Conference Program

2022 Undergraduate Research Conference at UC San Diego

Welcome to the 2022 Undergraduate Research Conference at UC San Diego, which showcases the scholarly and creative work conducted by undergraduates at UC San Diego during the academic year.

The community at UC San Diego has witnessed the many challenges faced by our student scholars this past year, as well as the fortitude with which they rose to the occasion. Their strength and determination are why we are particularly proud to announce the return of the URC, the only campuswide conference to recognize and encourage undergraduate researchers in all fields and provide them the opportunity to share their intellectual accomplishments with the broader community. This year's conference features over one hundred and twenty participants who have been nominated by their faculty mentors to be a part of this unique event.

We hope you will enjoy the conference and the students' presentations. We extend our thanks to our moderators for their assistance and support, and to the mentors who have provided training and guidance to their students throughout the academic year.

The Undergraduate Research Conference at UC San Diego is planned and coordinated by the Undergraduate Research Hub (URH), which is a unit of Student Retention and Success, within Student Affairs. Thank you to all the Office of Undergraduate Research staff.

Additional thanks to Veronica Bejar, Dr. Thomas K. Brown, Dr. Kirsten Kung, Dr. Marie Sheneman, Dr. Sophia Tsai, Jason Avalos, Daniel Movahed, Brenda Cruz and Simonne Darbonne who supported the preparation of this conference.

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Conference Schedule

Saturday, May 14th

8:00 AM	Opening Remarks
9:00 AM – 10:00 AM	Morning Session I
10:10 AM – 11:10 AM	Morning Session II
11:20 AM – 12:20 AM	Morning Session III
12:20 AM – 1:10 PM	Lunch
1:10 PM – 2:10 PM	Afternoon Session I
2:20 PM – 3:20 PM	Afternoon Session II
3:30 PM	Closing Remarks

Zoom Room Registration Links

Zoom Rooms		Registration Link
Opening Remarks		https://ucsd.zoom.us/webinar/register/WN_6SKZNJ-TQMWgurAcQM5Qug
Student Panel Rooms	Alki Beach	https://ucsd.zoom.us/meeting/register/tJIsfuCqpjIuHtJ2V-GYf4Poh_zhBafnOcDt
	Coronado Beach	https://ucsd.zoom.us/meeting/register/tJ0vc-uqqjIrE90Ig0uy2Av-uRR2ja0UwUgZ
	Moonlight Beach	https://ucsd.zoom.us/meeting/register/tJMkd-iprjMoE9LvUQh3s4bylmCnziS_Rufk
	Sands Beach	https://ucsd.zoom.us/meeting/register/tJIqcemhqzMsEt0xFvQ2JIioAkvWcb9Uf12V
	Venice Beach	https://ucsd.zoom.us/meeting/register/tJMvceqsrD4oH9bpOKmunjgTj74M9W5EvsLB
	Torrey Pines Beach	https://ucsd.zoom.us/meeting/register/tJIkd-Guqj0tG9ZqXA856PZ0tMxtXU34NpC2
Closing Remarks		https://ucsd.zoom.us/meeting/register/tJ0sf-mtqjsjGNPRMJyOcc4HsjSG_4J14OEt

Note: If you are moderating, presenting, and/or attending multiple panel sessions in the same zoom room, you only need to register for that room once. Then you can use the same emailed link to enter the room multiple times throughout the day.

Presentation FAQs

What should I wear?

The dress code for this conference—and for most academic conferences—is business casual. Depending on your own style preferences, this might mean a button-down shirt, a blouse and a sweater, a dress, or something else that represents your best scholarly self. Be sure to wear clothes that are comfortable; you don't want to be adjusting uncomfortable clothing during your presentation.

What should I do while I'm not presenting?

When you are not presenting, turn off your video and microphone and watch the other presentations. Whether you are a fellow panelist or an audience member, you should be actively listening and taking notes as needed. Taking notes is an effective strategy for reminding yourself about possible future directions for your own research, and for preparing to ask questions during a session.

Can I write out my presentation and read directly from it?

We encourage every presenter to have conversations with their faculty mentor about how to best approach the presentation. In some fields of study, the convention is to present more conversationally and refer to talking points as you go. In some fields of study, the convention is that you have a prepared paper that acts almost like a script. There is not a right or wrong way to present, but there are conventions and stylistic choices in every field of study that your faculty mentor can help explain.

If you do have a prepared script for your presentation, please do not simply read from it in a monotonous voice without engaging the audience. Think about your presentation as a performance, which should draw in your audience and get them excited about your project in a way that is different from simply reading a paper.

What should I do if someone asks me a question and I either don't know the answer or only partially know the answer?

When it comes to Q&A, honesty is always the best policy. If somebody asks you a question that you have difficulty answering, you can thank them for their question and explain that you will further pursue the answer to that question in future research. Keep in mind that—in most cases—scholars use conference presentations to workshop their ideas and implement feedback and inspiration for future work. If you already knew all the answers, why would you be doing research?

How do I ask good questions at a conference?

Audience members who ask good questions are an important part of any academic conference. When posing questions that allow for them to elaborate upon or clarify their argument. Also, ask questions that forge thematic connections between different panelists' presentations, and inspire conversation.

Here is an example of a good question: "Thank you for sharing your research about representations of women in eighteenth-century Japanese art. Based on the research you have conducted, have you observed any recurring visual motifs in these various paintings? If so, what do these motifs illustrate about ideologies of gender during this time period?

Conversely, we discourage audience members form asking questions that are off topic or irrelevant to the conversation. As an audience member asking questions, you should feel free to mention your own area of study if it is relevant, but not if it is a distraction from the topics being discussed during that panel.

Here is an example of a bad question: "Thank you for sharing your research about representations of women in eighteenth-century Japanese art. I study the chemical reactions that happen in AA batteries when you leave them out in the sun for too long. Can you please connect your research project to mine in 5 words or less?"

What should I do if I have technical difficulties during the conference?

If you are having trouble accessing a Zoom room, try logging out and then logging back in again. We will also have staff available via email who you can contact in an emergency if you are having technical difficulties, particularly if you are a panelist for that session.

Can my friends/research team/ family etc. attend? How do they register?

Yes! We encourage you to invite anybody who has been part of your ongoing intellectual journey, however directly or indirectly. They need to register through the zoom links (pgs. 5 of this program) for each event/panel they wish to attend.

Will the audience at my panel be knowledgeable about my field of study?

Yes and no. Some audience members might be faculty or fellow students who study related topics. Also, some audience members might know very little about your field of study. Think of your presentation as an opportunity to teach something new to both types of audience members.

Panel Presentation Schedule

Morning Session I, 9:00AM

Panel #	Panel Name	Location
1	Psychology and Cognitive Science	Alki Beach
2	Neurobiology & Neuroscience I	Coronado Beach
3	Biology and Medical Education	Moonlight Beach
4	Individual and Group Identities; Politics	Sands Beach
5	Particle Physics	Venice Beach
6	Sex Differences and Inflammation	Torrey Pines Beach

Morning Session II, 10:10AM

Panel #	Panel Name	Location
7	Economics	Alki Beach
8	Neurobiology & Neuroscience II	Coronado Beach
9	Acoustics in Marine Biology	Moonlight Beach
10	Education	Sands Beach
11	Physics	Venice Beach
12	Designing Gene Therapies and Drugs	Torrey Pines Beach

Morning Session III, 11:20AM

Panel #	Panel Name	Location
13	Materials Science	Alki Beach
14	Neuropathy & Neurodegeneration	Coronado Beach
15	Ecology & Plant Biology	Moonlight Beach
16	Mental Health & Resilience	Sands Beach
17	Data and Computer Science	Venice Beach
18	Neurosciences and Psychiatry	Torrey Pines Beach

Afternoon Session I, 1:10PM

Panel #	Panel Name	Location
19	Chemistry & Biochemistry	Alki Beach
20	Molecular Biology	Coronado Beach
21	Microbiome	Moonlight Beach
22	Public Policy and Politics	Sands Beach
23	Bioengineering	Venice Beach

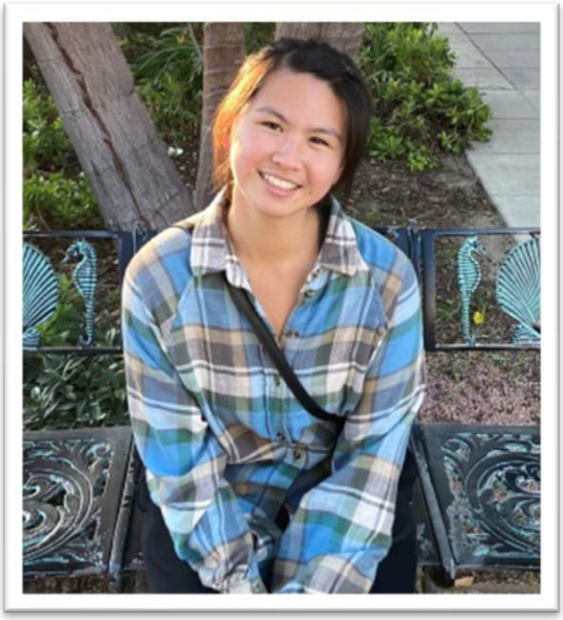
Afternoon Session II, 2:20PM

Panel #	Panel Name	Location
24	Cancer Genomics	Alki Beach
25	Molecular & Cell Biology	Coronado Beach
26	Stress & the Brain	Moonlight Beach
27	Health and Bias	Sands Beach
28	Medical Applications of Engineering	Venice Beach

Student Spotlights

Michelle Du

Pronouns:
They/Them/Theirs/She/Her/Hers
Research Programs:
Class Standing/College: 2nd Year, Earl Warren College
Major: General Biology
Presentation Title: *Student Understanding of COVID-19 Vaccines and Central Dogma*
Mentor: Dr. Melina Owens



What has been the most meaningful experience you've had conducting research on your current project?

The most meaningful experience I've had conducting research on my current project was seeing the lack of representation in certain demographics in biology education. Our research involves bio-education and the qualitative and quantitative analysis of data collected from a survey given to undergraduate biology students in a large public university. While analyzing the responses, my findings reaffirmed the lack of representation of certain minority groups taking biology courses. Although I have heard or read about the underrepresentation of certain ethnicity groups in STEM, seeing the underrepresentation through my own research of students at my university was even more profound. From this, I hope in the future I can serve to improve the accessibility and retention of minorities in higher STEM education.

Jack Ewing

Pronouns: He/Him/His
Research Programs:
Class Standing/College: 4th Year, John Muir College
Major: Marine Biology
Presentation Title: *Propagation of Substrate-Borne Sound through the Legs of Ghost Crabs*
Mentor: Jennifer Taylor

What has been the most meaningful experience you've had conducting research on your current project?

Over this past year, Dr. Taylor and Michael Allen have really looked out for my best interest and helped push my future in marine biology forward. Spending time with them, as well as the rest of the lab, has helped me develop a better understanding of this field and the amazing people that do research in it. It has been a privilege to have a professional group to push me to go deeper into a subject that has now become my discipline of research.

Reina Gomez

Pronouns: She/Her/Hers
Research Programs:
Class Standing/College: 4th Year (Transfer Student), Revelle College
Major: Nanoengineering
Presentation Title: *Combustion synthesis of Eu-doped Ca(4-x)(Sr,Ba)(x)LaB3O10 oxyborate phosphor*
Mentor: Senam Tamakloe and Olivia A. Graeve

What has been the most meaningful experience you've had conducting research on your current project?

My mentors have always been supportive of my work and efforts as an undergraduate student researcher. They allowed me to synthesize and characterize our desired materials which was extremely beneficial as I am beginning graduate school in the fall, where I will be conducting my own research. The work I have done throughout the duration of my project has provided me with the skill set necessary for my future success as a graduate student and has made me feel more confident in my abilities.

Amberley Stein

Pronouns: She/Her/Hers
Research Programs: Psychology Honors Program
Class Standing/College: 4th Year (Transfer Student), Eleanor Roosevelt College
Major: Psychology
Presentation Title: *Can Children Use Casual Relevance as a Guide during Information Search?*
Mentor: Caren Walker, PhD; Elizabeth Lapidow (Doctoral Candidate)

What is the best piece of advice your mentor has given you?

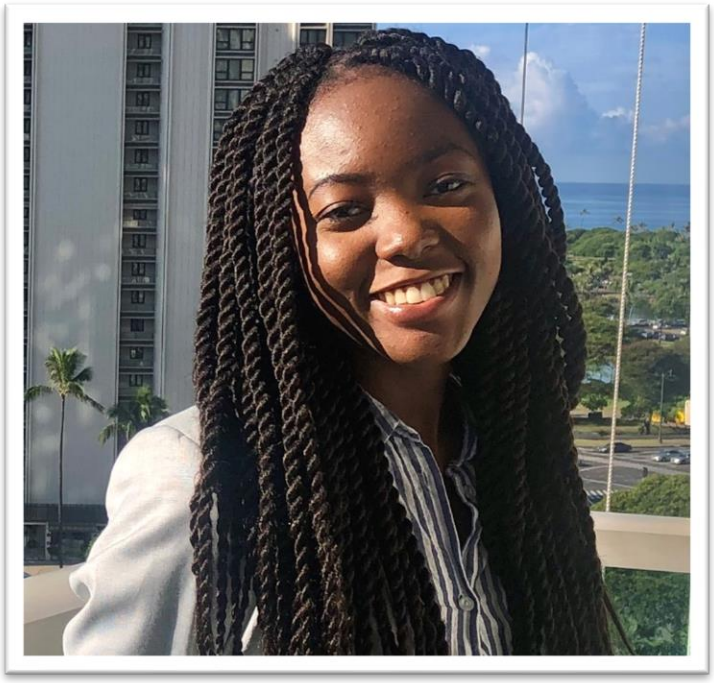
As a non-traditional transfer student, I was concerned that being a little bit older than most other students would be a disadvantage after graduation. My faculty mentor Caren Walker helped me see that it's okay to take a non-linear path toward my educational and career goals and showed me the unique strengths that I have as a slightly older student. Overall, working with Caren and the ELC Lab has helped me become more confident in myself as a researcher, student, and human by shifting my perspective on my non-traditional educational journey.

Saya Shahoy

Pronouns: She/Her/Hers
Research Programs: ROOTS
Class Standing/College: 3rd Year, John Muir College
Major: Human Biology
Presentation Title: *Student Understanding of COVID-19 Vaccines and Central Dogma*
Mentor: Dr. Melinda T. Owens

What is the best piece of advice your mentor has given you?

One of the most valuable pieces of advice I got from my mentor was to be comfortable with asking for help. She has taught me how to work with people who come from different backgrounds and use that as an advantage to achieve our goals. Throughout my research project, my mentor has continued to teach me how to push forward and learn to not be discouraged by inconclusive or non-significant results but instead to use that as motivation to seek out new ways to test my hypothesis and further our project.



Paula Kirya

Pronouns: She/Her/Hers
Research Programs: McNair Scholars Program
Class Standing/College: 4th Year (Transfer Student, Junior Standing), John Muir College
Major: Bioengineering
Presentation Title: *On-Chip Metasurface for Rapid, Colorimetric Cancer Tissue Diagnostics*
Mentor: Dr. Lisa Poulikakos

What is the best piece of advice your mentor has given you?
Every interaction I've had with my mentor has been especially meaningful, as her guidance and endless kindness has allowed me to power through the pitfalls of tackling a new and novel research project. She is one of my biggest supporters in my research endeavors and academic career, and her encouragement has only made it easier for me to work harder.

Panel Details

Morning Session I

Panel 1: Psychology and Cognitive Science

Zoom Room: Alki Beach
9:00 AM - 10:00 AM
Moderator: TBD

Jeffrey Xing - Sixth
Mentor: Timothy Q. Gentner; Professor
Syntactic modulation of rhythm in Australian pied butcherbird song

Jane Yang - Sixth
Mentor: Professor Judith Fan
Communicating understanding of physical dynamics in natural language

Nathan Chilbert - Marshall
Mentor: Provost Leslie Carver
Social Cue Learning in Infants with Familial History of Autism

Amberley Stein - ERC
Mentor: Caren Walker, PhD, Assistant Professor
Can Children Use Causal Relevance to Guide Information Search?

