecular mechanisms of action, particularly on aortic endothelial cells, are largely unknown. This study aimed to decipher in-depth molecular mechanisms, using multi-omic analyses, of epicatechin metabolites in human primary aortic endothelial cells under lipid-stress (as a model of atherosclerosis development). Stress was induced using human postprandial TGRL lipolysis products. Cells were pre-exposed to (−)-epicatechin phase-II and gut microbiota-derived metabolites at physiologically relevant concentrations and exposure time. Total RNA was extracted and global gene expression was obtained using Affymetrix arrays, followed by in-depth bioinformatic analysis illustrating metabolites simultaneously modulating expression of protein-coding and non-coding genes (miRNA, lncRNAs, snoRNAs). Differentially expressed genes formed functional groups of genes involved in regulating processing including VEGF-related functions, cell signaling and adhesion, and cell permeability, the initial steps of atherosclerosis development. 3D in-silico docking showed that metabolites can interact with transcription factors and cell signaling proteins. Correlation analysis between observed genomic modifications and genomic signature of patients with aortic aneurysms and hypertension showed opposite gene expression changes. Taken together, this study describes a multi-omic mechanism of action by which (-)-epicatechin metabolites could preserve aortic endothelial cell integrity and reduce the risk of atherosclerosis and cardiovascular diseases.

Dorsal Neurons are the Master Clocks for the Regulation of Body Temperature Rhythm in *Drosophila*

Victoria Zafra Marquez
Sponsor: Fumika Hamada, Ph.D.
Neuro Physio & Behavior

Human body temperature increases during the daytime, decreases during the nighttime, and starts to increase before dawn (morning anticipation). These daily changes in body temperature, body temperature rhythm (BTR), is controlled by the circadian clock genes. However, the mechanisms of BTR regulations in mammals are still unclear. Our laboratory previously discovered that fruit flies, *Drosophila melanogaster*, which are small ectotherms, regulate their BTR by selecting appropriate environmental temperatures throughout the day. Our research demonstrated that the fundamental regulatory mechanisms of BTR are conserved between mammals and *Drosophila*. Thus, we examined the role of *Drosophila* circadian clock neurons in BTR to determine its regulatory mechanisms. To test this, we suppressed the clock function in the respective core clock neurons using tim-CRISPR and the UAS/Gal4 binary gene expression system, and assessed their BTR in 12-hour light/dark cycles. We discovered that the clock suppression disrupted the morning anticipation in dorsal neurons (DNs: DN1a, DN1p, and DN2), but not in ventrolateral neurons (LNvs). Our findings suggest the BTR regulations primarily rely on the activity of DNs, and LNvs have subordinate roles in the BTR regulations. Thereby, we are closer than ever to understanding the mechanisms of BTR in both *Drosophila* and humans.

The Politics Behind AI: How Political Beliefs Drive Opinions on Artificial Intelligence in California

Aleena Zaheer
Sponsor: Zoe Drayson, Ph.D.
Philosophy

Humans can take hours, days, or even weeks to create content, but Generative Artificial Intelligence (AI) can make it in a single minute. Some embrace this transformative technology, while others fear it. Thus, we lack an understanding of how much Generative AI should be regulated. To address this, this research investigates the effect of an individual's political ideology and partisanship on their opinions toward the use of Generative AI. Through a survey of adult residents in California, I gathered data on individuals' political party, political ideology, acceptance of various Generative AI uses with different tones, and desired level of AI regulation. Acceptance was significantly different by tone overall ($p<0.01$) and by partisanship for negative uses ($p=0.037$). Overall, Democrats desired moderate regulation and varied between extreme acceptance and unacceptance across different AI uses. As a Democratic state, California may find support for policies regulating false media such as AI image and voice generation, rather than technical uses such as accessibility and analytical tools. Because tone heavily impacts public opinion towards Generative AI, further discussion of its regulation may depend on campaigning that highlights its positive aspects or displays its potential harms.

