The 2023 Summer Research Conference at UC San Diego

August 17 & 18

UC San Diego
UNDERGRADUATE RESEARCH HUB

2023 Summer Research Conference at UC San Diego

Welcome to the Annual Summer Research Conference (SRC) at UC San Diego, a national showcase for undergraduate research. This year we have over three hundred seventy undergraduate presenters whose home institutions range from local community colleges to large state universities and private institutions. In addition to UC San Diego, institutions represented include:

- Boston University
- California Polytechnic State University, San Luis Obispo
- CSU Bakersfield
- CSU Fullerton
- CSU Long Beach
- CSU Northridge
- CSU Sacramento
- CSU San Marcos
- Chabot College
- Charles R. Drew University
- Columbia University
- Cypress College
- Fisk University
- General Atomics
- Harvard University
- HHMI Janelia Research Campus
- Howard University
- Imperial Valley College
- La Jolla Institute of Immunology
- MiraCosta College
- Morehouse College
- Mt. San Jacinto Community College
- North Carolina State University
- Northern Arizona University
- Northwestern University
- Oberlin College
- Ohio State University
- Palomar College
- Rio Hondo College
- Salk Institute
- San Diego City College
- San Diego Miramar College
- Scripps Dorris Neuroscience Center
- Scripps Research Institute
- Southern Connecticut State University
- Spelman College
- Truman State University
- UC Berkeley
- UC Davis
- UC Irvine
- UC Los Angeles
- UC Merced
- UC Riverside
- UC Santa Barbara
- University of Central Florida
- University of Georgia
- University of Kentucky
- University of Massachusetts
- University of Massachusetts Amherst
- University of Oklahoma
- University of Texas at El Paso
- University of Texas at San Antonio
- Yonsei University

We hope you will find the conference and students' presentations to be engaging and enlightening. We extend our many thanks to our moderators for their assistance and support, and to the mentors who have provided training and guidance to their students throughout the summer. We are grateful for the support of Chancellor Pradeep Khosla, Executive Vice Chancellor Elizabeth Simmons, Vice Chancellor for Student Affairs Alysson Satterlund, Vice Chancellor for Research Corinne Peek-Asa, and Assistant Vice Chancellor for Student Retention and Success Maruth Figueroa.

The Summer Research Conference is planned and coordinated by the Undergraduate Research Hub at UC San Diego, which is a unit of Student Retention and Success within Student Affairs.

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Conference Schedule

Thursday, August 17th

7:45 AM – 8:30 AM	Check-In & Breakfast Price Center West Ballroom
8:30 AM – 9:00 AM	Welcome Remarks
9:15 AM – 10:15 AM	Morning Session I
10:30 AM – 11:30 AM	Morning Session II
11:45 AM – 12:45 PM	Lunch Price Center West Ballroom
1:00 PM – 2:00 PM	Afternoon Session I
2:15 PM – 3:15 PM	Afternoon Session II

Friday, August 18th

7:45 AM – 8:30 AM	Check-In & Breakfast Price Center West Ballroom
8:30 AM – 9:00 AM	Welcome Remarks
9:15 AM – 10:15 AM	Morning Session I
10:30 AM – 11:30 AM	Morning Session II
11:45 AM – 12 PM	Closing

Presentation FAQs

Can I play music and/or videos in my presentation?

Yes, you can make use of multimedia if it is appropriate to your presentation within the context of your project. If you choose to do this, please remember that you will still have a total time limit of 10 minutes for your presentation if you are presenting individually or 12 minutes for groups of two. Keep in mind that music and/or videos should be a supplement to your live presentation; they should not replace your live presentation. Also be sure to do a practice run-through beforehand to resolve any possible technical difficulties with playing this material.

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 with slacks, 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?

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.

Why wasn't I grouped in a panel with my lab mates or colleagues?

We encourage students to form new intellectual connections through the conference. Think of this as an opportunity to meet different people with whom to discuss your work and brainstorm new ideas.

What should I do if someone asks me a question and I 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. Consider asking questions that invite the presenter 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 from 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?

Ask the moderator, a conference volunteer, or one of the guests in the room to help you troubleshoot the problem. If you still need help, ask for a volunteer to get help from someone in the conference reception area in the Price Center West Ballroom foyer.

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.