Panel 2: Neurobiology & Neuroscience I

Zoom Room: Coronado Beach
9:00 AM - 10:00 AM
Moderator: TBD

Dhruv Parmar - Revelle
Mentor: Dr. Cory Root, Assistant Professor
Quantifying fluorescence through Synaptophysin Tracing to map the Intercalated Cells of the Amygdala

Faith Aloboudi - ERC
Mentor: Dr. Kay Tye
Elucidating overlapping neural ensembles that encode for social and physical pain

Angie Santos - Muir
Mentor: Dr. Lieselot Carrette & Dr. Olivier George
Characterization of the functional connectome of opioid intoxication through MOR and KOR agonism

Panel 3: Biology and Medical Education

Zoom Room: Moonlight Beach
9:00 AM - 10:00 AM
Moderator: Oliva Mota Segura

Max Gruber - Revelle
Mentor: Stanley Lo, Associate Teaching Professor
Assessment on the Implementation of Laboratory Kits in a Remote Course-Based Undergraduate Experience on Soil Microbiomes

Saya Shahoy and Michelle Du- Muir
Mentor: Dr. Melinda T. Owens
Student understanding of COVID-19 vaccines and central dogma

Flora Wong - Marshall
Mentor: Desiree Shapiro, MD (Associate Clinical Professor of Psychiatry)
Mindful Medical Education

Alice Tor and Ben Hofflich- ERC / Revelle
Mentor: Akshay Paul and Dr. Gert Cauwenberghs
Scalp and In-Ear Electrophysiology for Unobtrusive and Mobile Health Monitoring

Panel 4: Individual and group identities; politics

Zoom Room: Sands Beach
9:00 AM - 10:00 AM
Moderator: Dr. Michel Estefan

Meghan Traynor - Revelle
Mentor: Dr. Michel Estefan, Assistant Teaching Professor of Sociology
Cross-Cultural Comparison of Impact of Higher Levels of Familism on Adolescents' Experience of Dissenting With Familial Values

Finnley Armacost - Muir
Mentor: Dr. Gershon Shafir, Distinguished Professor
LGBT+ in Name Only? Log Cabin Republicans and the Clash of Identity

Mariah Kallhoff - Muir
Mentor: Pamela Ban, Ph.D Assistant Professor
Republican Women: For Women or for Trump? An Analysis on the Voting Behavior of Republican Women during the Trump Era

Panel 5: Particle Physics

Zoom Room: Venice Beach
9:00 AM - 10:00 AM
Moderator: Dr. Liang Yang

Sukanya Krishna - Marshall
Mentor: Professor Javier Duarte
Particle Graph Autoencoders for L1 Anomaly Detection

Thomas Sievert - Muir
Mentor: Dr. Javier Duarte
QAML-Z + NQAC on D-Wave Advantage

Brian Sheldon - Sixth
Mentor: Dr. Javier Duarte
Improving Di-Higgs Sensitivity at Future Colliders in Hadronic Final States with Machine Learning

Rohan Shenoy - Marshall
Mentor: Javier Duarte, Assistant Professor
Learned Energy Movers Distance a CNN based approximation to improve HGCAL trigger performance

Panel 6: Sex Differences and Inflammation

Zoom Room: Torrey Pines Beach
9:00 AM - 10:00 AM
Moderator: TBD

Chao-Chin Hsu - Warren
Mentor: Dr. Maripat Corr
Mapping of Pathways in Inflammatory Arthritis-Pharmacologic and Genetic

Katelyn Nguyen - Marshall
Mentor: Dr. Matthew Daugherty
NLRP10 inhibits the host innate inflammatory response and is targeted by diverse flavivirus proteases

Gwendalynn Stilson - Muir
Mentor: Dr. Maripat Corr
Sex Differences in a Model of Arthritis-divergence of Peripheral and Central Pathways

Mihir Dixit - Seventh
Mentor: Dr. Alice Zemljic-Harpf MD, Assistant Research Scientist
Sex Differences and Dug Specific Effects After Long-Term Rosuvastatin and Atorvastatin Administration

Morning Session II

Panel 7: Economics

Zoom Room: Alki Beach
10:10 AM - 11:10 AM
Moderator: TBD

Lin Peng - Marshall
Mentor: Professor Munseob Lee
Renegotiation on U.S.-Korea Free Trade Agreement

Jesus Osuna - ERC
Mentor: Professor Munseob Lee
Assessing the South Korean Government's Performance on Supply Factors in the Housing Market of Seoul

Haihan Tian - Marshall
Mentor: Emanuel Vespa Associate Professor
The Returns to Having a Major-Related Job: Evidence From China

Matthew Risley - ERC
Mentor: Dr. Isaac Martin
The Political Implications of the 2017 Tax Cuts and Jobs Act

Panel 8: Neurobiology & Neuroscience II

Zoom Room: Coronado Beach
10:10 AM - 11:10 AM
Moderator: TBD

Elena Assad - Revelle
Mentor: Dr. Brenda Bloodgood
Toward a molecular basis of learning and memory: neuronal activity-dependent downregulation of genes

Eunmi Ha - ERC
Mentor: Dr. Binhai Zheng
Regulation of Oxidative-Stress is Essential for Axonal Regeneration of Cortical Spinal Tract

Manan Chopra - Marshall
Mentor: Dr. Karl J Wahlin
High Efficiency Human Retinal Ganglion Cell Induced Neurons by Transcription Factor Mediated Cellular Reprogramming and BMP Inhibition

Panel 9: Acoustics in Marine Biology

Zoom Room: Moonlight Beach
10:10 AM - 11:10 AM
Moderator: TBD

Lauren Baggett - Muir
Mentor: Simone Baumann-Pickering, Associate Professor
Identifying environmental drivers of variability in toothed whale acoustic presence in the western North Atlantic

Gabrielle Arrieta - Muir
Mentor: Dr. Simone Baumann-Pickering
Sound in the Pelagic: Are Fish Chorusing in the San Diego Trough?

Jack Ewing - Muir
Mentor: Jennifer Taylor, Professor
Propagation of Substrate-Borne sound through the legs of Ghost Crabs

Panel 10: Education

Zoom Room: Sands Beach
10:10 AM - 11:10 AM
Moderator: Dr. Michel Estefan

Mei Lao - Warren
Mentor: Luz Chung, EDS Faculty
Self-Advocacy in First-Generation College Students

Guadalupe Marmolejo - Marshall
Mentor: Megan Hopkins Associate Professor
Latinx Student Identity Development in US Bilingual Programs

Shaelin Chong - Marshall
Mentor: Dr. Melinda T. Owens
Investigating the Impact of the Scientist Spotlight Homework Assignment on Student Ideas about Diversity and Science Identity

Evelyn Cho - ERC
Mentor: Professor Luz Chung
A Cost and Benefit Analysis of Religious Institutions

Panel 11: Physics

Zoom Room: Venice Beach
10:10 AM - 11:10 AM
Moderator: Dr. Liang Yang

Elias Trapp - Muir
Mentor: Julio Barreiro Guerrero, Assistant Professor
Preparing Optical Tweezer Arrays to build a next-generation Optical Atomic Clock

Mikaela Larkin - Revelle
Mentor: Professor Adam Burgasser
Characterization of Population III Stars with Stellar Atmosphere and Evolutionary Modeling and Predictions of their Observability with the James Webb Space Telescope

Malina Desai and Taiqoor Ahmad – ERC / Warren
Mentor: Dr. Liang Yang
Instrumentation of nEXO project to study 0Î½Î²Î²

Panel 12: Designing gene therapies and drugs

Zoom Room: Torrey Pines Beach
10:10 AM - 11:10 AM
Moderator:

Claire Williams - Seventh
Mentor: Samuel Pfaff Adjunct Professor
Moving Toward a Genetic Therapy for Duchenne Muscular Dystrophy by RNA End-joining

Sifat Alam - Revelle
Mentor: Alice Zemljic-Harpf M.D.
Sustained Exposure to the SGLT2 Inhibitor Ertugliflozin, but not NHE-1 Inhibition by Cariporide, Attenuates Adrenergic Stimulation of Cytosolic CA 2+ Levels in Spontaneously Contracting Cardiac Myocytes

Sebastian Rohrer - Revelle
Mentor: Dr. William Gerwick, PhD
Heterologous expression in Anabaena of the columbamide pathway from the cyanobacterium Moorena bouillonii and production of new analogs

Asim Mohiuddin - ERC
Mentor: Dr. Maripat Corr
Drivers of Chronic Symptoms In Mouse Arthritis: TLR 4

Morning Session III

Panel 13: Materials Science

Zoom Room: Alki Beach
11:20 AM - 12:20 AM
Moderator: TBD

Ainsley Clark - Revelle
Mentor: Darren Lipomi
Characterizing Haptic Moisture Sensation by Magnetically Tuning Ferrofluid Properties

Reina Gomez - Revelle
Mentor: Dr. Olivia Graeve
Combustion synthesis of Eu-doped Ca(4-x)(Sr,Ba)(x)LaB3O10 oxyborate phosphor

Anna Wilke - Sixth
Mentor: Dr. Olivia Graeve
Bismuth Ferrite Particle Formation Mechanism using Advanced Morphology Control

Jordan Bunch - Muir
Mentor: Darren J. Lipomi (Principal Investigator)
Improving the Survivability of Organic Solar Cells using Crosslinked Semiconducting Polymers

Panel 14: Neuropathy & Neurodegeneration

Zoom Room: Coronado Beach
11:20 AM - 12:20 AM
Moderator: TBD

Leonardo Gonzalez - Warren
Mentor: Yury Miller, Professor of Medicine
CIPN model shows AIBP can reverse allodynia

Rakesh Nemmani - Warren
Mentor: Nigel Calcutt
Effects of HDAC6 inhibition on Paclitaxel-Induced Peripheral Neuropathy in Mice

Brian Khov - Sixth
Mentor: Mark Ellisman PhD, Distinguished Professor
Synaptic changes in the SCN are associated with Alzheimer's disease

Elise Kim - Sixth
Mentor: Dr. Robert Rissman
Identifying Blood-Based Biomarkers of Alzheimer's Disease in Down Syndrome Populations

Panel 15: Ecology & Plant Biology

Zoom Room: Moonlight Beach
11:20 AM - 12:20 AM
Moderator: TBD

Sandy Nguyenphuoc - Muir
Mentor: Dr. Ronald Burton
Using DNA barcoding of ichthyoplankton to monitor the diversity of pelagic spawning California fish

Kailey Ramsing - Muir
Mentor: Dr. Jennifer Smith
Competition of Turf and Crustose Coralline Algae on Branching and Massive Coral Colonies Following Bleaching Events

Manuel Garcia - Muir
Mentor: Richard Norris
Experimental Dissolution of Barite and Impact on Estimates of Ocean Export Productivity

Sabrina Lin - Revelle
Mentor: Dr. Julian Schroeder
Identifying Putative Candidates Involved in Stomatal Movement

Panel 16: Mental Health & Resilience

Zoom Room: Sands Beach
11:20 AM - 12:20 AM
Moderator: Dr. Michel Estefan

Rebecca Lim - ERC
Mentor: Dr. Amy Bintliff, Assistant Teaching Professor
Trauma-Informed Social Emotional Learning During Pandemic-Related Remote Instruction: Educator Perspectives

Rita Ewaz - ERC
Mentor: Dr. Amy Bintliff
Academic Resilience in Relation to Socioeconomic Status During COVID-19

Kendall Quesenberry - Warren
Mentor: Dr. Michel Estefan, Faculty Advisor
The Impact of the Choice to Disclose vs. Not-Disclose ADHD on the Academic Self-Confidence of Higher Education Students

Rachel Kunowski - ERC
Mentor: Camille Nebeker
Return of Results: Understanding the design space for the return of digital mental health research data

Panel 17: Data and Computer Science

Zoom Room: Venice Beach
11:20 AM - 12:20 AM
Moderator: Dr. Paul Siegel

Sayan Shaw - ERC
Mentor: Dr. Jan Kleissl, (Director, Center for Energy Research)
Neighbor-Based Optimized Logistic Regression Machine Learning Model For Electric Vehicle Occupancy Detection

Arunav Gupta - ERC
Mentor: Dr. Isaac Martin
Coloring Inside the Lines: The Jagged Legacy of the HOLC Neighborhood Risk Maps

Sirui Tao - Warren
Mentor: Judith E. Fan - Assistant Professor
Physion: Evaluating Physical Prediction from Vision in Humans and Machines

Shubham Kulkarni - Sixth
Mentor: Garrison Cottrell, CSE Professor
Visual Expertise and the Face Inversion Effect

Panel 18: Neurosciences and Psychiatry

Zoom Room: Torrey Pines Beach
11:20 AM - 12:20 AM
Moderator: Oliva Mota Segura

Olivia Alcoran and Katrina Lin – Marshall/ERC
Mentor: Eric Zorrilla, PhD | Adjunct Professor
EFFECTS OF ETHANOL NON-REWARD ON BINGE-LIKE DRINKING IN RATS: TOWARDS MODELING NEGATIVE URGENCY

Garrett Tan - Revelle
Mentor: Christine Smith
Novel News Events Test Predicts Cortical Thickness in Older Adults with Normal Cognition or Mild Cognitive Impairment

Zoe Adelsheim - ERC
Mentor: Dr. Michael McCarthy, Associate Adjunct Professor, Psychiatry
The Specific Contributions of Bipolar Disorder-Associated Risk Genes to Circadian Rhythms

Afternoon Session I

Panel 19: Chemistry & Biochemistry

Zoom Room: Alki Beach
1:10 PM - 2:10 PM
Moderator: TBD

Vedran Markota - Sixth
Mentor: Dr. J. Andrew McCammon
Covalent Docking Against Different Protein Conformations Reveals Potential SARS-CoV-2 Mpro inhibitors

Lehan Li - Sixth
Mentor: Dr. Alexis Komor
Optimization of GFP reporters for evolving new base editors

Noura Mohamed - Revelle
Mentor: Dr. Johannes Schöneberg
Effects of Ketogenic Diet on Mitochondria Dynamics in Epilepsy-Associated Mutations

Jiwoo Kim - Marshall
Mentor: Charles Perrin, Distinguished Professor Emeritus of Chemistry and Biochemistry
Complete mechanism of an aldol condensation in water

Panel 20: Molecular Biology

Zoom Room: Coronado Beach
1:10 PM - 2:10 PM
Moderator: TBD

Khoa Tran - Warren
Mentor: Dr. Colleen McHugh
Identifying functional region(s) of the long non-coding RNA linc00883 in regulating human cell growth

Raul Johnson - Revelle
Mentor: Colleen A. McHugh, Ph.D. Assistant Professor
Alternative splicing of SAT1

Lauren Grubbs - Revelle
Mentor: Dr. Emma Farley, PhD Assistant Professor
Identifying single nucleotide variants within transcription factor binding sites of a Ciona notochord enhancer that alter gene expression

Vaishnavi Khandavilli - Sixth
Mentor: Amit Majithia, M.D.
Proposing new genetic associations involved in metabolic diseases through reanalysis of adipocyte morphology changes with independent bioinformatic tools

Panel 21: Microbiome

Zoom Room: Moonlight Beach
1:10 PM - 2:10 PM
Moderator: TBD

Nathan Glonek and Katie Short – Warren/Marshall
Mentor: Dr. Karsten Zengler
Constructing a synthetic, reproducible consortia to study the interaction dynamics within the soil microbiome

Nadine Mikaelle Rosete - ERC
Mentor: Dr. Karsten Zengler
Developing Standards for Staphylococcus Biomass Curves

Mia Tonkin - Muir
Mentor: Diana Rennsion, Assistant Professor
Fish, their guts, and why: exploring gut microbiota diversity associated with threespine sticklebacks' divergence in trophic ecology

Panel 22: Public Policy and Politics

Zoom Room: Sands Beach
1:10 PM - 2:10 PM
Moderator: Dr. Brian McInnis

Kyleen Martin - Revelle
Mentor: Dr. Boatema Boateng
Secrecy and Privacy as Property

Zixuan Shao - ERC
Mentor: Professor Mirle Rabinowitz-Bussell
Qualitative Analysis of Mandatory Hotel Quarantine Policies based on Ethical Principals

Honor Gosch - Muir
Mentor: Vanesa Ribas - Associate Professor of Sociology
Social Media As Political Tool: Competitive Framing in the Abortion Debate

Panel 23: Bioengineering

Zoom Room: Venice Beach
1:10 PM - 2:10 PM
Moderator: TBD

Meenakshi Singhal - Muir
Mentor: Dr. Trey Ideker, PhD
Exploration of Multi-localizing Proteins in Integrated Maps of Cell Structure

Yufei Gao - Marshall
Mentor: Dr. Gene Yeo
WRKR-B: Molecular Biology Automation on the Space Station

Sirasit Prayotamornkul, Khang Hoang, and Chan-yu Kuo – Revelle/Sixth/Sixth
Mentor: Lingyan Shi, Assistant Professor
DO-SRS and MPF Imaging of Cancer Cell Metabolic Activities Regulated with Aromatic Amino Acids

Afternoon Session II

Panel 24: Cancer Genomics

Zoom Room: Alki Beach
2:20 PM - 3:20 PM
Moderator: TBD

Hei Yu Annika So - Muir
Mentor: Professor Alexis Komor
Designing a Fluorescence-based Reporter Plasmid to Characterize Cancer Variants

Jonathan Nguyen - Marshall
Mentor: Dr. Colleen McHugh
Investigating the Cellular Functions of GAS5 in Cancer Cells

Zichen Jiang - Warren
Mentor: Ludmil B. Alexandrov, Assistant Professor
Genomic Profiling of Colorectal Adenoma and Cancer Samples Without Matched Normal

Panel 25: Molecular & Cell Biology

Zoom Room: Coronado Beach
2:20 PM - 3:20 PM
Moderator: TBD

Allison Li - Marshall
Mentor: Gene Yeo
The Effectiveness of CIRTS in Targeting Microsatellite Repeat Expansion Disorders

Yazmin Munoz - Revelle
Mentor: Cressida Madigan, Ph.D Assistant Professor
Investigating the Role of RHBDL4 in Vertebrates

Mohnish Alishala - Muir
Mentor: Dr. Christopher Glass
Use of CRISPR/Cas9 gene editing methods to investigate mechanisms of Trem2-dependent gene expression in macrophages

Anthony Estrella - Muir
Mentor: Antonio De Maio
Phospholipids and macrophage functions

Panel 26: Stress & the Brain

Zoom Room: Moonlight Beach
2:20 PM - 3:20 PM
Moderator: TBD

Romona Dong - Revelle
Mentor: Professor Nicholas Spitzer
An Analysis on the Efficacy of Fluoxetine Treatment on Fear-Conditioned Mice

Eleanna Sakoulas - Revelle
Mentor: Dr. Eric Zorrilla
Benztropine Reduces Reacquisition of Alcohol Self-Administration in Rats with Stress History: Role of FKBP5

Kirollos Tadrousse - Warren
Mentor: Dr. Kellie Breen Church, Associate Professor
The Role of Norepinephrine Neurons in the Locus Coeruleus in Stress-Induced Suppression of Luteinizing Hormone

Panel 27: Health and Bias

Zoom Room: Sands Beach
2:20 PM - 3:20 PM
Moderator: Dr. Brian McInnis

Vivian Chang - ERC
Mentor: Giselle Sanchez
The Faces of ACES: Examining Effectiveness of ACE Measurement Scales for US Immigrant Youth

Colette Kirkpatrick - ERC
Mentor: Dr. Hua Wu
Addressing Gender-Based Violence Against Rohingya Refugee Women Through Inclusive Wash

Christina Buksa - Sixth
Mentor: Dr. Blair Loy and Dr.Shafir
How the Paradigm of "Emotional and Irrational" Pregnant Patient was Constructed and is Contemporarily Observed

Brian Do - Revelle
Mentor: Dr. Jarryd Willis Principle Investigator
Improving Linkage to Care for Patients in Vietnam

Panel 28: Medical Applications of Engineering

Zoom Room: Venice Beach
2:20 PM - 3:20 PM
Moderator: TBD

Emerson Chin - Warren

Mentor: Professor Darren J. Lipomi

Metallic Nanoisland Sensor Arrays for the Measurement of Cardiomyocyte Contractility

Paula Kirya - Muir

Mentor: Dr. Lisa Poulikakos

On-Chip Metasurfaces for Rapid, Colorimetric Cancer Tissue Diagnostics

Xi Wang - Revelle

Mentor: Dr. Ludmil B. Alexandrov, Assistant Professor of Cellular and Molecular Medicine, Assistant Professor of Bioengineering

Mutational Signature Assignment Benchmark

Abstracts

Zoe Adelsheim

Neurobiology, ERC

Mentored by Dr. Michael McCarthy, Associate Adjunct Professor, Psychiatry

The Specific Contributions of Bipolar Disorder-Associated Risk Genes to Circadian Rhythms

Bipolar disorder is a neuropsychiatric disorder impacting 1-2% of the global population that is characterized by episodes of depression and mania in addition to altered sleep, appetite, and energy. Increasing evidence illustrates a connection between bipolar disorder and circadian rhythms. Recent studies indicate that some genes such as ANK3, CACNA1C, and TCF4 previously associated with conferring risk for bipolar disorder are also implicated in chronotype—a trait that is controlled by the circadian clock. However, the function of these bipolar risk genes in regulating circadian rhythms is not well understood. Across the genome >10% of genes are rhythmically expressed. This project aims to understand how these bipolar disorder-associated risk genes contribute to circadian rhythms in transcription across the genome in neuronal precursor cells. Expression of candidate genes will be reduced using siRNA and 24h rhythms in gene expression will be examined across the genome using RNA sequencing. Differences in rhythms resulting from loss of function of genes implicated in both bipolar disorder and chronotype will be examined. We anticipate that the reduction in expression of TCF4, CACNA1C, and ANK3 will result in losses and/or gains of rhythms in downstream transcripts.