Dose-dependent Mock Maternal Antibody Protection Against IBV

Miranda Zaynor
Sponsor: Rodrigo Gallardo, D.V.M.,Ph.D.
VM: Population Hlth & Reprod

Infectious bronchitis virus (IBV) is a highly contagious coronavirus affecting chickens worldwide. It causes acute upper respiratory disease and can target the reproductive tract, reducing egg production and quality. One potential method for protection against IBV is the use of hyperimmune serum to mimic maternal antibodies. A previous study demonstrated that spray immunization of hyperimmune serum in chicks reduced upper respiratory tract (URT) clinical signs but did not reduce viral loads. It is suspected that the sprayed antibodies only provided localized protection, but it is not known how antibody dosage levels affect this protection. The following study aims to observe the effects of dosage levels. Day-of-age chicks were sprayed with a 1X or 2X dose of serum from IBV-challenged chickens. At three days-of-age, a challenge was administered by intramuscular injection or ocular-nasal drops. Over four weeks, samples for antibody titer and viral loads will be collected, and tracheal inflammation and cilia activity will be measured. It is predicted that spray antibody protection is dose-dependent: the 2X dose will reduce both URT clinical signs and viral load, while the 1X will only reduce URT clinical signs. Such findings would suggest potential for industry application of hyperimmune serum for protection.

Exploring Factors that Influence Children's Speech Fluency Under Stress

Ziling Zeng
Sponsor: Camelia Hostinar, Ph.D.
Psychology

Evidence suggests that younger adults tend to produce more pauses than older adults, particularly under stressful conditions. Yet, there remains a gap in our understanding of how children's speech patterns are influenced by their socioeconomic backgrounds, particularly under stress. Using data from the Social Support Study, this research study investigated the link between total unfilled pause duration in children's speeches given during the Trier Social Stress Test (TSST) and family income, as well as parental educational attainment. Results of multiple linear regression indicated that there were multiple significant predictors of total pause duration, specifically for parental income ($t(56) = 2.13$, $p = .04$) and parental social support ($t(56) = 2.15$, $p = .04$). Both predictors were linked to more pauses during the speeches given in the TSST. These results remain significant after adjusting for cortisol reactivity, both parents' educational attainment, the child's sex, and age. This aligns with previous research on speech pattern differences based on socioeconomic background. More research is needed to explore children's speech patterns and their susceptibility to environmental factors.

MALDI Mass Spectrometry Imaging of Lipids on Undecalcified Fresh-frozen Spinal Column

Cici Zhai
Sponsor: Elizabeth Neumann, Ph.D.
Chemistry

The spinal column is an intricate structure and function fundamental for human health. Despite its importance, studying its native metabolic features remains challenging. Our research presents a novel method for matrix-assisted laser desorption/ionization mass spectrometry imaging (MALDI MSI) on fresh-frozen, unfixed, undecalcified spinal columns to preserve its spatial integrity. Using a tape-based sectioning approach, we achieved 10 µm spatial resolution. H&E staining was performed to further validate its ability to maintain tissue architecture and minimize tissue damage. As a result, MALDI MSI revealed 6 distinct lipid distributions across various spinal tissues, such as the spinal cord, vertebrae, intervertebral discs, muscle, and blood vessels. Across multiple samples, lipid identification and spatial locations demonstrated consistency. Our method facilitates the spatial analysis of biomolecules within the spinal column without the interaction or degradation typically associated with bone decalcification. This approach lays groundwork for future molecular signatures in spinal diseases and traumatic injuries, advancing spinal research and clinical diagnostics.

Flow Visualization with Smoke Tunnel

Albert Zhan
Sponsor: Camli Badrya, Ph.D.
Mechanical & Aerospace Engr

The Davis Applied Aerodynamics Lab (DAAL) at UC Davis wants to create educational videos to provide students a visualization of flow characteristics over airfoils. To do this, a smoke tunnel is used to generate thin streamlines of smoke over various airfoils and objects to demonstrate the impact of airfoil geometry on the flow field. A Fujifilm XT2 camera records the airfoil's effect on the surrounding flow field. Demonstrations include flow over an airfoil at varying angles of attack, flow separation over an airfoil at high angles of attack, wingtip vortices, and turbulent flow from a blunt body. We plan to demonstrate the flow field of a rotating cylinder, active flow control, and other high lift configurations. Additionally, we plan to create a video series covering the development and demonstration of early airfoils such as Lilienthal glider airfoils, Wright Flyer airfoils, frequently studied NACA airfoils, and other airfoils from the 1910s to 1940s. Our final educational goal is to visually disprove the commonly-known equal transit time theory of lift.