Taiqoor Ahmad and Malina Desai

Physics with specialization in Materials Physics, Warren / ERC

Mentored by Dr. Liang Yang

Instrumentation of nEXO project to study 0Î½Î²Î²

The next Enriched Xenon Observatory (nEXO) consortium is an international collaboration with the goal of observing the neutrinoless double beta decay reaction. Observing this decay would confirm that the neutrino is a Majorana particle, meaning that it is its own antiparticle. This would contradict lepton flavor conservation and would be evidence for the existence of new physics beyond the standard model. Measuring this decay accurately is difficult due to cosmic particle background noise. To enable this investigation, Rare Labs at UCSD is working on the research and development of test systems that will validate the cryogenic circuity. We are supporting this development by digitally modeling, creating, and assembling physical components

of the vacuum chamber, as well as writing software for monitoring and controlling key physical parameters inside the chamber.

Sifat Alam

Global Health MA, Revelle

Mentored by Alice Zemljic-Harpf M.D.

SUSTAINED EXPOSURE TO THE SGLT2 INHIBITOR ERTUGLIFLOZIN, BUT NOT NHE-1 INHIBITION BY CARIPORIDE, ATTENUATES ADRENERGIC STIMULATION OF CYTOSOLIC CA 2+ LEVELS IN SPONTANEOUSLY CONTRACTING CARDIAC MYOCYTES

Sodium-glucose cotransporter 2 inhibitors (SGLT2i) target renal SGLT2 to lower blood glucose in patients with Type II diabetes (T2DM). The drugs also decrease mortality and heart failure (HF) hospitalizations in T2DM patients. Patients with HF exhibit sympathetic overdrive and cytosolic Ca2+ overload in cardiomyocytes. Because SGLT2i harbor cardioprotective effects, we hypothesize that the SGLT2i ertugliflozin (ERTU) will lower cytosolic Ca2+ concentration ([Ca2+]cyt) in contracting cardiomyocytes after adrenergic stimulation. Cardiomyocytes were isolated from 0–2-day old mice. Spontaneously contracting cardiomyocytes were treated for 72 hours with either ERTU, 10 µM cariporide (CARI), ERTU and CARI, or vehicle. After 72 hours, baseline [Ca2+]cyt was recorded, then cells were stimulated with phenylephrine (100 µM), and [Ca2+]cyt was recorded for additional 30 minutes. ERTU exposure for 72 hours did not alter baseline [Ca2+]cyt in beating cardiomyocytes when compared to vehicle treated controls but reduced the increase in [Ca2+]cyt after adrenergic stimulation with phenylephrine. In contrast, 72-hour-long NHE1 inhibition with CARI increased [Ca2+]cyt at baseline when compared to vehicle and ERTU, and further enhanced the increase in [Ca2+]cyt after phenylephrine stimulation.Because sustained exposure to the SGLT2i ERTU reduced, but the NHE-1 inhibitor CARI increased [Ca2+]cyt, these data indicate for the first time that ERTU's beneficial effect on [Ca2+]cyt homeostasis is distinct from NHE1 inhibition. Reduced [Ca2+]cyt levels after sympathetic stimulation may contribute to the cardioprotective effect of SGLT2i. Further research is needed on the molecular mechanisms behind ERTU's influence on cardiac [Ca2+]cyt.

Olivia Alcoran and Katrina Lin

Human Biology / Cognitive and Behavioral Neuroscience, Marshall / ERC

Mentored by Eric Zorrilla, PhD | Adjunct Professor

EFFECTS OF ETHANOL NON-REWARD ON BINGE-LIKE DRINKING IN RATS: TOWARDS MODELING NEGATIVE URGENCY

Negative urgency, the disposition to act impulsively under distress, is the type of impulsivity most associated with externalizing behaviors, including problematic alcohol use and alcohol use disorder. Animal models are needed to understand its neurobiological basis and identify therapeutic targets. In humans, omission of expected rewards, or "frustrative" non-reward, leads to greater neuroactivational and externalizing behavioral responses in people high in negative urgency. Here we tested the hypothesis that frustrative non-reward would facilitate binge-like drinking in a 2-bottle choice (2BC), limited-access paradigm in Wistar rats (n=22), even in a novel environment expected to suppress drinking. Rats first received 2BC-access to a 20% v/v ethanol solution for 48 hr. They then received scheduled, intermittent (Monday-Wednesday-Friday), 2BC 2-hr access to ethanol for 3 weeks. Rats then were tested in a 2 (Pre-stress: Frustration vs. Control) X 2 (Drinking cage: Home vs. Novel) Latin square design. Frustrative non-reward involved 15-min presentation of an empty, ethanol-scented bottle. Results indicated a sex difference whereby the frustrative stressor increased ethanol intake during the first fifteen minutes of access, regardless of cage condition ($p = 0.009$). Total fluid intake increased in females during the first 15 minutes of alcohol presentation ($p = 0.004$), but not during presentation of the frustrative cue. In males, only water intake increased within the first 15 minutes ($p=0.025$). Thus, ethanol non-reward increased ethanol intake differentially in female rats, warranting further study on sex differences in response to reward omission and negative urgency and the effects of frustrative stress on binge-like drinking.

Mohnish Alishala

Human Biology, Muir

Mentored by Dr. Christopher Glass

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

Macrophages play a major role in the immune system. They not only provide protection against foreign entities but also assist other immune cells in the healing process. Triggering Receptor Expressed on Myeloid Cells 2 (TREM2) is a surface receptor expressed in macrophages during tissue injury (Gratuze et al., 2018). This receptor plays a role in driving phagocytosis and lipid catabolism (Jaitin et al., 2019). Because of this, they play a large part in diseases such as Alzheimer's disease, nonalcoholic steatohepatitis, metabolic syndrome, and cancer. However, the exact pathway in which TREM2 is involved in these diseases is rather unknown (Xiong et al., 2019). Macrophage gene expression is regulated by a variety of transcription factors such as ATF3 and TFEB. These transcription factors have been suggested to be involved in some of the disease processes mentioned above by RNA-seq or ChIP-seq experiments (Seidmann et al., Troutman et al.).

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

Faith Aloboudi

Neurobiology, ERC

Mentored by Dr. Kay Tye

Elucidating overlapping neural ensembles that encode for social and physical pain

The COVID-19 pandemic has increased the prevalence of social pain as more individuals experience social isolation and exclusion. Currently, there is a lack of effective treatments to relieve social pain because there is a lack of knowledge of how social pain is processed within the brain, and if the neural substrates for social pain are distinct from or similar to physical pain. Our project aims to understand how the anterior insular cortex (aIC), an area of the brain that has been shown to process social behavior and pain, processes experiences of social exclusion, and if this process is affected by neuromodulators. Using calcium and biosensor imaging within the aIC in a novel social exclusion paradigm, we hope to understand how social exclusion is represented within the brain, and how social pain can modulate physical pain.

Finnley Armacost

Sociology, Muir

Mentored by Dr. Gershon Shafir, Distinguished Professor

LGBT+ in Name Only? Log Cabin Republicans and the Clash of Identity

LGBT+ people are far more likely to identify themselves as Democrats than Republicans making them a reliable voting block for Democratic Party (Mallory, 2019). The LGBT+ community's commitment to the Democratic Party seems reasonable considering how the party has largely embraced the community while the Republican Party has aligned itself with the Religious Right, the most consequential opponent of the LGBT+ Rights Movement. However, despite this reality, some LGBT+ people are proud members of the Republican Party. In the age of identity politics and in a political context marked by increasing polarization, how does one reconcile their LGBT+ identity and their partisan Republican identity? This study utilizes Identity Theory and measures of identity salience and prominence to examine how LGBT+ Republicans manage their seemingly conflicting

identities. Through in-depth qualitative interviews and supplemental survey data I measured the salience and prominence of identities of members of the San Diego chapter of the Log Cabin Republicans (LCRs), a local organization of LGBT+ people within the Republican party. I sought not only to understand how LCRs manage their partisan and LGBT+ identities but how their degree of identification impacts their political beliefs. I found that some LGBT+ Republicans identify more with the LGBT+ Community and others with the Republican Party. These individuals manage their identities in diverse ways with some having what I call Dissociated Identities while others have Coalesced Identities. It was also found that levels of identification and identity management strategies had an impact on political beliefs.

Gabrielle Arrieta

Marine Biology, Muir

Mentored by Dr. Simone Baumann-Pickering

Sound in the Pelagic: Are Fish Chorusing in the San Diego Trough?

The open ocean is usually characterized as having low levels of ambient noise compared to coastal communities. One of the many sounds that have been found in coastal areas are fish choruses. However, deep water recordings in the San Diego Trough from 2017 indicated the presence of a fish chorus with unknown origin. In order to understand where this fish chorus originated from, we wanted to know if the chorus amplitude was greater at sites that were closer to shore. Additionally, we investigated if the chorus correlated with backscatter strength to find out if it could originate from pelagic migrators. Using passive acoustic data collected at each site, the chorus was found to start in May and end in the beginning of November with peaks at sunset and sunrise. The amplitude of the chorus at the sunset peak was comparable between sites, indicating that the chorus was not coming from a single (coastal) source. Furthermore, using active acoustic data, there was a positive correlation between the chorus amplitude and backscatter strength, showing that the source may be a vertical migrator. Getting a better understanding of fish choruses from the open ocean will hopefully give us insight into behavior of pelagic fish, a group that has been difficult to study due to its remote living environment.

Elena Assad

General Biology, Revelle

Mentored by Dr. Brenda Bloodgood

Toward a molecular basis of learning and memory: neuronal activity-dependent downregulation of genes

The changes required to consolidate learning and hold onto memories for years remains a mystery. Numerous studies show a strong link between electrical activity in neurons and the subsequent upregulation – an "on switch" of sorts – in gene transcription across many brain regions. Such transcriptional changes play key roles in memory formation and synaptic plasticity. There is, however, very little pre-existing literature on the downregulation of genes in response to neuronal activity, where these genes may reveal new therapeutic targets for the regulation of synaptic plasticity. However, these targets have previously been challenging to identify because pre-existing RNA levels complicated the temporal kinetics of transcriptional shutoff measurements. RNA metabolic labeling in neurons depolarized with high potassium allows for the isolation of newly synthesized transcripts in response to neuronal activity, and about half of the 16,000 activity-dependent genes were found to be downregulated. Here, we sought to identify some of the transcription factors that bind these downregulated genes and delve into the biological pathways these genes are involved in to generate hypotheses about the mechanisms and functions of activity-dependent transcriptional downregulation. Through subsequent bioinformatics analyses, known transcription factors were matched to the genes based on the degree of similarity between their binding sequence and the enriched motifs found in the genes' extracted promoter sequences. Preliminary results indicate that the most significant transcription factors identified regulate genes involved in new synaptic formation and development, further consolidating the known role of neuronal activity in the refinement of synaptic plasticity.

Lauren Baggett

Marine Biology, Muir

Mentored by Simone Baumann-Pickering, Associate Professor

Identifying environmental drivers of variability in toothed whale acoustic presence in the western North Atlantic

Odontocetes, or toothed whales, are highly mobile top predators that serve as ecological indicators. Their pivotal role in promoting ecosystem health makes them a target species for management efforts, and understanding drivers of observed distribution patterns is essential for effective conservation. Since odontocetes utilize vocal cues for everything from communication, to navigation, to foraging, and many of these cues are species-specific, acoustic monitoring is an effective means of quantifying species presence and studying many aspects of their ecology. This analysis combined acoustic data collected in the western North Atlantic with oceanographic variables to identify drivers of patterns in presence for two species with differing foraging strategies: short-beaked common dolphins and Cuvier's beaked whales. Acoustic data were collected using moored devices at eleven sites spanning a latitudinal gradient in the

western North Atlantic. Vocal cues were extracted and labeled using automated detection and classification algorithms, yielding high temporal-resolution time series of acoustic presence. Remotely-sensed and modeled environmental covariates were explored to identify correlations with species' presence, and then habitat models were built using generalized estimating equation-generalized linear models (GEEGLMs) to characterize the influence of these environmental metrics on acoustic presence. These habitat models, based on high spatial and temporal resolution data aggregated across a large region, provide novel insights into the habitat preferences of species with differing foraging ecology and can be utilized in population conservation and management decision making.

Christina Buksa

Major: Sociology of Science and Medicine. Minor: Human Developmental Sciences. Emphasis: Pre-Medical :, Sixth

Mentored by Dr. Gershon Shafir

How the Paradigm of "Emotional and Irrational" Pregnant Patient was Constructed and is Contemporarily Observed

This study was conducted to identify whether or not the quality of medical care for pregnancy-related diseases and complications is influenced by physicians' biases. I evaluated attitudes toward pregnant women in healthcare historically and today. To explore the construction of the paradigm of the "pregnant patient", historical academic and medical materials were analyzed for associated false syllogisms. The mechanism of bias, testimonial injustice, was also used to analyze whether or not biases are present in and influence the quality of modern prenatal care. Through this extensive evaluation it is proposed that the medical field has failed to address and resolve the socially constructed gender-stereotypical assumptions that are embedded in women's healthcare, specifically prenatal care. This study proposes implementing an Implicit Association Test (IAT) for medical biases coupled with a system of reeducation in health care institutions for all healthcare professionals.

Keywords: Pregnancy, Prenatal Care, Diagnostic Treatment, Applied Treatment, Quality of Care, Testimonial Injustice, Syllogisms, Biases, Heuristics, Female Reproductive System, Hysteria.

Vivian Chang

Global Health (B.S.), ERC

Mentored by Giselle Sanchez

The Faces of ACES: Examining Effectiveness of ACE Measurement Scales for US Immigrant Youth

Early detection and intervention of Adverse Childhood Experiences (ACEs) are integral in the prevention of lifelong health risks and consequences. ACE measurement scales in the United States, however, are not inclusive of the country's diverse population, which includes the 40% that is comprised of immigrants or children who are being raised by at least one immigrant parent. This paper conducts a non-systematic literature review of studies that look to measure prevalence of ACEs in the US in immigrant youth groups, with specific attention to the methods and tools used to perform these measurements. Results found that immigrant-specific experiences and socio-structural adversity are not reflected in the ACEs examined by the ACE Questionnaire nor are the examination methods used in healthcare settings cognizant of cultural differences that may affect ACE score reporting for this group. This, in turn, contributes to misleadingly understated reports of ACE prevalence in immigrant youth as compared to US-born children raised by US-born parents. ACEs pose a costly burden on the individual and society as a whole, and its impact can only be lessened with improved detection and measurement scales that are truly representative of its target population with expansion of ACE categories to include broader array of traumatic experiences, as well as cultural and linguistic sensitivity in the testing environment.

Nathan Chilbert

Neurobiology, Marshall

Mentored by Provost Leslie Carver

Social Cue Learning in Infants with Familial History of Autism.

Autism Spectrum Disorder (ASD) is characterized by a broad array of challenges, including sensory sensitivities, restricted and repetitive interests, and problems with social communication. Recent theories suggest that these challenges may arise for individuals with ASD due to a difficulty to make predictions about their environment. These differences may begin as early as infancy and later manifest into the different challenges and symptoms we see in older children and adults with ASD. To determine how and when these prediction challenges develop, we are studying 9- to 10-month-olds with (FH+) and without (FH-) a family history of ASD, in the form of having a diagnosed older sibling. FH+ infants have a 20%-30% chance of also being diagnosed with ASD at 3 years of age, so this population allows us to study early signs that may begin before official diagnosis. In this study, infants will be cued with social (gaze direction) or nonsocial (moving rectangle) cues to learn where an object will appear. We will test the hypothesis that infants with a family history of ASD will learn to follow the nonsocial cues better than the social cues. Infants without a family history of ASD are expected to learn equally well with social and nonsocial cues, as has been the case in previous research. Together, the results of this research will inform our understanding

of the role of prediction in the early etiology and characteristics of ASD. The findings can aid in earlier detection and more targeted interventions in the first few years of life.

Emerson Chin

Nanoengineering, Warren

Mentored by Professor Darren J. Lipomi

Metallic Nanoisland Sensor Arrays for the Measurement of Cardiomyocyte Contractility

Cardiomyopathies are a class of diseases that interfere with the mechanical properties of the heart. This interference prevents the cells from accomplishing their primary purpose: coupling the periodic electrical excitations of the heart into contractions of the ventricles. We monitor the contractions of cardiomyocytes to draw conclusions concerning cell health. The process of developing a sensor platform requires creating and characterizing microscale strain sensors. To take these measurements, we develop a system utilizing high-sensitivity graphene-metal composite strain gauges with the ability to perform contractility measurements in parallel. Having a sensor array that measures in parallel and is highly-scalable greatly increases measurement efficiency over conventional methods.

Evelyn Cho

Education Studies, ERC

Mentored by Professor Luz Chung

A Cost and Benefit Analysis of Religious Institutions

The separation of Church and State within educational contexts has always been incredibly nuanced. With the absence of an explicit statement in the Constitution about how the two can intersect, schools have continuously operated under the notion that religious institutions entail conversion, strict religious rules, and no room for personal opinion. I want to analyze the possibility of challenging societal norms of religious institutions to neutralize the acceptance of receiving help from institutions that may have more access to direct, individual support than the public school system. Through research conducted at a private, religious institution in San Diego County, I have been able to witness the benefits that many students have reaped from the school's religious affiliation. All of the students at this school receive a holistic education, addressing students' needs beyond their academia, at no cost. While there is an in-depth interview process that goes into being selected to attend this school, many families and students have been able to receive direct, personalized support to frame their students up for success. Upon committing to the school, students are required to sign a contract that states they will graduate from high school and higher education, college/university. This

research, based heavily on observational data and interviews, studies the costs and benefits of religious institutions within the American educational context.

Shaelin Chong

Molecular and Cell Biology, Marshall

Mentored by Dr. Melinda T. Owens

Investigating the Impact of the Scientist Spotlight Homework Assignment on Student Ideas about Diversity and Science Identity

Scientist Spotlights are homework assignments that showcase the personal stories and research of diverse scientists relating to class material. They have been shown to increase student grades and student's ability to personally relate to scientists (Schinske et al, 2016). We believe that the Scientist Spotlights likely have varied impacts on students' perceptions of scientists, the scientific community, and their place within it. In our research project, we are investigating these impacts by qualitatively analyzing their responses to the prompt: "What did you learn from your experiences in this course that will continue to influence you for many years to come?" The course was an introductory biology course at a large public West Coast university. Preliminary analysis found that roughly 70 percent of students (n=231) mentioned the Scientist Spotlights even though they were not prompted to do so. Using thematic analysis, we developed and refined a coding guide with five main themes that we found are most common when students reference the impact of Scientist Spotlights: About Myself, Inspiration to Me, About Science as a Field, About Scientists, and About Spotlights. Many students learned that anyone can do science and that scientists were more diverse than they thought. Currently, we are analyzing the replicability of our findings by comparing the codes given by two independent coders. In future, we hope to relate themes to students' identities by correlating the impacts that Scientist Spotlights had on students to their membership in various demographic groups, such as gender, ethnicity, and LGBTQ status.

Manan Chopra

Biology w/ Specialization in Bioinformatics, Marshall

Mentored by Dr. Karl J Wahlin

High Efficiency Human Retinal Ganglion Cell Induced Neurons by Transcription Factor Mediated Cellular Reprogramming and BMP Inhibition

Retinal ganglion cell (RGC) death is a major cause of vision loss and permanent blindness. Directed differentiation of pluripotent stem cells (PSCs) grown as monolayers or as 3D retinal organoids offers a convenient approach to regrow RGC neurons,

however, these neurons are heterogeneous, thus reducing their utility. To address this, we generated a multi-cistronic transgene system that recapitulated expression of many key RGC genes. A pioneer transcription factor was engineered into cells as a tetracycline cassette which after induction led to stem cell-to-neuron conversion. By combining this transcription factor with transcription factors typically expressed in developing RGCs we were able to generate retinal ganglion cell-like induced neurons (hRGC-iNs). Neural conversion accompanying transgene overexpression was greatly enhanced by developmental pre-patterning with small molecule chemicals, which not only led to highly efficient conversion but did so in a matter of days as opposed to months. Transcriptional profiles of RGC-like cells by RNAseq showed enrichment of many RGC expressed genes. These cells also exhibited electrical properties, including NMDAR-mediated synaptic transmission, consistent with developing RGCs. Lastly, we demonstrated that hRGC-iNs can be injured with a microtubule destabilizing agent and rescued by targeting specific kinase pathways. We conclude that combining developmental patterning cues with transcription factor reprogramming leads to the rapid, robust, and reliable generation of RGC-like neurons which will greatly enhance their utility in studies of RGC development and disease.

Ainsley Clark

Chemistry and Mathematics, Revelle

Mentored by Darren Lipomi

Characterizing Haptic Moisture Sensation by Magnetically Tuning Ferrofluid Properties

Haptic technology transmits information through the sense of touch. Tactile devices, therefore, aim to actuate human-machine interfaces to convey life-like touch sensations. Moisture is a sensation commonly felt by humans, and has not been thoroughly investigated for haptic applications. In both preliminary psychophysical testing and past studies, cold temperature and light pressure have been suggested to be two tactile cues which elicit the sensation of moisture. Magnetic ferrofluids are colloidal suspensions of iron oxide nanoparticles, and are notable for their various thermal properties. In this work, we investigate the use of magnetic ferrofluid as a tunable material to elicit this sensation of interest. The ferrofluid consists of Fe3O4 magnetic nanoparticles suspended in water. Upon applying a magnetic field of approximately 700 Gauss, the ferrofluid thermal conductivity increased by 3,233%. The ferrofluid was encapsulated in a thin Ecoflex pocket membrane, intended for use as an interface to psychophysically test for human perception of moisture induced by magnetically tuning its thermal conductivity. This work developed a ferrofluid-based human-machine interface to elicit a realistic sensation of moisture upon magnetic actuation for haptic technology.

Mihir Dixit

Bioengineering: Biotechnology, Seventh

Mentored by Dr. Alice Zemljic-Harpf MD, Assistant Research Scientist

SEX DIFFERENCES AND DRUG SPECIFIC EFFECTS AFTER LONG-TERM ROSUVASTATIN AND ATORVASTATIN ADMINISTRATION

Introduction: Heart failure (HF) patients may present preserved ejection fraction (HFpEF) or reduced EF (HFrEF). Statins lower LDL-C, preventing cardiovascular disease. Statin adverse events include skeletal muscle pain and increased risk of new-onset type II diabetes. We showed that lipophilic atorvastatin (Ator), not hydrophilic pravastatin, increased sudden death in cardiomyopathic mice. Because statins may impair oxidative phosphorylation within mitochondria, we investigated long-term effects of hydrophilic rosuvastatin (Rosu) and Ator administration on laboratory serum parameters, voluntary locomotive activity, and cardiac function in male and female mice.

Results: 8-week-old male (M) and female (F) C57BL6J mice received Ator, Rosu, or vehicle by daily oral gavage (6 groups, M+Ator, F+Ator, M+Rosu, F+Rosu, M+Veh, and F+Veh, n= 9-12 each). Ator and Rosu administration reduced voluntary locomotive in M+Ator, M+Rosu, F+Ator, and F+Rosu mice compared to M+Veh and F+Veh. After 10m-long daily statin or vehicle administration, echocardiography revealed preserved systolic ejection fraction (%EF) in M+Ator, M+Rosu, F+Ator, and F+Rosu while tissue Doppler analysis detected decreased E'/A' ratios. Serum glucose increased in F+Rosu but not in F+Ator, F+Veh, M+Veh, M+Rosu, and M+Ator.

Conclusion: Ator and Rosu administration reduced voluntary cage activity and induced HFpEF in male and female mice. We show for the first time that Rosu administration increased serum glucose levels only in females. This sex difference indicates a higher risk of females developing new-onset type II diabetes after Rosu administration.

Michelle Du and Saya Shahoy

General Biology / Human Biology, Warren / Muir

Mentored by Dr. Melinda Owens

Student understanding of COVID-19 vaccines and central dogma

Can students apply their biology knowledge to issues like the mRNA COVID vaccines? Previous research shows many students misunderstand the "central dogma" (DNA codes for RNA, which codes for protein), but this concept is necessary to understand how mRNA COVID vaccines work (Briggs et al, 2016). Thus, we wanted to know to what extent college biology students relate central dogma to the mRNA COVID vaccines. We asked 214 biology students at a large, public R1 university, "What is the mRNA's role in

the COVID vaccine?" and used thematic analysis to qualitatively analyze their responses. Major themes that emerged included "immunity," "uncertainty," and "central dogma." The most common "immunity" code was "triggers immune response" (54% of students), while the most common "central dogma" codes were "mRNA to protein" (28%), "provides instructions" (21%), and "mRNA to COVID protein" (14%). Students at all expertise levels (non-biology, entering, and advanced biology majors) mentioned "mRNA to protein" equally, but advanced biology majors (ABM) more frequently said "mRNA to COVID protein" ($p<0.002$). Also, entering biology majors more frequently stated, "I don't know" than ABMs ($p=0.01$). However, we found no significant differences in code frequency by political orientation. Overall, we found that ABMs were more able to apply knowledge of central dogma. Currently, we are analyzing other demographic information such as gender, transfer status, and ethnicity to look for correlations with COVID vaccine knowledge. We hope to further illuminate student understanding to help instructors better teach students about these vaccines.

Anthony Estrella

Microbiology, Muir

Mentored by Antonio De Maio

Phospholipids and macrophage functions

Phospholipids are amphiphilic molecules occurring naturally as major components of cell membranes in all living organisms. They are composed of a glycerol or sphingosine backbone esterified to two fatty acids, a phosphate group, and a hydrophilic residue. Due to their amphipathic nature, they form the two-layer structure known as the lipid bilayer, the structural basis of all cell membranes and extracellular vesicles (ECV), lipid-bound vesicles naturally secreted from almost all cell types. Macrophages are professional phagocytes found in virtually all tissues. They are highly specialized in ingesting apoptotic cells, apoptotic bodies, and cellular debris and are particularly efficient at internalizing ECV. Several studies have described how macrophages are affected by the protein and nucleic acid content of ingested apoptotic entities and ECV, but little is known about how macrophage functions are modified by the massive amounts of phospholipids found in these apoptotic cells and vesicles. To investigate this gap in our understanding of macrophage biology, we utilized liposomes made of phosphatidylcholine and/or phosphatidylserine, two key lipids found in cell membranes and ECV, to determine the effect of phospholipids on macrophage functions with particular emphasis on the inflammatory response.

Rita Ewaz

Human Developmental Sciences, ERC

Mentored by Dr. Amy Bintliff

Academic Resilience in Relation to Socioeconomic Status During COVID-19

This study aims to understand how individual academic resilience is affected by socioeconomic status in higher education. The focus of this study is to examine the academic and personal student experience with the transition to remote learning. Our research highlights well-being practices, individual motivation, and academic resources that students utilized during COVID-19 to persist in learning.

Jack Ewing

Marine Biology, Muir

Mentored by Jennifer Taylor, Professor

Propagation of Substrate-Borne sound through the legs of Ghost Crabs

Reception of sound is poorly understood in crustaceans, but modern technology has made it possible to measure the propagation of waves with high precision and accuracy. Here, we examine the propagation of seismic waves through the legs of ghost crabs (Ocyopode quadrata) with Laser Doppler Vibrometry (LDV). Using the minimally invasive approach of LDV, we measured the frequency and magnitude of waves across a linear transect line on the merus of each side of each leg. This allowed for us to better understand the way in which frequency and magnitude are modulated from the distal end of each leg to the proximal end, where the hearing organ (Barth's Myochordotonal Organ) is located. From our measurements, we found that the vibration amplitude is significantly greater at the distal location than the proximal for the anterior face of all the legs, but not at the posterior face. This data suggests that the magnitude of the vibrations traveling through the leg dissipates as it approaches the myochorodotonal organ.

Manuel Garcia

Chemistry, Muir

Mentored by Richard Norris

Experimental Dissolution of Barite and Impact on Estimates of Ocean Export Productivity

The carbon pump, biological uptake of atmospheric carbon by the ocean, is a key component of climate models, however it is a poorly defined quantity. A key proxy measurement for the carbon pump is through the measurement of marine barite, which

is thought to precipitate with sinking organic matter from autotrophs which inhabit the surface layer of the ocean. However, the dissolution of marine barite is a relatively unknown quantity with estimates of 60% ± 20% barite loss. In order to gain a better understanding of marine barite dissolution, and by extension a better understanding of the carbon pump, there is a need for more data on the topic. In order to obtain more data, model barite microcrystals were precipitated and placed into a number of different temperatures, pH, and salinity conditions. The model barite microcrystals were then imaged every week over a five-week period in order to gain a better understanding of how these conditions affect the dissolution rate of barite. This experiment represents the first attempt to understand dissolution rates of marine barite analogues. The experiment aims to create a better understanding of barite dissolution and how it may impact estimates of carbon export. Dissolution was observed across all treatments and the extent of dissolution will be quantified with the image processing tool ImageJ.

Nathan Glonek and Katie Short

Microbiology / Human Biology, Warren / Marshall

Mentored by Dr. Karsten Zengler

Constructing a synthetic, reproducible consortia to study the interaction dynamics within the soil microbiome

Synthetic communities are fast becoming the standard for studying the complex dynamics that drive host-microbiome interactions and their influence on the environment. Optimizing plant-microbe interactions to promote sustainable agricultural practices requires a model system that can maintain community diversity over time and can capture the complexity of the soil microbiome with just a few key members. Here we describe the role of a synthetic community for the rhizosphere in growing and characterizing 17 soil isolates, and combining them in specific ratios to construct a synthetic community with lasting community diversity and reproducibility.

Reina Gomez

Nanoengineering, Revelle

Mentored by Dr. Olivia Graeve

Combustion synthesis of Eu-doped Ca(4-x)(Sr,Ba)(x)LaB3O10 oxyborate phosphor

Borate-based phosphors are desired due to their ultraviolet transparency, wide bandgap, high stability, and optical damage threshold for improving solid-state white-light sources. Here, we report on the synthesis and photoluminescence properties of Ca4-y-xMxEuyLaB3O10 (M = Sr, Ba where x = 0, 0.5, … 4; y = 0.05) as potential phosphors for solid-state white-light applications. Strontium and barium were

substituted in calcium sites to examine the changes in the crystal structure and to determine the tunability of the luminescence response. The powders were made by solution combustion synthesis with subsequent calcination steps. The crystal structure and phases of the powders at each dopant concentration were analyzed using X-ray diffraction techniques. For strontium concentrations at $x > 2$, a two-phase system was formed as a result of lattice expansion. A similar behavior was observed for the barium-substituted powders where the initial breakdown into several independent phases occurred at $x = 0.5$. Additionally, the photoluminescent properties of the corresponding borate materials (with $x = 0.5$ for Ba and $x \leq 2$ for Sr) were investigated using a fluorescence spectrophotometer. The photoluminescence spectra show the presence of Eu^{3+} ions, which are the source of the luminescence signal at wavelengths around 600 nm.

Leonardo Gonzalez

General Biology, Warren

Mentored by Yury Miller, Professor of Medicine

CIPN model shows AIBP can reverse allodynia

In order to study pain the Chemotherapy-induced Peripheral Neuropathy (CIPN) model is used, where 16 mice are placed on a platform and Von Frey filaments are used to get their paw withdrawal, as a measurement of pain, being calculated using an up-down method. Our data shows the mice in pain when injected with patlitaxel and a reversal after using AIBP.

On day 10 the mice are euthanized and DRG from each mouse will be collected for single cell suspension on the DRG neurons, staining them with different antibodies which then go through flow cell cytometry to quantify the different amounts of lipids, neurons and immune cells. The goal is to study the physiological differences between normal mice and mice injected with chemotherapeutic and see if the pain threshold and physiological state can be reversed back to normal using a protein, AIBP. The receptors modulating pain (TLR4 and TRPV1) are also tested by using a PLA assay tests the proximity of the receptors between each other and other parts of the cell membrane like the lipid rafts. Our results show a few of the differences caused by the chemotherapeutic can be reversed to a normal physiological state using AIBP.

Honor Gosch

Sociology, Muir

Mentored by Vanesa Ribas - Associate Professor of Sociology

Social Media As Political Tool: Competitive Framing in the Abortion Debate

This research investigates how social media is used to mobilize stakeholders via competitive framing. To do this, I preform a comparative discursive analysis of the Facebook and Twitter content of two diametrically opposed abortion-issue organizations: NARAL and Live Action. Two main findings emerged from this analysis. First, the anti-choice organization's provocative framing methods are starkly contrasted by the benign methods used by the pro-choice organization. Second, the anti-choice organization capitalizes on the utility of social media by coopting established pro-choice discourse. These findings are representative of the greater polarization between the Left and Right in the United States, where the Right has increasingly focused on extremist orchestration to fulfill their agenda.