Social Media Usage and Mental Well-Being on Young Adults

Anna Zhang
Sponsor: Azra Jahanitabesh, Ph.D.
Psychology

In the contemporary landscape, social media has become an integral part of individuals' lives, significantly influencing daily routines. This research project investigates the multifaceted relationship between social media usage patterns and their impact on mental well-being, with a focus on self-esteem, identity, comparison, and depressive symptoms. The study examines variables such as the time spent on social media, types of activities engaged in (e.g., passive scrolling, active posting), and social identity among college students. Approximately 100 UC Davis undergraduates participated in a 15-minute survey, providing insights into perceived and actual social media usage, self-esteem levels, and depressive symptoms. The research employs linear regressions and mediation analyses to unravel the intricate interplay between social media habits, self-esteem, and depression symptoms. The main hypothesis posits that increased passive social media use will exhibit positive correlations with depressive symptoms and lower self-esteem. By delving into these variables, the study aims to contribute valuable insights into the nuanced dynamics between social media engagement, social identity, and mental well-being among college students. The findings may inform strategies for promoting healthier social media habits and ultimately enhance the overall mental health of this demographic.

The Role of PRC2-mediated H3K27me3 in Spermatogonial Stem Cells

Tina Zhang
Sponsor: Satoshi Namekawa, Ph.D.
Microbiology & Molec Genetics

Mammalian males maintain lifelong fertility through a delicate equilibrium between self-renewal and differentiation of spermatogonial stem cells (SSCs) within the slow-cycling and heterogeneous undifferentiated spermatogonia cell population. As pivotal epigenetic regulators, mammalian Polycomb proteins, comprising two functionally intertwined complexes PRC1 and PRC2, play an indispensable role in preserving undifferentiated spermatogonia. Recent findings suggest that PRC1 shields adult undifferentiated spermatogonia from premature differentiation by directing the deposition of PRC2-mediated H3K27me3. This implicates H3K27me3 as an epigenetic hallmark of adult undifferentiated spermatogonia. However, the establishment timeline of this H3K27me3 hallmark in spermatogonia and its functional role in maintaining SSCs in adults remain unclear. To address these gaps, we employ a conditional loss-of-function mouse model targeting PRC2 and demonstrate that the absence of PRC2-mediated H3K27me3 expedites the cell cycle of undifferentiated spermatogonia, leading to SSC exhaustion in early adulthood. This study unveils the pivotal role of H3K27me3 in dictating spermatogonia fate decisions, providing valuable insights into potential epigenetic mechanisms that ensure lifelong fertility in adult males.

What Factors Explain Differences In the Gender Wage Gap Across Countries?

Diana Zhang
Sponsor: Aaron Smith, Ph.D.
Ag & Resource Economics

This undergraduate honors thesis examines the determinants of the gender wage gap across countries, focusing on contemporary economic and gender dynamics. Drawing on a thorough literature review, including insights from Claudia Dale Goldin's *Prize in Economic Sciences 2023*, the study investigates factors contributing to variations in wage disparities between men and women. Utilizing data from sources such as Our World, UN, IMF, and ILO, econometric methods like Difference-in-Differences (DiD) are applied to analyze temporal changes in gender wage gaps, while regression analysis explores causal relationships between variables. By elucidating the multifaceted nature of gender wage disparities on a global scale, this research aims to provide valuable insights for policymakers and contribute to ongoing efforts aimed at reducing gender inequities in the labor market. Through a rigorous examination of economic and social factors, this thesis seeks to advance our understanding of the complexities surrounding gender wage gaps and their implications for achieving greater gender equality in the workforce.