Max Gruber

Neurobiology, Revelle

Mentored by Stanley Lo, Associate Teaching Professor

Assessment on the Implementation of Laboratory Kits in a Remote Course-Based Undergraduate Experience on Soil Microbiomes

Course-based undergraduate research experiences (CUREs) serve as innovative avenues for increasing accessibility of early research experience to a larger number of students, including underrepresented minority students. Previously, we reported the implementation of a large-enrollment introductory in-person CURE on soil microbiomes. To address the remote learning shift necessitated by COVID-19, we created and distributed laboratory kits that allowed students to complete half of the hands-on experiments previously presented in-person.

In this study, we describe student outcomes on self-efficacy on research skills from 3 course modalities: in-person CURE, remote CURE without laboratory kits, and remote CURE with laboratory kits. Student outcomes were measured pre- and post-course using a modified version of the classroom undergraduate research experience survey. We hypothesized that students would report decreases in self-efficacy on research skills in the remote CUREs compared to the in-person CURE, and that students in the remote CURE with laboratory kits would report increased gains in self-efficacy on research skills compared to the remote CURE without laboratory kits.

One-way ANOVA analyses showed that students in the remote CURE without laboratory kits reported significant self-efficacy gains in 10 out of 21 items compared to the in-person CURE. Students in the remote CURE with laboratory kits reported significant gains in 3 additional items: carrying out a project entirely designed by students, analyzing research data, and writing a research proposal. The data suggest that remote CUREs with laboratory kits may provide an avenue to enhance the development of research skills in undergraduate students enrolled in remote learning programs.

Arunav Gupta

Data Science, ERC

Mentored by Dr. Isaac Martin

Coloring Inside the Lines: The Jagged Legacy of the HOLC Neighborhood Risk Maps

There has been a large body of work exploring the discriminatory nature of the home mortgage risk maps produced by the Home Owners' Loan Corporation in the late 1930s. However, little attention has been paid to whether these maps are still descriptive of racial residential boundaries in their cities 80 years after their creation. To address this gap, Markov Chain Monte Carlo, previously unutilized in the relevant literature, is employed to randomly generate maps with alternative borders. The findings were significantly descriptive: on average, original HOLC maps were found to have entropies 14.2% higher than the generated counterfactual maps, indicating that the published borders are the most optimal description of present-day racial residential divides. These findings serve as a stark reminder that, despite integrationist housing policy and urban renewal over the last 80 years, there is still significant progress to be made in desegregating American cities.

Eunmi Ha

Human Biology, ERC

Mentored by Dr. Binhai Zheng

Regulation of Oxidative-Stress is Essential for Axonal Regeneration of Cortical Spinal Tract

Spinal cord injury (SCI) is a severe condition that results in loss of function in mobility. The corticospinal tract (CST) is a clinically important target for functional recovery after SCI. Multiple molecular pathways, including the PTEN/mTOR signaling pathway, have been revealed to regulate axon regeneration and sprouting from the CST. However, among diverse populations of CST neurons, only a subset regenerates axons following molecular intervention and the number of regenerating neurons declines with age. Here, we found, using single cell sequencing, one of the oxidative stress relief genes, NFE2L2 which is a top regulator of many regeneration correlated genes. With immunostaining, we found that it can reduce the regeneration induced by PTEN knockout, indicating that the regulation of oxidative stress is essential in CST regeneration.

Khang Hoang, Chan-yu Kuo, and Sirasit Prayotamornkul

Bioengineering: Biotechnology / Bioengineering / Bioengineering, Sixth / Sixth / Revelle

Mentored by Lingyan Shi, Assistant Professor

DO-SRS and MPF Imaging of Cancer Cell Metabolic Activities Regulated with Aromatic Amino Acids

Understanding the dynamics of metabolism in a multicellular organism is essential to unraveling the mechanistic basis of many biological processes in healthy and diseased conditions. There has been an urgent need for high spatial resolution, non-invasive imaging techniques for visualization and quantification of various biomolecules in cells and tissues. In the present work, we applied deuterium-oxide probed stimulated Raman scattering (DO-SRS) to generate chemical specific metabolic imaging with high resolution, deep penetration of depth, multiplex, chemical selectivity, 3D volumetric and quantitative capability. Within the broad vibrational spectra, we can image different molecules including lipids, protein, and DNA-specific Raman profiles, and develop spectral detection methods to obtain multiplex imaging of various biomolecules. Additionally, our imaging system is equipped with label-free Multiphoton Fluorescence (MPF) microscopy to directly detect auto-fluorescence signals of NADH and flavin in biological samples. By combining these non-invasive, universally applicable multimodal imaging techniques together, we can acquire, co-localize, and analyze images of biomolecules in the same region of interest. This information will help us better understand metabolic dynamics in cells and tissues during aging processes, neurodegeneration, tumor progression, etc. Specifically, in this study, we applied DO-SRS coupled with MPF to understand the role of aromatic amino acids in regulating the metabolic dynamics of cervical cancer.

Chao-Chin Hsu

Neurobiology, Warren

Mentored by Dr. Maripat Corr

Mapping of Pathways in Inflammatory Arthritis-Pharmacologic and Genetic

Inflammatory arthritis can be deforming and debilitating. One such disease is rheumatoid arthritis which is an autoimmune disease that is 3 fold more common in women than men. This disease is associated with autoantibodies that bind to proteins in the joint. To replicate the features of this disorder we use the K/BxN passive serum transfer model of arthritis. In this model recipient mice reliably develop arthritis that resolves. The paw swelling is accompanied by mechanical allodynia. In male mice the mechanical hypersensitivity persists in wild-type mice, but not in females. We tested the swelling and pain behavior in male mice for response to ketorolac, nonsteroidal anti-

inflammatory drug, and gabapentin. The swelling in the mice treated with both compounds resolved faster than control mice. The mice responded quickly to the gabapentin treatment but not the ketorolac in terms of their behavior. These data suggest that cyclo-oxygenase inhibition is not sufficient to block established arthritis symptoms. In contrast, the Aδ fiber inhibition by gabapentin enabled resolution of all visual and measurable signs of joint inflammation. In Toll-like receptor 4 (TLR4)-/- mice there is a similar rapid resolution of allodynia and a slower resolution of joint swelling. Future studies will explore if there is a mechanistic link between the two signaling systems that give phenotypic similarities.

Zichen Jiang

Biology with a specialization in Bioinformatics, Warren

Mentored by Ludmil B. Alexandrov, Assistant Professor

GENOMIC PROFILING OF COLORECTAL ADENOMA AND CANCER SAMPLES WITHOUT MATCHED NORMAL

Colorectal cancer (CRC) is the third most common and the third deadliest cancer in the US.

A combination of mutational processes—each generating a unique pattern of somatic mutations, a mutational signature—leads to each CRC sample having a distinct mutational portrait. This genomic profiling analysis can help understand the genetic and environmental contributors to tumorigenesis and tumor progression so that CRC cannot only be treated but also prevented. A significant obstacle in this analysis arises when no matched normal sequence is available but only the tumor and this makes the subsequent genomic characterization step intractable.

To meet this challenge, we developed the Unmatched Variant Calling (UVC) pipeline that incorporates the commonly used unmatched variant caller MuTect2 tumor-only mode and a machine learning classifier ISOWN to identify somatic single nucleotide variants (SNVs) that have a moderate to high functional impact. Genomic profiling uses this variant calling result to extract mutational signatures.

We applied UVC to a cohort of 92 colorectal adenoma and cancer patients with only tumor sequencing data available to call moderate to high functional impact SNVs, followed by tumor mutational burden (TMB) analysis and mutational signature extraction using SigProfilerExtractor and SigProfilerSingleSamplePro.

No TMB difference is observed between the adenoma and the cancer subgroups. The genomic profile aligns with previous mutational signature studies, including signatures caused by aging and DNA repair deficiencies. Therefore, UVC is an improved pipeline to

accurately call somatic mutations and enabled genomic profiling analysis in the absence of matched normal DNA.

Raul Johnson

Biochemistry/Chemistry, Revelle

Mentored by Colleen A. McHugh, Ph.D. Assistant Professor

Alternative splicing of SAT1

Neurodegenerative diseases are debilitating illnesses that decrease quality of life for many people, and the underlying cause of disease is still not understood. A common observation in many patients diagnosed with neurodegenerative diseases such as frontotemporal dementia (FTD) and amyotrophic lateral sclerosis (ALS) is aberrant accumulation and behavior of TDP-43. One of the most significant increases in TDP-43/RNA binding in patient samples with neurodegenerative diseases compared to healthy brain samples is to the non-coding RNA MALAT1. As these are both known splicing factors, the MALAT1/TDP-43 interaction may be involved in alternative splicing (AS) regulation. Through cross-referencing existing RNA-sequencing data, Spermine / Spermidine Acetyltransferase 1 (SAT1) was found as a common splicing target. SAT1 is a rate-limiting enzyme involved in the acetylation of polyamines . Polyamines are a biomarker for neurodegenerative diseases, and their maintenance by SAT1 prevents the activation of autophagy pathways. Alternative splicing of SAT1 results in the inclusion of Exon X containing three premature stop codons, resulting in mRNA degradation through nonsense-mediated decay. Experiments conducted in MALAT1KD HEK293 cells suggests an increase in SAT1 protein levels. This upregulation was found to be mediated through SAT1 AS. MALAT1KD promoted AS and reduced exon inclusion of SAT1, resulting in more stable mRNA production. This effect was mediated through TDP-43, as MALAT1KD reduces TDP-43 binding to SAT1 to regulate AS. Determining this functional relevance of MALAT1/TDP-43 interaction provides a foundation for therapeutic approach towards combating neurodegenerative disease progression.

Mariah Kallhoff

Political Science: Public Policy and Anthropology (Biological Concentration)), Muir

Mentored by Pamela Ban, Ph.D Assistant Profressor

Republican Women: For Women or for Trump? An Analysis on the Voting Behavior of Republican Women during the Trump Era

In this thesis, I investigate the changes in voting behavior of Republican women in Congress before and during the Trump Administration in regard to women's legislation. Republican women are a unique group within Congress as their identities of being

women and Republicans allowed for a paradox to form in which Republican women are placed in a position to choose between voting based on gender or party. Over the years, the rise in party polarization has placed this paradox at the forefront of voting on women's legislation and has forced Republican women to choose between voting based on their gender and their party. With this, I examine the effects of gender on Congressmember's voting behavior across America's two major parties and investigate how the rise of Trump influences these gender effects. I present new Congressional data on the voting behavior of legislators on women's legislation before and after President Trump took office in order to evaluate the recent accounts of Republican women voting more conservatively during Trump's presidency. The entrance of Trump into the Oval Office, I argue, provided the means necessary for the Republican Party to advance more conservatively driven women's legislation resulting in Republican women voting more conservatively to reflect the ideals of the party. Ultimately, I find a significant negative correlation between Republican women's voting and the influence of party and the presence of Trump, resulting in Republican women voting more conservatively on women's legislation.

Vaishnavi Khandavilli

General Biology, Sixth

Mentored by Amit Majithia, M.D.

Proposing new genetic associations involved in metabolic diseases through reanalysis of adipocyte morphology changes with independent bioinformatic tools

A previous publication, "Discovering metabolic disease gene interactions by correlated effects on cellular morphology" by Jiao et al., which used the image analysis software Harmony to obtain morphological measurements of adipocytes with knockouts of genes related to metabolic diseases like T2D, showed that genes associated with similar morphological changes could be interacting (such as BSCL2 with PLIN1 and CEBPA with AGPAT2). In this project, the same images from the original publication were analyzed using another image analysis software, CellProfiler, along with UMAP clustering to investigate whether novel potential gene interactions could be found based on similarity of morphological measurements. Using the images of the original publication's experiment, in which 125 genes related to metabolic genes were knocked out in adipocytes, morphological information about the differentiated adipocytes was extracted with CellProfiler. Then, UMAPs were used to find clustering between morphological changes associated with each gene knock out. The resulted analysis suggests that INSR and VARS2 are potentially involved in each other's pathway in metabolic diseases.

Brian Khov

Molecular and Cell Biology, Sixth

Mentored by Mark Ellisman PhD, Distinguished Professor and Satchidananda Panda PhD, Adjunct Professor

Synaptic changes in the SCN are associated with Alzheimer's disease

Circadian disruption, and specifically sleep disruption, is an early indicator of Alzheimer's disease (AD), occurring before the onset of more commonly known neurodegenerative symptoms such as memory loss. The suprachiasmatic nucleus (SCN), the central circadian clock in the brain responsible for regulating the timing of many biological rhythms, receives retinal input through melanopsin-expressing retinal ganglion cells (mRGCs) to synchronize with the light environment. However, the anatomical basis for circadian disruption in the SCN of those with Alzheimer's disease is largely unknown. Image volumes of the SCN were obtained from serial block-face scanning electron microscopy of 3-month and 8-month APP/PS1 mouse models. Here we provide evidence of the relationship between AD progression and disruption of the neuronal organization of the SCN associated with synaptic loss. We observe significant decreases in the volume of boutons with dendritic intrusions and decreases in axodendritic synapse frequency. Conversely, we notice a significant increase in bouton frequency on the axons in the 8-month SCN from the 3-month SCN. These preliminary results suggest that there are considerable changes in the connectomics, particularly in the boutons and synaptic connections, of the SCN that may be responsible for circadian disruption in those with Alzheimer's disease. Further analysis looking specifically at mRGCs will be crucial to elucidating the role of retinal input in the onset of circadian symptoms of AD.

Elise Kim

Molecular and Cellular Biology, Sixth

Mentored by Dr. Robert Rissman

Identifying Blood-Based Biomarkers of Alzheimer's Disease in Down Syndrome Populations

Down Syndrome (DS) is associated with a high prevalence of cognitive impairment and dementia in middle to older aged DS patients; indicators of such AD (Alzheimer's Disease) dementia include neuropathological findings such as toxic peptide aggregation, oxidative stress, and neuroinflammatory pathways. These neuropathologies can cause imbalances in exosome formation and their cargoes, which is a possible cause for the elevated pathologies found in DS-AD patients. However, early detection of such neuropathologies before the onset of dementia in DS-AD patients is an unexplored field. Thus, there is a need to develop reliable blood-based AD biomarkers for the DS

population. By analyzing isolated exosomes from DS-AD patients, we hope to identify biomarkers of AD in order to further the search for reliable blood-based biomarkers.

Jiwoo Kim

Biochemistry/Chemistry, Marshall

Mentored by Charles Perrin, Distinguished Professor Emeritus of Chemistry and Biochemistry

Complete mechanism of an aldol condensation in water

According to Perrin & Chang J. Org. Chem., 2016, 81, 5631, the rate-limiting step in the aldol condensation of a benzaldehyde and an acetophenone in aqueous acetonitrile is the final loss of hydroxide. According to Coutinho, Machado, Carvalho-Silva and da Silva, Phys. Chem. Chem. Phys., 2021, 23, 6738, calculated solvent kinetic isotope effects confirm this conclusion for pure acetonitrile but indicate that the rate-limiting step in aqueous solution becomes the second enolization. We have concluded that those calculations are not reliable and now present solvent kinetic isotope effects that show that the final loss of hydroxide is still the rate-limiting step in pure water.

Colette Kirkpatrick

Global Health and Communication, ERC

Mentored by Dr. Hua Wu

Addressing Gender-Based Violence Against Rohingya Refugee Women Through Inclusive WaSH

Since the most recent wave of state sanctioned violence against the Rohingya, an ethnic group from Myanmar, nearly 1 million refugees fled to resettlement camps in primarily Bangladesh, living without basic access to water, sanitation, and hygiene (WaSH). Although it is widely accepted that poor WaSH access is linked to increases in gender-based violence, no current Rohingya WaSH interventions adequately address women's needs and vulnerability. Through literature review and textual analysis, the author seeks to understand the influence that inadequate WaSH services have on gender-based violence in the Rohingya population and provide a framework to guide WaSH practitioners' future interventions. Findings reveal that poorly planned WaSH interventions exacerbate gender-based violence, such as when walking to collect water or while using sanitation facilities. Additionally, comparisons from previously successful interventions in other countries indicate that inclusive WaSH can reduce gender-based violence while increasing efficacy and sustainability. The author argues that inclusive WaSH is essential in reducing gender-based violence and their intervention framework centers women in planning, education, and leadership processes of WaSH. New

approaches to inclusive WaSH, informed by missteps from past interventions, are vital to protecting Rohingya women as well as women in future refugee situations.

Sukanya Krishna

Bioengineering, Marshall

Mentored by Professor Javier Duarte

Particle Graph Autoencoders for L1 Anomaly Detection

At the CERN Large Hadron Collider, the FPGA-based real-time data filter system that rapidly decides which collision events to record, known as the level-1 trigger, requires small models because of the low latency budget and other computing resource constraints. To enhance the sensitivity to unknown new physics, we want to put generic anomaly detection algorithms into the trigger. Past research suggests that graph neural network (GNN) based autoencoders can be effective mechanisms for reconstructing particle jets and isolating anomalous signals from background data. Rather than treating particle jets as ordered sequences or images, interaction networks embed particle jet showers as a graph and exploit particle-particle relationships to efficiently encode and reconstruct particle-level information within jets. This project investigates graph-based standard and variational autoencoders. The two objectives in this project are to evaluate the anomaly detection performance against other kinds of autoencoder structures (e.g. convolutional or fully-connected) and implement the model on an FPGA (programmable circuits) to meet L1 trigger requirements.

Shubham Kulkarni

Computer Science, Sixth

Mentored by Garrison Cottrell, CSE Professor

Visual Expertise and the Face Inversion Effect

Subjects perform poorly at recognizing upside-down faces. This face-inversion effect is in contrast to subjects' performance with inverted objects, which is not as drastically impaired. Experimental results have suggested that a similar effect, though to a lesser degree, may be seen in the inversion of mono-oriented objects, such as cars. Here, subjects' performance on inverted mono-oriented objects is between that of faces and other objects. We build an anatomically-inspired neurocomputational model to explore this effect. The mapping from the visual field to V1 can be approximated as a log-polar transform. This transformation causes changes in scale to appear as horizontal translations, leading to scale equivariance. Rotation is similarly equivariant, leading to vertical translations. However, there is a crucial topological difference between the two. Rotational invariance is discontinuous, with V1 ranging from 90 degrees (vertically up)

to 270 degrees (vertically down). Hence when a face is inverted, the configural information in the face is disrupted. Here, using log-polar inputs, we investigate why this effect disrupts face recognition to a greater degree than object recognition, and explore why mono-oriented objects behave differently than other objects. Finally, we show that as the network gains expertise with cars, it makes more use of configural information, disrupting inversion processing further.

Rachel Kunowski

Applied Mathematics, ERC

Mentored by Camille Nebeker

Return of Results: Understanding the design space for the return of digital mental health research data

Background: Digital mental health technologies can help people to diagnose, treat, and monitor their mental wellbeing, by collecting and analyzing their personal data. How has existing digital mental health research returned this data to users (e.g., graphs, statistics, infographics)?

Methods: This poster will present preliminary findings from a systematic literature review of how data from digital mental health research has been returned to study participants. The literature search involved the ACM digital library and included peer-reviewed articles containing the keywords “mental” and “health” anywhere in the article. The article collection was refined by reviewing the mental health concerns, how the technology was used to address each mental concern, and whether data collected by the technology was returned to participants.

Results: The literature review will be used to develop a data return design space, which will relate specific mental health concerns (e.g., anxiety) to data collection, analysis, and presentation strategies applied by existing research. Organizing existing research into such a design space will help to identify design considerations that have received more attention than others. Additionally, we plan to use the design space to learn about the digital and data literacy needs of specific stakeholder groups, such as older adults.

Conclusion: We plan to identify common strategies used to return information in digital mental health technology to create guidelines for other researchers to improve this research space for specific user groups, such as older adults, and for the other stakeholders in a user’s wellbeing (e.g., family, friends).

Mei Lao

Human Biology, Warren

Mentored by Luz Chung, EDS Faculty

Self-Advocacy in First-Generation College Students

Self-Advocacy in First Generation College Students: To mitigate educational disparities, I am researching effective methods of teaching self-advocacy in to-be first-generation college students in relation to socio-emotional learning. First-generation college students are typically from immigrant families, low socioeconomic status, face language barriers, financial constraints, or attend under resourced schools. Ultimately, this demographic is most vulnerable to educational disparities. From high school to college, it can be difficult for first-generation students to navigate their own academic journey in addition to these obstacles. It is imperative for students to learn self-advocacy, or taking initiative to speak up for one's self and their interests, as a lifelong skill throughout one's academic career and beyond.

Mikaela Larkin

Physics with a Specialization in Astrophysics, Revelle

Mentored by Professor Adam Burgasser

Characterization of Population III Stars with Stellar Atmosphere and Evolutionary Modeling and Predictions of their Observability with the James Webb Space Telescope

Population III stars were the first stars to form after the Big Bang and are believed to have contributed the first elements in the universe beyond primordial hydrogen and helium. These stars are theorized to have had extremely short lifespans, and therefore would only be observable at high redshifts ($z \sim 7$-17) and faint apparent magnitudes ($>\sim 35$ AB). For this reason, the direct detection of Population III stars remains elusive. However, the recently launched James Webb Space Telescope (JWST) will be capable of detecting stars in the relevant magnitude range in the event of favorable gravitational lensing. Theoretical models are required to interpret the future data returned by JWST. In this study, the atmospheric modeling software ATLAS-9 and the evolutionary modeling software MESA were used to characterize the observable properties of zero age main sequence Population III stars. The calculated models cover a wide range of possible Population III stellar masses, from the minimum mass predicted by star formation studies to the maximum mass capable of maintaining hydrostatic equilibrium. Synthetic photometry and theoretical color-magnitude diagrams were calculated for the filters of the Near-Infrared Camera on JWST. The final results are compared to the scales of known lensing events and anticipated JWST magnitude limits.

Allison Li

Human Biology, Marshall

Mentored by Gene Yeo

The Effectiveness of CIRTS in Targeting Microsatellite Repeat Expansion Disorders

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

Rebecca Lim

Education Sciences, Psychology, ERC

Mentored by Dr. Amy Bintliff, Assistant Teaching Professor

Trauma-Informed Social Emotional Learning During Pandemic-Related Remote Instruction: Educator Perspectives

Schools play a pivotal role in fostering student intrapersonal and interpersonal development and wellbeing, also known as social-emotional learning (SEL). This qualitative study examines how K-12 teachers supported student SEL in remote classroom environments during the COVID19 pandemic, a time of heightened distress and trauma. Survey data were collected from 26 teachers in Southern California and follow-up semi-structured interviews were conducted with 16 teachers. Teacher responses were analyzed through the lens of trauma-informed practices (TIP). Trauma-informed strategies that emerged from the data included focusing on relationships; building routines and predictability; creating space to identify and share feelings; incorporating movement, mindfulness, and play; implementing culturally affirming practices; providing student choice and leadership; and engaging and collaborating with families. Various challenges associated with implementing SEL in remote learning environments are discussed, and recommendations for practice and further research are provided.

Sabrina Lin

Neurobiology & Global Health, Revelle

Mentored by Dr. Julian Schroeder

Identifying Putative Candidates Involved in Stomatal Movement

In the past six decades, recorded atmospheric CO2 concentration measurements show that CO2 concentration is rising at an alarming rate. Plants, a major source of CO2 turnover, contribute to ecosystems by turning CO2 into usable oxygen for other species while capturing carbon via photosynthesis. Internal carbon dioxide regulation is vital to plant health; without it, plant growth, function, water-use efficiency, and leaf heat stress will affect plant vigor. Additionally, rising atmospheric CO2 is reducing plant-atmosphere gas exchange globally. Current literature suggests that plants exhibit a sensing mechanism for the CO2 response in guard cells that control the opening and closure of stomata in the leaf epidermis. Many genes implicated in CO2 signaling have been identified and characterized in the model organism, A. thaliana, which play a role in this pathway by encoding factors like protein kinases (Zhang et al., 2018). While it is known that high concentrations of CO2 will cause stomatal closure, many CO2 signaling factors and their underlying genes in plants have yet to be discovered and further explored. Our current research involves identifying novel factors involved in CO2 signaling through two complementary genetic screens: gain-of-function using

Full-length cDNA Over-eXpression (FOX) and reduced function using an artificial microRNA(amiRNA) library. We will isolate, confirm and characterize CO2 response mutants in the CO2 signaling network. Ultimately, the goal is to learn more about the CO2 signaling pathway with regards to stomatal movement and by doing so, improve water usage and stress resilience of plants in light of climate change.

Vedran Markota

Molecular and Cell Biology, Sixth

Mentored by Dr. J. Andrew McCammon

Covalent Docking Against Different Protein Conformations Reveals Potential SARS-CoV-2 Mpro inhibitors

Gaussian accelerated Molecular Dynamics (GaMD) is a method in computational chemistry for generating different protein conformations by smoothing the free energy surface, allowing the protein to overcome energy barriers. We used GaMD to generate four apo structures of the active site of SARS-CoV-2 Main protease (Mpro), representing a range of pocket sizes, in order to screen for potential inhibitors of Mpro activity. A previous study revealed molecule â€œN3â€œ as an inhibitor of Mpro, which

established cysteine 145 as a potential target residue for other covalent inhibitors. We screened in silico a library of covalent inhibitors in order to find new potential Mpro inhibitors. The molecule library was clustered by Morgan fingerprints, from which centroids were selected for virtual screening. Selection of centroids allowed for a reduction in the number of molecules screened while maintaining the diversity of reactive groups among the molecules. The selected molecules were virtually screened using Schrodinger's “Covdock” by targeting Mpro's cysteine 145 residue via Michael addition reaction.

Guadalupe Marmolejo

Education sciences, Marshall

Mentored by Megan Hopkins Associate Professor

Latinx Student Identity Development in US Bilingual Programs

This paper shares findings from a literature review examining how language pedagogies shape Latinx students' identities in K-12 schools in the United States. It also explores factors beyond schools and classrooms, and how they facilitate or hinder Latinx students' identity development. Implications of these findings for teachers are discussed.

Kyleen Martin

Ethnic Studies, Revelle

Mentored by Dr. Boatema Boateng

Secrecy and Privacy as Property

This paper will be looking at how the California Consumer Privacy Act and subsequent legislation form privacy into a form of property while upholding corporate trade secrets. Property has been a racialized right that as often afforded white privilege, even in cases of intangible properties. Privacy as well as security has often been afforded to whiteness while surveillance has disproportionately impacted communities of color. Using discourse analysis and close reading techniques, my research seeks to tease out the meaning of intangible property rights and their implications for people of color.

Noura Mohamed

Chemistry and Biochemistry, Revelle

Mentored by Dr. Johannes Schöneberg

Effects of Ketogenic Diet on Mitochondria Dynamics in Epilepsy-Associated Mutations

Patients with drug-resistant epilepsy are referred to the ketogenic diet, which helps them by reducing both seizure severity and frequency across refractory seizure disorders spanning the entire epilepsy spectrum. Here we designed a ketogenic medium for culturing induced pluripotent stem cells and used those cells to study the effects of this diet on epilepsy-associated mutations. We hypothesize that this pathway recovers mitochondria morphology changes in both the OPA1 knockout and the SCNA1 knockout. This hypothesis will be tested by fluorescent imaging of mitochondria under the conditions of the ketogenic diet vs. the glycolytic diet.

Asim Mohiuddin

Human Biology, ERC

Mentored by Dr. Maripat Corr

Drivers of Chronic Symptoms In Mouse Arthritis: TLR 4

Rheumatoid arthritis is a debilitating and deforming form of autoimmune arthritis. This disease and its symptoms can strike as early as childhood and early adulthood and is more prevalent in women than men. Although there are several new antibody therapies, specifically biologics and kinase inhibitors that are more effective than older treatments, the benefits are not felt by all patients. There are several emerging treatments such as inhibitors that target the Toll-like receptor 4 (TLR4) pathway. In prior studies our laboratory, in collaboration with others, found that there is reversible allodynia in arthritic mice that are TLR4 deficient. Our lab further studied TLR4 deficiency using different promoters for Gfap, Lysm, and Cd11c to drive Cre recombinase expression. All models are characterized by reversible allodynia however that of Tlr4 Cd11c was the most pronounced while being greater and more rapid in males. We propose to examine further arthritis models for Cd11c expressing cells to see if this effect is the same.

Yazmin Munoz

Molecular and Cell Biology, Revelle

Mentored by Cressida Madigan, Ph.D Assistant Professor

Investigating the Role of RHBDL4 in Vertebrates

Rhomboid proteases are intramembrane serine proteases that have been linked to many cellular functions and mechanisms. These multipass membrane enzymes cleave proteins inside their respective transmembrane helices unlike the cytoplasm like other proteases. The mammalian rhomboid protease RHBDL4 has yet to be sufficiently studied. However, it’s harder to know more without studying it's in vivo functions in a multicellular organism. RHBDL4 knockout is vital in understanding the full extent of

RHBDL4's function in vertebrate biology. To bypass the high embryonic lethality seen in attempted mouse knockouts, knockouts can be generated in zebrafish. Rhomboid proteases, like RHBDL4, remain highly conserved across species like zebrafish and humans. Zebrafish are ideal model organisms for CRISPR knockout thanks to the transparency of their eggs and larvae, development outside of the mother, and resilience to phenotypes that would typically be fatal in mammals. Additionally, there are established cancer models in zebrafish, a process RHBDL4 has been linked to previously. Here I used single-cell injection to deliver RHBDL4 sgRNAs which have been confirmed by PCR genome sequencing to WT zebrafish. I confirmed knockouts using T7 endonuclease assays and monitored for potential phenotypes coupled with sequencing data. A consistent isoleucine deletion mutation has resulted from the CRISPR injections as the line is being established. This work is the first step toward generating the first RHBDL4 knockout zebrafish and vertebrate knockout model.

Rakesh Nemmani

Human Biology, Warren

Mentored by Nigel Calcutt

Effects of HDAC6 inhibition on Paclitaxel-Induced Peripheral Neuropathy in Mice

Chemotherapeutics such as paclitaxel stop tumors from proliferating by preventing microtubule assembly and mitotic division. However, microtubules also support axonal transport to nerve terminals, and chemotherapeutics can induce neurodegeneration, termed Chemotherapy Induced Peripheral Neuropathy (CIPN), in cancer patients. The histone deacetylase (HDAC) enzyme family regulates protein acetylation, with the HDAC6 subtype focused on deacetylation of cytosolic tubulin. HDAC6 inhibitors increase acetylated tubulin levels and stabilize microtubules. I therefore investigated efficacy of a HDAC6 inhibitor (Miralinc Pharma Inc.) against paclitaxel-CIPN. Mice were given vehicle or paclitaxel, with sub-groups (N=10/group) given the HDAC6 inhibitor (20 or 60mg/kg/day or 60mg/kg/day twice daily), gabapentin (60mg/kg/day) or vehicle. Paclitaxel caused tactile allodynia and heat hypoalgesia. HDAC6 inhibition attenuated both disorders, with best efficacy at 20mg/kg/day. Gabapentin, the standard of care for CIPN, was also effective. These results support the potential of HDAC6 inhibitors to prevent CIPN and allow optimal use of chemotherapeutics.

Katelyn Nguyen

Microbiology, Marshall

Mentored by Dr. Matthew Daugherty

NLRP10 inhibits the host innate inflammatory response and is targeted by diverse flavivirus proteases

Throughout history, viral pathogens and their hosts have been engaged in an extensive, interminable molecular arms race. This is a concept coined by evolutionary biologists as the Red Queen Hypothesis; its moniker deriving from the antagonist in Lewis Carrolâ€™s 1871 fictional novel Through the Looking Glass. This hypothesis is best illustrated through the Red Queen's remarks to the main character Alice: â€œHere, you see, it takes all the running you can do to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!â€ As a fundamental aspect of their continued persistence in host species, viruses evolve to antagonize host immune systems, adapting viral proteins to better evade immune recognition. Consequently, host immune proteins are then placed under selective pressure to evolve additional barriers to defend against this antagonism.

Many of these rapidly evolving host-pathogen interactions include various host innate inflammasomes such as CARD8, which lures viral proteases to cleave at its "tripwire" region, thus inducing a downstream antiviral response. However, other host tripwire proteins may also mediate inflammasome activation. Though not much has yet been elucidated about its mechanism of action, the multifunctional regulator NLRP10 is another human protein implicated in participating in the host-virus arms race. Previous studies suggest that NLRP10 prevents inflammasome activation by inhibiting caspase-1 and IL-1Î². Compellingly, diverse flavivirus proteases also target NLRP10 for proteolytic cleavage, presenting a potential alternative pathway for induction of the innate inflammatory response.

Sandy Nguyenphuoc

Marine Biology, Muir

Mentored by Dr. Ronald Burton

Using DNA barcoding of ichthyoplankton to monitor the diversity of pelagic spawning California fish

Ichthyoplankton (the eggs and larvae of fish) surveys can be used to monitor marine ecosystems and the reproductive activity of pelagic spawning fish. The Burton Lab has been collecting fish eggs off the Scripps pier for the last 9 years and expanded to 4 additional sites along the California coast. Using DNA barcoding the COI and 16s genes can be amplified from the eggs and sequenced to determine the species. Only two species (Pacific sardine and northern anchovy) are able to be morphologically identified. The data we collected was compared across years and locations in order to elucidate patterns in diversity and egg abundance spatially (latitude) and temporally. We have found that Scripps Pier consistently had the highest egg abundance and species diversity. Furthermore, our data shows that locations north of Point Conception tend to have lower levels of diversity compared to more southern locations (Choi et al. 2021). We also found that the egg abundance of the Northern anchovy has seen a drastic

increase since 2019 at Scripps Pier which could be a good sign, as the species has been overfished. Overall, gaining a better understanding of the fish community composition in marine protected areas can lead to better management practices and highlights the importance of protecting areas with high diversity.

Jesus Osuna

International Studies- International Business, ERC

Mentored by Professor Munseob Lee

Assessing the South Korean Government's Performance on Supply Factors in the Housing Market of Seoul

Seoul has had a history of experiencing strong rises in its housing prices, which has made it a key issue in South Korea that affects the livelihoods of many. Understanding the causes of this pattern, and understanding the tools at hand that can combat the issues, are the keys to arriving at a worthwhile resolution. As with other markets of goods and services, both private and public agents are responsible for the interplay of supply and demand in Seoul's housing market, which sets prices. In particular, this paper seeks to isolate two of these, which are supply, and the public sector, by highlighting the South Korean government's net impact on supply factors in the housing market. The tools at the disposal of South Korea's government to influence supply include its greenbelt policy, price controls, and public housing. The results of this research illustrate that the South Korean government has had an overall negative impact on supply factors in Seoul housing, which has generated an upwards trend in prices.

Dhruv Parmar

Molecular & Cell Biology, Revelle

Mentored by Dr. Cory Root, Assistant Professor

Quantifying fluorescence through Synaptophysin Tracing to map the Intercalated Cells of the Amygdala.

The Intercalated Cells of the Amygdala have been an understudied region of the brain for a very long time. Through our understanding of neural systems, we know that the location and connections of different regions of the brain correlate to their impact on behavior. Previous research of the ITCs has highlighted their location within the brain, but not many individuals have looked at how their regulation plays a role in behavior. Bearing in mind the relationship between the role of neural connections and behavior, we can deduce that by locating what brain regions the ITCs synapse to, we will be able to gain greater insight into their role in behavior. The most optimal tool for this method is Synaptophysin Tracing, through which we infect the neurons within the ITCs with an

Adeno-associated Virus with a marker and identify where those markers travel to through fluorescent microscopy. Quantification of the fluorescence is done in the bioimaging software, ImageJ, and the data is compiled to show how fluorescence changes as we travel through the brain. After completing the analysis, we can identify that the ITCs have connections to many locations within the anterior and central amygdala. This supports the previous studies indicating that the ITCs play a role in controlling fear responses.