Metabolite Profile and Sensory Attributes of California Honeys

Yun Zhang
Sponsor: Carolyn Slupsky, Ph.D.
Food Science & Technology

California is a national leader in the production of honey, and its unique botanic sensory and nutritional properties are sought after. How botanic origin affects honey's metabolite profile, and sensory aspects is not well-studied. Here, characterization of the honey metabolome was correlated to sensory attributes and botanical origins of 12 California honey products from 3 botanical origins (sage, orange blossom, avocado) obtained from multiple professional beekeepers. Honey was analyzed for its sensory properties and metabolite content. Quantitative and qualitative sensory measures of honey products were obtained using descriptive analyses by a trained sensory panel of 10 people. Metabolite content was measured with ^{1}H NMR and 10 sugars, and 8 amino acids were quantified. The pairwise correlation between botanical origin, metabolite composition, and sensory attributes was evaluated. Overall, honey metabolites are highly correlated with botanical origins and sensory attributes. Raffinose was found to be a differentiable marker of botanic origin. A dried mango flavor and odor were positively correlated with uridine, alanine, formate, and acetate, and a wax odor and flavor were positively correlated with raffinose (Pearson's correlation, $r>0.7$, $p<0.05$). Integrating NMR metabolomics and sensory analysis provides a deeper insight into flavor-associated compounds in honey.

The Evolution of Humanity and the Destruction of Nature in French Science Fiction

Yifang Zhang
Sponsor: Jeff Fort, Ph.D.
French & Italian

Climate change and possible apocalyptic futures have been much discussed in the past decades, and science fiction shows shifting understandings of the relationship between humanity and nature during this era of climate crises. I explore how artistic and content choices in contemporary French apocalyptic science fiction reflect and influence public perceptions of the human-nature relationship. Specifically, I closely read the 2020 graphic novel *Carbone & Silicium* (Carbon & Silicon) by Mathieu Bablet, and, by comparing it to earlier sci-fi narratives, I consider how our understanding of climate change and appreciation for the ecosystem has evolved over the past decades. Additionally, I examine how modern technologies such as artificial intelligence and the internet affect human survival and look at evolution into non-human beings as a survival strategy in post-apocalyptic worlds. Sci-fi narratives such as Mathieu Bablet's *Carbone & Silicium* confront these intimidating questions that are relevant to the public as well as to ecologists. They present scientific knowledge in real-world contexts and help the reader imagine what the future might look like after current and projected climate crises.

Analysis of Previous Cardiopulmonary Clinic Data to Improve Patient Cardiopulmonary Healthcare Services

Jay Zhang
Sponsor: Ronald Jan, M.D.
MED: Surgery

Cardiovascular and pulmonary diseases are prominent health problems in underserved communities due to limited access to proper healthcare, language barriers, financial difficulties, and being uninsured. The Cardiopulmonary Committee of Paul Hom Asian Clinic was founded in 2015 to provide free cardiopulmonary assessments to those in the underserved community. This project aims to improve the health monitoring progress and treatments of patients enrolled in Cardiopulmonary Specialty Clinic through use of an established database. Data was gathered from patients' lab tests between 2015 and 2022 and averages were generated from patients entering our specialty clinic per year. Patient entries (n=102) consist of ages ranging from 17 to 77 years old. 68 patients were male and 34 were female. Findings indicate slightly elevated mean LDL and above-normal mean HDL among patients. Additionally, higher-than-normal fasting glucose and elevated BMI values in Asian patients raise concerns about potential cardiovascular and pulmonary risks. The database will permit improved patient follow-ups, monitoring of health progress, and potential interventions to address recognized health indicators; furthermore, the demographic and vitals data can be used to identify future cardiopulmonary patients at the clinic.

Education and Consumption during the Great Recession, 2006-2012

Yuqing Zhao
Sponsor: Katherine Eriksson, Ph.D.
Economics

This paper delves into the intricate relationship between education levels and household expenditure from 2006 to 2012, utilizing data sourced from the Panel Study of Income Dynamics. Employing a rigorous econometric framework, including the time fixed effect model, interaction terms strategy, and addressing omitted variables, the study scrutinizes the impact of economic uncertainty on individuals' spending decisions. The analysis differentiates between varying income, deposit, and educational backgrounds, particularly distinguishing below and above college degree attainment. The findings not only shed light on the dynamics of household expenditure but also contribute to the broader understanding of the socioeconomic implications associated with educational disparities. Moreover, this research aims to provide valuable insights for policymakers, economists, and scholars seeking to formulate strategies that address the multifaceted influences of education on economic behavior. The robustness of the results across different econometric methodologies enhances the reliability and applicability of the study's conclusions with implications for various stakeholders in economic and educational policy.