Lin Peng

International Studies - Economics, Marshall

Mentored by Professor Munseob Lee

Renegotiation on U.S.-Korea Free Trade Agreement

The free trade agreement between United States and South Korea (aka KORUS FTA), was originally announced on February 2nd, 2006, and it was finalized and signed on April 1st and June 30th respectively of the following year. However, the trade agreement was remodified and signed on September 24th of 2018. Which included new policies such as increasing the number of exports from the U.S. to South Korea, as well as putting a cap on South Korean imports coming into America. The presentation will be focusing on whether the renegotiation had brought any economics benefits to both South Korea and the U.S.. Specific changes in the agreement will be analyzed; graphs and statistics will be provided as well to explain the economy post renegotiation. Moreover, the renegotiation was known for its policy remodification on the automobile and steel industries. With that being said, the presentation will discuss the impact that the renegotiation had on the two industries in both Korea and the U.S., hence analyzing whether the renegotiation was beneficial after all.

Kendall Quesenberry

Sociology, Warren

Mentored by Dr. Michel Estefan, Faculty Advisor

The Impact of the Choice to Disclose vs. Not-Disclose ADHD on the Academic Self-Confidence of Higher Education Students

About 9.4% of US Children have been diagnosed with ADHD, making it the highest mental health diagnosis among this population. Despite the prevalence of this diagnosis, very little has been written on the impact of the stigma associated with receiving this diagnosis. This research observes the impacts of the ADHD label on students' self-confidence in higher education. Students (n=21) who received a diagnosis in K-12 versus higher education were surveyed to understand whether being given the choice to

disclose vs. conceal their ADHD had an impact on academic self-confidence. This study utilized one on one interviews with UCSD students between the ages 18 and 32. Participants were asked a mix of open-ended questions and scale-based questions that measured their academic confidence, severeness of learning disability, and other questions related to their diagnoses and its impact on them. It was hypothesized that students' academic self-confidence, by having the choice to disclose or conceal their ADHD, would be negatively impacted due to the stigmatizing nature of learning disabilities. This research concludes that age of diagnosis does not have a significant impact on self-confidence, however, having the choice to disclose or conceal their ADHDit does. This study suggests that the younger a person is labeled, the more likely they are to accept their label, but when faced with the option and opportunity of having full agency over disclosing their diagnosis is where the doubt comes in and therefore has a negative impact on academic self-confidence.

Kailey Ramsing

Marine Biology, Muir

Mentored by Dr. Jennifer Smith

COMPETITION OF TURF AND CRUSTOSE CORALLINE ALGAE ON BRANCHING AND MASSIVE CORAL COLONIES FOLLOWING BLEACHING EVENTS

Turf algae and crustose coralline algae (CCA) represent distinct functional groups on coral reefs. Turf algae are fleshy, fast-growing, opportunistic, and competitive. Since they can overgrow corals and other benthic taxa particularly during disturbances, an abundance of turf can indicate a more degraded reef. CCA are slow-growing, calcifying, active reef-builders that release settlement cues for coral larvae. The purpose of this study was to observe competition and abundance of CCA and turf on branching and massive coral colonies during and following bleaching events on Palmyra Atoll in the central Pacific. We used a yearly photoquadrat time series taken between 2009-2019 at two habitats . In Photoshop, we extracted planar areas of live normally-pigmented or discolored coral, CCA, turf algae, or other organisms within borders of coral colonies and tracked them over time. We found that turf and CCA were equally abundant during bleaching events whereas CCA was more prevalent a year later. This shows that CCA have the ability to regrow after disturbances and that pristine reefs can remain generally stable in terms of reef-builder dominance. Understanding these patterns is useful for predicting changes in reef health, especially as oceans warm and coral bleaching becomes more prevalent, possibly leading to reef degradation. Palmyra is a remote, uninhabited reef with no local stressors, so it is also important to consider how reefs with more human impact may respond differently.

Matthew Risley

Political Science, ERC

Mentored by Dr. Isaac Martin

The Political Implications of the 2017 Tax Cuts and Jobs Act

On December 22, 2017, then-president Donald Trump signed the largest tax rearrangement since 1986 into law. The Tax Cuts and Jobs Act (officially titled "To provide for reconciliation pursuant to titles II and V of the concurrent resolution on the budget for fiscal year 2018" and hereafter referred to as the TCJA), created sweeping tax reform, including a temporary decrease on individual income tax, increase in the tax-exempt amount from an estate, a near-doubling of the standard deduction, and a permanent slashing of corporate tax rates, among other things. This paper will be a compilation and analysis of previous research conducted on the predicted effects of the TCJA, both by congressional committees and independent researchers and organizations. Alongside this, it will discuss the distributive effects of the tax cut, focusing on the effects of the large corporate tax cut. The conclusion of the paper will focus on the unique political effects that the temporary provisions of the act will have.

Sebastian Rohrer

Molecular and Cell Biology, Revelle

Mentored by Dr. William Gerwick, PhD

Heterologous expression in Anabaena of the columbamide pathway from the cyanobacterium Moorena bouillonii and production of new analogs

Cyanobacteria are prolific producers of bioactive natural products, which constitute a promising source of new drug leads. Obtaining sufficient material for structure elucidation and bioassays from the native producers is a major bottleneck. Thus, we expressed the columbamide biosynthetic gene cluster (BGC), from native producer Moorena bouillonii, in the model cyanobacterium Anabaena PCC 7120. The BGC was assembled in yeast from PCR products, sequence-verified, and transferred into Anabaena by conjugation from E. coli. Investigation of the engineered Anabaena revealed production of previously characterized as well as novel columbamides. We characterized new columbamide K, the □-dechlorinated analog of columbamide A, by comprehensive NMR experiments and HR-LCMS/MS. We present structures for new analogs I, J, L and M based upon 1H NMR and HR-LCMS/MS. These results show the enzymatic plasticity in the BGC and highlight heterologous expression as an efficient way to circumvent bottlenecks and generate novel chemical diversity for drug discovery.

Nadine Mikaelle Rosete

Bioengineering: Bioengineering, ERC

Mentored by Dr. Karsten Zengler

Developing Standards for Staphylococcus Biomass Curves

Staphylococcus bacteria are essential players of the skin microbiome. Depending on the strain, they can either provide either benefit or detriment to the human body. Particularly, three strains of interest include USA300 (Staphylococcus aureus), SA113 (Staphylococcus aureus), and SE 12228 (Staphylococcus epidermidis). The objective of this experiment was to develop standards to convert between optical density and dry biomass for each strain. This was completed by creating stock cultures for each strain in HHWM media, capturing a pre-determined optical density of bacteria within a filtration system, and eliminating water to measure dry biomass. Overall, it was found that USA300 propagates the most with a noticeable biofilm, while SA113 had the least growth within a 48 hour time period. These conversion factors will be used to determine biomass growth for each strain grown in isolation and co-culture with different metabolites.

Eleanna Sakoulas

General Biology, Revelle

Mentored by Dr. Eric Zorrilla

Benztropine Reduces Reacquisition of Alcohol Self-Administration in Rats with Stress History: Role of FKBP5

Post-traumatic stress disorder (PTSD), often comorbid with alcohol use disorder, increases alcohol relapse risk and associates with variants in the FKBP prolyl isomerase 5 (FKBP5) gene. FKBP5 encodes FK506-binding protein 5 (FKBP5), a chaperone modulator of glucocorticoid receptors (GR) implicated in stress-related psychiatric disorders and alcohol withdrawal severity. FKBP5 inhibition may decrease alcohol intake, but its role in post-traumatic recurrence of alcohol drinking is unknown. We tested the hypotheses that (1) amygdala Fkbp5 expression is increased in rats with a history of traumatic stress and associates with greater reacquisition of ethanol self-administration, and that (2) benztropine mesylate, an FDA-approved drug that inhibits FKBP5-GR binding, reduces reacquisition of ethanol self-administration in rats with a history of traumatic stress. Male and female Wistar rats received 3 sessions of light-cued footshock stress (30 min sessions, 60 footshocks, 1-s 0.4 mA) before acquiring operant ethanol (10% v/v) self-administration (1-h sessions, fixed ratio1-3), followed by extinction (16 sessions), and then renewed alcohol access. Amygdala Fkbp5 expression correlated significantly with increased ethanol self-administration ($r_s(23)=0.463$, $p=0.023$) during renewal of ethanol

access. Subchronic (3 days) benztropine pretreatment (-2 h, i.p., 0, 5, and 10 mg/kg) significantly reduced the reacquisition of ethanol self-administration. On days 2 and 3 of reacquisition, self-administration was significantly reduced in drug-treated animals (Dose x Day: $F(4,64)=2.83$, $p<0.04$), culminating in a 68% and 41% reduction in males and females at the 10 mg/kg dose. Overall, the results warrant further study of benztropine and its potential inhibition of FKBP5 to reduce post-traumatic alcohol relapse risk.

Angie Santos

Biochemistry, Muir

Mentored by Dr. Lieselot Carrette & Dr. Olivier George

Characterization of the functional connectome of opioid intoxication through MOR and KOR agonism

Background: Understanding the impact of opioids on the brain is essential for the development of better analgesics and to combat opioid abuse. Both the mu opioid receptor (MOR) and kappa-opioid receptor (KOR) have analgesic effects, but MOR agonists are widely abused while KOR agonists may provide protection against addiction. Here, we use single-cell whole-brain imaging to map the functional connectivity following intoxication with selective MOR and KOR agonists.

Methods: Mice (N=8, 4M+4F) were treated with heroin (20 mg/kg), salvinorin A (2 mg/kg), U50488 (5 mg/kg), or saline, 30 minutes before behavioral assessment of intoxication through open field and tail immersion tests. Then, 90 minutes after injection, the mice were sacrificed. The brains were immunolabeled for cFos and cleared using the iDisco+ protocol, imaged using light-sheet microscopy, and processed using the ClearMap pipeline to map the functional connectome.

Results: Agonism at both receptors had an analgesic effect during tail immersion but resulted in the opposite effect in the open field with heroin increasing mobility and salvinorin A reducing it. The functional connectome of opioid intoxication through selective MOR and KOR agonism will be visualized, characterized, and compared. Moreover, specific behaviors will be modeled onto the network using multiple linear regression.

Conclusion: The functional connectome can help understand the brain-wide impact of intoxication with different drugs at single cell-level and can be used to predict specific effects or behaviors through the synchronized activation of key brain regions.

Zixuan Shao

Data Science, ERC

Mentored by Professor Mirle Rabinowitz-Bussell, Associate Teaching Professor and Director of Undergraduate Studies, Urban Studies and Planning

Qualitative Analysis of Mandatory Hotel Quarantine Policies based on Ethical Principles

Many governments adopted mandatory hotel quarantine (MHQ), compulsory 1-to-3-week quarantine in officially approved facilities for people arriving from abroad, during the COVID-19 pandemic. However, neglecting MHQ's negative impacts on quarantined individuals violates public health ethics. Guided by public health scholar R.E.G. Upshur's four principles of public health ethics, this study examined current MHQ policies by analyzing (a) various governments' MHQ policies and (b) YouTube videos depicting the COVID-19 MHQ experience. Overall, this research identifies fourteen indicators to measure ethics in MHQ policies and four indicators in YouTube videos that embodies Upshur's four principles of public health ethics. The data revealed considerable differences between the focuses of policies and the experiences of people. Inflexible MHQ duration, limited hotel choice, expensive fees, and fines indicate that the MHQ policies need improvement. The people, however, preferred well-furnished MHQ rooms with balconies, satisfactory food and services, and more importantly, no MHQ fees. To implement ethical MHQ, governments should adjust MHQ inclusion standards and duration based on individuals, offer hotel choices within various reasonable price ranges, guarantee the quality of hotel services, and provide health-related facilities during MHQ and MHQ tips in advance.

Sayan Shaw

Mathematics-Computer Science, ERC

Mentored by Dr. Jan Kleissl, (Director, Center for Energy Research)

Neighbor-Based Optimized Logistic Regression Machine Learning Model For Electric Vehicle Occupancy Detection

This paper presents an optimized logistic regression machine learning model that predicts the occupancy of an Electric Vehicle (EV) charging station given the occupancy of neighboring stations. The model was optimized for the time of day. Trained on data from 57 EV charging stations around the University of California San Diego campus, the model achieved an 88.43% average accuracy and 92.23% maximum accuracy in predicting occupancy, outperforming a persistence model benchmark.

Brian Sheldon

Physics, Sixth

Mentored by Dr. Javier Duarte

Improving Di-Higgs Sensitivity at Future Colliders in Hadronic Final States with Machine Learning

Future particle colliders offer the advantage of higher energy collisions which make possible more precise measurement of various phenomena. One of which is the event in which a single collision gives rise to the production of two Higgs Bosons that quickly decay to other particles. Accurate measurements of the frequency of this event (Higgs self-coupling constant) could elucidate the origin of electroweak symmetry breaking and offer a more complete understanding of the standard model. This paper uses machine learning on simulated data of high energy collisions in an attempt to improve signal-to-background discrimination. We focus only on the high branching fraction decay of two Higgs bosons into four b-quarks. The Future Circular Collider (FCC) is set to be completed in 2035 and will allow for the experimentation of high energy collisions. Through use of simulated data we demonstrate the potential improvements that the FCC may offer, especially with the use of graph neural networks.

Rohan Shenoy

Physics, Mathematics, Marshall

Mentored by Javier Duarte, Assistant Professor

Learned Energy Movers Distance a CNN based approximation to improve HGCAL trigger performance

The High Granularity Calorimeter (HGCAL) is part of the High Luminosity upgrade of the CMS detector at the Large Hadron Collider (HL-LHC). For the trigger primitive generation of the 6 million channels in this detector, data compression at the front end may be accomplished by using deep-learning techniques using an on-ASICs network. The ASIC foresees an encoder based on a convolutional neural network (CNN). The performance is evaluated using the energy mover's distance (EMD). Ideally, we would like to quantify the loss between the input and the decoded image at every step of the training using the EMD. However, the EMD is not differentiable and can therefore not be used directly as a loss function for gradient descent. The task of this project is to approximate this EMD using a separate set of CNNs and then implement the EMD NN as a custom loss for the ASIC encoder training, with the goal of achieving better physics performance.

Thomas Sievert

Physics, Muir

Mentored by Dr. Javier Duarte

QAML-Z + NQAC on D-Wave Advantage

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

Meenakshi Singhal

Bioengineering: Biosystems, Muir

Mentored by Dr. Trey Ideker, PhD

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

Recent work from the Ideker Lab features MuSIC (Multi-Scale Integrated Cell), a computational platform to build hierarchical maps of cell structure. The pipeline integrates both protein-protein interaction (PPI) and imaging datasets, whose information occurs at different physical resolutions. MuSIC thus serves as a scalable system to discover novel subcellular structures and protein complexes, and how they are organized within a given cell. Because structure and function go hand-in-hand, what we learn about the human proteome through MuSIC hierarchies can provide new insights into the effects of genetic variation. With new proteomics data from the Bioplex Initiative, we are expanding MuSIC to the U2OS osteosarcoma line. We now seek to stratify the U2OS data by creating cell compartment-specific MuSIC maps. Multi-localizing proteins are of interest as they may help the cell coordinate various reactions and pathways, and thus act as metabolic switches. In particular, we can determine the spatial organization of the complexes in which these hub proteins reside. In Python, I first applied the U2OS PPI network edges into HiDeF, a community detection algorithm. The compartment-specific hierarchies were then visualized via the Cytoscape web tool. Gene Ontology term enrichment was determined to evaluate the novelty of each protein community within a given compartment hierarchy. Overall, this approach presents a way to advance the MuSIC pipeline, by considering the dynamic nature of multi-localizing proteins. With such knowledge, we may more precisely infer cellular structures and genes with clinical significance, like cancer therapeutic targets.

Amberley Stein

Clinical Psychology, ERC

Mentored by Caren Walker, PhD, Assistant Professor

Can Children Use Causal Relevance to Guide Information Search?

Gathering information to resolve uncertainty is an essential, but difficult, part of human learning because of the vast amounts of information available. The ability to restrict information search to sources that are most likely to be relevant is therefore essential for achieving effective and efficient learning. In this project, we investigate 5- to 7-year-olds' ability to identify and utilize the causal relevance of information as a cue to guide their information search. Data collection is currently underway to test a minimum target n of 144 children on a storybook task. Participants hear a description of an event, the exact cause of which is unknown, but from which features of the cause can be inferred (e.g., a mess is found on a high-up surface, implying that the animal that caused the mess must be able to climb). Following this description, participants are presented with a series of forced choices between searching for information about causally-relevant (e.g., climbing ability) or causally-irrelevant features (e.g., ability to make noise) of the possible causes. The results of this study will indicate whether young learners can use an understanding of the abstract causal connections between an event and its cause to identify and investigate relevant, informative questions during information search.

Gwendalynn Stilson

Human Biology and Psychology, Muir

Mentored by Dr. Maripat Corr

Sex Differences in a Model of Arthritis-divergence of Peripheral and Central Pathways

Rheumatoid arthritis is the hallmark of autoimmune joint diseases. Although the adaptive immune system is integral in the development of this disease the inflammation is driven in large part by the innate immune system. The Toll-like receptors (TLRs) are a key part of the innate immune system. We tested a series of mice that were deficient in individual Toll-like receptors in a mouse model of arthritis. The K/BxN model passive serum transfer model of arthritis is penetrant in strains that are not deficient in critical elements needed to develop clinical signs of arthritis. In wild type mice, paw swelling developed in both male and female mice and resolved concordantly. However, the allodynia in male mice persisted whereas it partially resolved in female mice. In Tlr4-/- and Tlr7-/- mice the swelling and the allodynia resolved in both males and females. These two TLRs contribute to stimulating the production of type I interferons. Indeed Ifnar1-/- mice had paw swelling that had minimal associated allodynia in both sexes. Currently using mice that delete the type I interferon receptor (Ifnar1-/-) with cell types

we were able to demonstrate that the swelling in male mice is dependent on monocyte derived cells expressing the type I interferon receptor. However, female mice in the same strains were not significantly different than their wild type counterparts. These results demonstrate that there are sex differences in the reliance of the type I interferon pathway and disease manifestation and symptoms.