Phenotypic Characterization of Monkey Flower (*Mimulus guttatus*) Root Architecture to Discover New Drought Resistance Mechanisms

Michelle Zhao
Sponsor: Florian bernard arthur Deligne, Ph.D.
UC Davis Genome Center

Mimulus guttatus is a curious and remarkable plant that can grow in various environments, in the range from the desert areas of Mexico to the snowline of the Altiplano region. Such a diverse habitat environment makes *Mimulus guttatus* a good model for climate adaptive mechanisms. Drought in California is a great problem for seed companies. In 2022, California's rice yields dropped by 50% compared to 2019. To uncover novel mechanisms of drought resistance, we have chosen to study the root adaptation of *Mimulus guttatus*. To achieve that, we utilize seeds from 18 populations of *Mimulus guttatus* which were harvested before and after the California drought spanning from 2013 to 2016. We evaluated their drought response by assessing the root system architecture. Seedlings were cultivated in-vitro on adapted media, incorporating Polyethylene Glycol 8000 (PEG8000) to mimic drought conditions through dehydration. The phenotypic data obtained will be employed in a Genome-Wide Association Study to find new potential candidate genes associated with drought resistance. This study aims to contribute new insight into mechanisms that may have broader applicability to other species.

Out of Frame: Does Discussing Artificial Intelligence Through the Lens of Artist Impact Affect Support for Generative AI Regulation?

Sunny Zhou
Sponsor: Mark Verbitsky, Ph.D.
Political Science

The rise of artificial intelligence (AI) image generators has major implications for artists who must compete with models trained off their work without consent. Prior research shows that the way discourse is framed can change public opinion and impact policy adoption. How might framing AI use through the lens of artist impact affect public support for regulating image generators? To investigate this, I designed a survey experiment where respondents read scenarios of AI usage in two areas impacting artists (training data and market competition) followed by questions about their support for various regulations. I found that public opinion on regulation is highly favorable, as every proposal enjoyed at least majority support. Depending on the proposal, frames emphasizing AI's positive aspects decreased or increased support, while frames emphasizing artist impact largely had no effect or decreased support. This implies two things: if artist impact frames increase the issue's relevance to an individual, it does not necessarily promote supportive attitudes towards regulation. Additionally, the underlying nature of a regulation may factor into how framing affects support. These results expand our understanding of how framing AI influences public attitudes towards regulation.

Cyclic Sieving Phenomena on Necklace Patterns

Sabrina Zhu
Sponsor: Sean Griffin, Ph.D.
Mathematics

In mathematics, there is a classical problem that explores the patterns of necklaces. Suppose some beads are provided with k colors, and necklaces with length n are made with those beads. Mathematicians are interested in the patterns of these necklaces under rotations. The orbit of a given necklace is defined as the collection of patterns that can be obtained by rotating the necklace. In 2004, Reiner, Stanton, and White introduced the cyclic sieving phenomenon, mathematically encoding the symmetries in objects like necklaces that they observed. The cyclic sieving phenomenon is exhibited when there is a formula to count the number of orbits with different sizes, with the corresponding complex numbers being plugged in. In my project inspired by Oh and Rhoades' results, I found a simplified formula that still exhibits the cyclic sieving phenomenon, when the number of colors satisfies a special condition. In recent years, many instances supporting this phenomenon have been discovered, and those cyclic sieving results often involve representation theory, an important branch of mathematics with significant applications.

A Hands-on Sustainable Energy System to Empower Tomorrow's Engineers

Peggy Zhu
Sponsor: Andre Knoesen, Ph.D.
Elect & Comp Engr

As our society is experiencing the transition from conventional to smart power grids, simulation is transforming the power grid design by integrating a diversity of sensors and renewable energy sources. This project aims to develop a practical platform for engineering students to conduct experiments with a cyber-physical sustainable power grid, capable of reflecting the intricate challenges present in real-world scenarios. Other than its power-grid related use, this project shows a wide range of educational opportunities suitable for undergraduate students majoring in EE, CE, CS, ME, and many other related fields. To effectively demonstrate concepts related to power management and efficiency in a grid, we are developing applications for STEM education within a power grid context. In collaboration with university partners in the US and Mexico, we have created five physical modules and corresponding software applications that mirror power grid infrastructures. Each module supports control, data collection, processing, and feedback for analysis, fostering engaging solutions and creative exploration for students. By interacting with these modules, students can experiment with the feasibility of their programmatic and control solutions by applying simulation to these electronic-physical models, thereby enhancing their experiences and readiness to tackle real-world challenges in building sustainable cities in the future.