Kirollos Tadrousse

Human Biology, Warren

Mentored by Dr. Kellie Breen Church, Associate Professor

The Role of Norepinephrine Neurons in the Locus Coeruleus in Stress-Induced Suppression of Luteinizing Hormone

The Locus Coeruleus (LC) is part of the brainstem thought to regulate stress responses. I am investigating neurons in the LC during conditions known to suppress reproduction. Female C57/Bl6 mice were exposed to psychosocial stress paradigms: acute restraint stress (n=3), chronic restraint stress (n=3) or control (n=3). We also examined LC neurons following activation of another brainstem region (nucleus of the solitary tract [NTS]) using chemogenetics, which mimics most stress responses (activated: n=7, control: n=6). Immunohistochemistry was performed on neural tissue to label cFos, a marker for cell activation, and dopamine beta-hydroxylase (DBH), a marker for norepinephrine cells. We observed no significant differences in LC DBH cell activation in mice exposed to either restraint stress paradigm compared to controls. However, we found an increase in LC DBH cell activation in animals following activation of the NTS. Thus, the LC is regulated during NTS cell activation, but not in psychosocial stress.

Garrett Tan

Cognitive Psychology, Revelle

Mentored by Christine Smith

Novel News Events Test Predicts Cortical Thickness in Older Adults with Normal Cognition or Mild Cognitive Impairment

Mild Cognitive Impairment (MCI) is thought to be a transitional stage between normal aging and Alzheimer's Disease (AD). Both disorders are associated with cortical thinning in the temporal lobes and impairment in anterograde memory (i.e., new learning). Numerous studies have postulated that the temporal lobes are important for semantic memory retrieval and these regions are the first to decline in AD. We applied in vivo structural magnetic resonance imaging and obtained a measure of semantic retrograde memory (a retrograde memory news events test) in sixty-eight older adults with either normal cognition or MCI. We identified brain regions where retrograde memory

accuracy scores predicted cortical thickness. In alignment with predictions, we found that lower retrograde memory scores were associated with the thinner cortex in the temporal and frontal cortices, with the findings being predominantly left-sided. These findings were most prominent in participants with MCI. The results indicate that retrograde memory is supported by a large network of regions that highly overlaps with the regions first affected in AD.

Sirui Tao

Data Science; Statistics & Probability, Warren

Mentored by Judith E. Fan - Assistant Professor

Physion: Evaluating Physical Prediction from Vision in Humans and Machines

While current vision algorithms excel at many challenging tasks, it is unclear how well they understand the physical dynamics of real-world environments. Here we introduce Physion, a dataset and benchmark for rigorously evaluating the ability to predict how physical scenarios will evolve over time. Our dataset features realistic simulations of a wide range of physical phenomena, including rigid and soft-body collisions, stable multi-object configurations, rolling, sliding, and projectile motion, thus providing a more comprehensive challenge than previous benchmarks. We used Physion to benchmark a suite of models varying in their architecture, learning objective, input-output structure, and training data. In parallel, we obtained precise measurements of human prediction behavior on the same set of scenarios, allowing us to directly evaluate how well any model could approximate human behavior. We found that vision algorithms that learn object-centric representations generally outperform those that do not, yet still fall far short of human performance. On the other hand, graph neural networks with direct access to physical state information both perform substantially better and make predictions that are more similar to those made by humans. These results suggest that extracting physical representations of scenes is the main bottleneck to achieving human-level and human-like physical understanding in vision algorithms. We have publicly released all data and code to facilitate the use of Physion to benchmark additional models in a fully reproducible manner, enabling systematic evaluation of progress towards vision algorithms that understand physical environments as robustly as people do.

Haihan Tian

Economics; Data Analytics, Marshall

Mentored by Emanuel Vespa Associate Professor

The Returns to Having a Major-Related Job: Evidence From China

I study the returns to having a college major-related job using linear regressions with fixed effects to estimate the correlations between individuals' annual salaries in the natural log and their self-reported relatedness between their college majors and their current jobs while holding other variables constant. I survey 2,954 individuals from China to generate the sample. The estimations show that having a college major related job correlates with a 24.3% increase in annual salary while holding other variables constant. The estimations are statistically significant on all significance levels. I include interaction terms in my second stage empirical analysis to validate the estimated coefficient of the match between majors and jobs. The robustness check shows the match between college majors and employment is still positive and significant to individuals' annual salaries.

Mia Tonkin

Environmental Systems: Ecology, Behavior, Evolution, Muir

Mentored by Diana Rennsion, Assistant Professor

Fish, their guts, and why: exploring gut microbiota diversity associated with threespine sticklebacks' divergence in trophic ecology

Host-associated microbial communities (i.e., microbiotas) are crucial for many aspects of their hosts' physiology, including nutrient metabolism. Yet, relatively little is known about how microbiotas can affect the ecology and evolution of their hosts. Studying host-microbiota interactions can help researchers determine microbiota changes associated with their hosts' adaption to different ecological niches. Threespine stickleback fish represent our model to tackle this question as marine populations repeatedly and recently (< 12,000 years ago) colonized freshwater environments across the Northern hemisphere. Freshwater stickleback mainly feed on two types of prey associated with different habitats: littoral invertebrates from the lake sediment (benthic prey) and pelagic zooplankton (limnetic prey). The repeated colonization of freshwater habitats and the divergence in trophic ecology make stickleback a powerful system to study gut microbiota dynamics in response to novel environmental conditions, e.g. different diets. We characterized the gut microbiota of 14 lake populations from Vancouver Island, British Columbia to further understand the repeated divergence across benthic and limnetic feeding types. We are utilizing this effort to identify relative contributions of host ecology and morphology in addition to external environmental factors in order to determine patterns of microbiota variation within and across stickleback populations. Our data has the potential to improve our understanding of how a host, its gut microbiota, and the environment interact during the adaptation to different ecological niches.

Alice Tor and Ben Hofflich

Bioengineering, ERC / Revelle

Mentored by Akshay Paul and Dr. Gert Cauwenberghs

Scalp and In-Ear Electrophysiology for Unobtrusive and Mobile Health Monitoring

Electroencephalography (EEG) systems are devices designed to detect biopotentials that occur from synchronized neural firing from increased brain activity. However, traditional EEG headsets tend to be bulky, uncomfortable, and generally inconvenient. By leveraging the space inside the ear canal, we will demonstrate a wireless and mobile experimental in-ear EEG system for improved user and subject experience. The integrated system is a discrete and comfortable wearable device that fits into the ear and ear canal, similar to a wireless earphone. These factors make this in-ear EEG system uniquely appropriate for monitoring auditory evoked potentials, such as the auditory steady-state response (ASSR). The ASSR is an electrophysiological response originating from the primary auditory cortices in response to a custom auditory stimulus. Signal strength of the ASSR is correlated with perceived stimulus volume, and thus presents a unique method in which a user may characterize subjects' hearing sensitivities without subjective subject participation. The signal-to-noise ratio of the ASSR may also be optimized by changing stimulus and data processing parameters. Further applications that we explore include attention state monitoring via manipulation of the alpha band and opportunities for integration in neurofeedback systems. Beyond the signals and applications mentioned here, EEG signals have been implicated and used in countless more physiological conditions, and thus this in-ear system holds promise for the future of unobtrusive health monitoring.

Khoa Tran

Biochemistry, Warren

Mentored by Dr. Colleen McHugh

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

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

The target of my research is the lncRNA linc00883. This lncRNA has already been identified as mis-regulated in colorectal cancer and prostate cancer. However, the functions of linc00883 in normal and diseased cells and the specific RNA region(s) necessary for its function have not yet been explored. Furthermore, the mechanism by which linc00883 interacts with proteins or other RNAs to produce normal and disease phenotypes has not been studied. In this research project, my goal is to determine which specific RNA region(s) of linc00883 are important for its functions in regulating human cell growth. This study will expand our understanding of the function of the linc00883 lncRNA specifically, and potentially provide more information about the functions of lncRNAs in general.

Elias Trapp

Physics, Muir

Mentored by Julio Barreiro Guerrero, Assistant Professor

Preparing Optical Tweezer Arrays to build a next-generation Optical Atomic Clock

Atomic clocks allow for incredible precision in timekeeping by measuring the frequency of an atomic resonance. Typically operating on an ultranarrow microwave transition, an optical transition instead enables a theoretical improvement in precision by an approximate factor of 50,000. Such ultraprecise clocks have been realized with single highly-controlled ions, however, they commonly lack accuracy standards achieved by optical lattice clocks utilizing multiple, lesser-controlled particles. With recent advancements in individual control over multiple ordered neutral atoms using optical tweezer arrays, this technique could be the key to building an atomic clock that excels current precision and accuracy standards. Such an optical clock would allow for novel experiments in geodesy, gravitational waves, metrology and general relativity.

A basis for optical clocks, in this work we prepare, characterize and realize such an array of optical tweezers that allows for individual trapping of closely-spaced neutral atoms operating on a blue magic wavelength of Strontium.

Meghan Traynor

Sociocultural Anthropology and World Literature, Revelle

Mentored by Dr. Michel Estefan, Assistant Teaching Professor of Sociology

Cross-Cultural Comparison of Impact of Higher Levels of Familism on Adolescents' Experience of Dissenting With Familial Values

In society, you often hear the phrase "family over everything". But the notion of what family means, and what one's obligation to it are, vary from culture to culture, and household to household. "Familialism" describes the degree to which one prioritizes

familial values and obligations over one's own personal interests and values. The level of familialism within families depends on factors such as immigration status, religiosity, and cultural values associated with family. Among Americans who have been here for several generations, they are marked by lower levels of familialism, and a higher sense of individualism (Fuligini).

Little research has utilized a cross-cultural comparison to understand how differing levels of familism among families influences the process by which adolescents develop individual identities which conflict with their collective family identity. For this study, I interviewed young adults aged 18-20 Americans of Mexican and European with varying generational statuses in America regarding how they navigate their familial relationships and personal identities while having an identity that conflicts with their familial identity. The questions guiding this research are: Do higher levels of familism within families create more difficulty for adolescents in dissenting or challenging their family identity, or creating identities that contrast their family identity? And what are the modes by which these adolescents resolve this conflict and continue developing their individual identity? This study aims to bring greater awareness to how higher levels of social control within families impacts the nature of how young adults dissent to their family identity.

Xi Wang

Bioengineering: Bioinformatics, Revelle

Mentored by Dr. Ludmil B. Alexandrov, Assistant Professor of Cellular and Molecular Medicine, Assistant Professor of Bioengineering

Mutational Signature Assignment Benchmark

All cancers are characterized by somatic mutations. Mutations are accumulated following specific patterns, termed mutational signatures, according to the process responsible for their generation. Although mutational signature extraction from sequencing data has been extensively characterized, there is not a consensus strategy on how to determine the contribution of each signature to each tumor. Thus, the main goal of this project will be to benchmark up to seventeen different bioinformatic tools designed for this process, known as mutational signature assignment, as well as to benefit from this knowledge to upgrade the current algorithm used by our research group.

Anna Wilke

Neurobiology, Sixth

Mentored by Dr. Olivia Graeve

Bismuth Ferrite Particle Formation Mechanism using Advanced Morphology Control

Bismuth ferrite (BFO) is a robust multiferroic perovskite material that can be used for antiferromagnetic and ferroelectric applications simultaneously. The particle formation process of bismuth ferrite is yet to be characterized for advanced tunable morphologies. In this study, cubic and Magnoliophyta particles were synthesized using nitrate and chloride hydrothermal synthesis methods. Both synthesis methods employed potassium hydroxide mineralizer to manufacture pure BFO powders of tunable morphologies. The advanced morphologies of bismuth ferrite are formed using the same mechanism despite the difference in iron precursor type. One synthesis is done with an iron chloride hexahydrate precursor and the other is completed with an iron nitrate nonahydrate precursor. All products were characterized using XRD and SEM. The observed formation mechanism is produced through the preferential growth of small sub-particles that nucleate and agglomerate around a center hollow point. The mode of preferential growth results in the sub-particles arranging in similar patterns during both synthesis methods. Despite the differing morphologies, the particle formation method is the same and can be taken into consideration for future studies of advanced morphology control of multiferroic materials, like bismuth ferrite.

Claire Williams

Molecular and Cell Biology, Seventh

Mentored by Samuel Pfaff Adjunct Professor

Moving Toward a Genetic Therapy for Duchenne Muscular Dystrophy by RNA End-joining.

Using a new RNA end-joining (REJ) technique to overcome the size limitations that is being faced in current AAV gene therapies to treat Duchenne Muscular Dystrophy (DMD). DMD is caused by a mutation of the longest gene in the human genome which results in it not being able to fit in current AAVs. This new technology is being tested using three pathways and in two different mouse models to test the efficacy of REJ in the clinical treatment of DMD.

Flora Wong

Biochemistry/Chemistry, Marshall

Mentored by Desiree Shapiro, MD (Associate Clinical Professor of Psychiatry)

Mindful Medical Education

The experience of medical school is intellectually and emotionally challenging. Studies report concerning rates of burnout and mental health conditions among medical students compared to similarly aged individuals outside of medicine that may impact care delivery and wellbeing. This study investigates the feasibility and effectiveness of

offering micro-doses of mindfulness practices as a part of pre-clinical electives at UC San Diego School of Medicine to promote empathy, compassion, and mindfulness. Three electives participated for two quarters during the academic year; during one of the quarters, the elective integrated mindfulness. 5-minute mindfulness scripts were developed and delivered by instructors during each weekly class. 45 short text messages inviting mindful interventions such as mindful breathing, listening, and movement, were sent an average of 5 times per week throughout each academic quarter. All medical student participants completed a pre and post self-report survey at the beginning and end of the academic quarter to assess mindfulness, empathy, compassion, and perceived stress. Spring quarter data collection is ongoing and complete statistical analysis, difference in differences statistical analysis, is pending. Without statistical significance, preliminary results suggest an increase in self-reported mindfulness-attention and compassion that were more pronounced for students in electives adopting mindfulness interventions. Additionally, there was a greater decrease in self-reported stress for participants in the intervention group. Interestingly, both groups saw an increase in self-reported empathy that was more pronounced in students participating in electives without mindfulness interventions. More research is needed to better understand mechanisms to cultivate empathy, compassion, and mindfulness within medical education for healthcare professionals and their patients.

Jeffrey Xing

Psychology with a Specialization in Sensation and Perception & Interdisciplinary Computing and the Arts Major (Music), Sixth

Mentored by Timothy Q. Gentner; Professor

Syntactic modulation of rhythm in Australian pied butcherbird song

Birdsongs have complex underlying song structures that support their functional goal of conspecific communication. Such song complexities are often investigated in a syntactic framework, where complexity is examined as statistical features of a symbolic song sequence. Alternatively, song complexities can also be investigated in a rhythmic framework as the relative timing patterns of song units, which may offer complementary insights to syntactic song complexities. We investigate the merits of combining both frameworks by integrating syntax and rhythm analyses in Australian pied butcherbird songs, which exhibit both organized syntax and diverse rhythms at the note level. We present preliminary methods for investigating syntactic-rhythmic relations in birdsong, and find that pied butcherbird song rhythms are not only categorically organized, but can also be predicted by the song's first-order sequential syntax. Furthermore, song rhythms remain categorical and strongly associated with first-order sequential syntax after controlling for note length, showing that syntactic-rhythmic relations in pied butcherbird song are not dependent on systematic length

variations between notes. We discuss the implication of syntactic-rhythmic relations as a relevant feature of song complexity in respect to signals such as human speech and music, and advocate for a systematic conception of song complexity that takes into account not only individual song features, but also their interactions.

Jane Yang

Cognitive Science, Sixth

Mentored by Professor Judith Fan

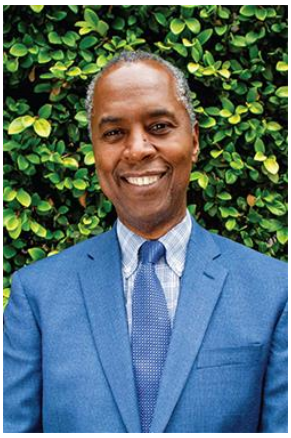
Communicating understanding of physical dynamics in natural language

Language is a powerful vehicle for communicating what we perceive and know about the external world. We can talk not only about observable properties of objects in our surroundings, but also their latent physical properties and predictions about how they will behave. Nevertheless, little is known about what characterizes language about physical properties, and distinguishes it from language about static visual properties.

To address this gap, we conducted an online behavioral experiment in which participants (N = 238) first played a physics-based video game, then wrote about their experience. The game required participants to learn how to predict where a ball would fly when launched under different conditions. Half of the participants were prompted to explain to someone how the game works (Explanation group); the remaining participants described how the game interface looked (Description group).

We found that while both descriptions and explanations included references to visual properties (e.g., color), explanations emphasized latent physical properties (e.g., gravity) to a greater degree than descriptions ($X^2(12) = 253.88$, $p < 0.001$), in addition to being reliably longer (explanation = 63.7 words, description = 41.4 words; $b = 22.2$, $t = 4.53$, $p < 0.001$). Moreover, participants who had performed better at the game also mentioned more of these properties ($r = 0.34$, $p < 0.001$), suggesting that what they had learned about the underlying game mechanics was explicitly accessible. Taken together, these findings contribute to our understanding of how people produce language to encode intuitive physical knowledge.

URH Staff



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