Isolation of Starch Hydrolyzing Bacteria from Bioplastic Used in Biosolarization

Zeyu Zhu
Sponsor: Christopher Simmons, Ph.D.
Food Science & Technology

Developing agricultural markets' need for cheap and reliable materials leads to an increasing need for plastics. Producer and consumer efforts have increased bioplastic use, but their substrate contribution post-biodegradation is unknown. Biosolarization, an agricultural biocontrol technique which uses plastic film to trap solar radiation to increase temperature and organic amendments to accumulate biopesticides, is being used as a case study to assess the usage of bioplastics as an alternative to polyethylene (PE) film. We hypothesize environmental conditions created by biosolarization will create conditions that select for bioplastic degrading microbes. We isolated bacteria from bioplastic film samples exposed to biosolarized soils in the field and lab. Iodine assays were run on bacterial isolates taken from the bioplastics and grown on starch agar medium showing that 21 of the 24 isolates from 3 month and 6 month points had the ability to hydrolyze starch. To determine if this starch hydrolysis ability carries over to bioplastic degradation, we are currently molecularly identifying the bacterial isolates and will characterize bioplastic degradation using liquid culture screening.

Movement Kinematics as Predictors for the Success of Reaching and Grasping Tasks in Selectively Sensory-Deprived Gray Short-Tailed Opossums

Faith Zirkelbach-Ngai
Sponsor: Leah Krubitzer, Ph.D.
Psychology

Reaching and grasping is the primary means with which rodents, non-human primates, and humans interact with the world, specifically with food items. Reaching and grasping is a targeted sensory-dependent movement pattern that is well studied in rodents and non-human primates, but detailed assessment of this behavior is lacking in non-eutherian animal models. Short-tailed opossums (*Mondelphis domestica*) are adept at single-arm reaching and grasping, but the reason for their success remains unknown. Here we characterize the kinematics of reaching and grasping while we vary available sensory input. We sequentially removed somatosensory and olfactory input before testing the animals' ability to reach and grasp. To quantify data, we used video recording analysis and pose estimation with DeepLabCut, an algorithm that extracts pose kinematics in three dimensions before and after the reaching and grasping event. Preliminary data suggests that reaching success rate covaries with reach speed, such that slower reaches are more successful. Somatosensory and olfactory deprivation impairs the success rate and the kinematic characteristics of the movements. These data will inform future studies of the impact of sensory deprivation on the kinematic movements of non-eutherian animals, and will expand our understanding of how different sensory systems contribute to complex ethologically relevant behaviors.

Development of Breath Test for Respiratory Virus Diagnostics

Christina Zumout
Sponsor: Cristina Davis, Ph.D.
Mechanical & Aerospace Engr

To increase the capacity to test for respiratory viruses worldwide, such as COVID-19, the development of a new type of test is needed. Due to health complications, many patients may not be able to partake in the widely available nasopharyngeal swab test or blood test, so an alternative noninvasive test is highly desired. The purpose of our study is to distinguish unique breath VOC (volatile organic compounds) biomarkers of respiratory viral infection, and then use these biomarkers to develop a portable breath analysis device that could be used by clinicians to noninvasively diagnose patients. This breath analysis device would use our miniature differential mobility spectrometry (DMS) detector, coupled with chip-based gas chromatography. The device will include a custom chip-based preconcentrator, which will be concentrated with chemical sorbent to allow extraction of VOCs from breath. We currently recruit subjects from the UC Davis Medical Center and collect exhaled breath through Tenax Sorbent Tubes that capture VOC biomarkers and collect nasopharyngeal swabs along with demographic information. Our findings so far indicate that there is variation in the VOCs found between different respiratory viruses, including the distinct strands of COVID-19.