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, whereas 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

Thursday: Morning Session I, 9:15 AM

Panel #	Panel Name	Location
01	Healthcare: Birth and Children	Bear Room
02	Your Brain on Drugs	Roosevelt College Room
03	Physics and Chemistry	Green Table Room
04	Nanomaterials and Nanoparticles	Marshall College Room
05	Medical Applications of Machine Learning and Data Science	Red Shoe Room
06	Gut Disorders	Revelle College Room
07	Ecology and the Effects of Ocean Fauna	Warren College Room
08	Stem Cells and Regenerative Medicine	Dance Studio
09	Social Psychology: Identity & Perception	Forum
10	Teaching & Learning	Governance Chambers
11	Music & Theatre	Sixth College Room
12	Computer and Data Sciences I	East Ballroom
13	Medicine and Medical Applications	Student Services Center, Room 260
14	Healthcare: Cancer Inequities	Student Services Center, Room 300

Thursday: Morning Session II, 10:30 AM

Panel #	Panel Name	Location
15	Cancer	Bear Room
16	Women’s Health	Roosevelt College Room
17	Robotics Engineering	Green Table Room
18	Intersections of Bioscience and Engineering	Marshall College Room
19	Mathematics, Data Science, and Machine Learning	Red Shoe Room
20	Motor Neurons and Movement	Revelle College Room
21	Biomedical Applications of Silicon Nanoparticles	Warren College Room
22	Electrical and Computer Engineering I	Forum
23	Galaxies & Stars	Governance Chambers
24	Healthcare: Literacy & Communication	Sixth College Room
25	Computer and Data Sciences II	East Ballroom
26	Biomedical Sciences	Student Services Center, Room 260
27	Racial & Ethnic Inequities	Student Services Center, Room 300

Thursday: Afternoon Session I, 1:00 PM

Panel #	Panel Name	Location
28	Language, Communication, and Memory	Bear Room
29	Biological Studies Involving the Microbiome	Roosevelt College Room
30	Astronomy & Astrophysics	Green Table Room
31	Aging in Metabolism and Mitochondria	Marshall College Room
32	Neurodegenerative Disease	Red Shoe Room
33	Migration	Warren College Room
34	Molecular Biology I	Dance Studio
35	Electrical and Computer Engineering II	Forum
36	Oceanography & Geochemistry	Governance Chambers
37	Neurodevelopment	Sixth College Room
38	Computer and Data Sciences III	East Ballroom
39	Silicon Nanoparticles	Student Services Center, Room 260
40	Organic Chemistry	Student Services Center, Room 300

Thursday: Afternoon Session II, 2:15 PM

Panel #	Panel Name	Location
41	Learning and Education	Bear Room
42	Public Health	Roosevelt College Room
43	Materials Science and Engineering	Green Table Room
44	Medicine and Viruses	Marshall College Room
45	Neuroscience and Behavior	Red Shoe Room
46	Materials Science	Revelle College Room
47	Developmental and Cell Biology	Warren College Room
48	Molecular Biology II	Dance Studio
49	Electrical and Computer Engineering III	Forum
50	Atmospheric Chemistry	Governance Chambers
51	Neurobiology and Neuroscience	Sixth College Room
52	Mechanical and Aerospace Engineering	East Ballroom
53	Physical Chemistry & Nanotechnology	Student Services Center, Room 260
54	Neurological Studies on Alzheimer’s	Student Services Center, Room 300

Friday: Morning Session I, 9:15 AM

Panel #	Panel Name	Location
55	Mental and Physical Well-being and Healthcare	Bear Room
56	Medical Applications of Engineering	Roosevelt College Room
57	Fat and Metabolism in Health	Green Table Room
58	PTSD and Fear	Marshall College Room
59	Lung Health	Red Shoe Room
60	Work & Education	Revelle College Room
61	Nanoengineering and Materials Science I	Warren College Room
62	Neuroaging, Inflammation, and Repair	Dance Studio
63	Olfaction and Social Cues	Forum
64	Higher Education I	Governance Chambers
65	Particle Physics	Sixth College Room
66	Cognitive Science, Neuroscience, and Psychology	East Ballroom
67	Climate and Plant Studies	Student Services Center, Room 260
68	Biochemistry	Student Services Center, Room 300

Friday: Morning Session II, 10:30 AM

Panel #	Panel Name	Location
69	Autism	Bear Room
70	Computational Biology	Roosevelt College Room
71	Genome Editing	Green Table Room
72	Social Interactions	Marshall College Room
73	Immunology	Red Shoe Room
74	Political Science	Revelle College Room
75	Nanoengineering and Materials Science II	Warren College Room
76	Child Development and Social Interactions	Dance Studio
77	Neuroplasticity and Learning	Forum
78	Higher Education II	Governance Chambers
79	Nanotechnology	Sixth College Room
80	Post-translational Modifications in Biology	East Ballroom
81	Behavior, Developmental and Evolutionary Biology	Student Services Center, Room 260
82	Inorganic Chemistry	Student Services Center, Room 300

Student Spotlights

Adrian Miguel Arciniega

Summer Research Program: Genentech

Class Standing/College: Junior, Revelle

Major: Neurobiology

Field of Research: Aging

Presentation Title: Age-Related Differences in Complex V-Mediated ATP Hydrolysis

Mentor: Dr. Anthony Molina, Howard J. Phang

What has been the most meaningful experience you have had during the Summer Research Program?

Running my experiments by myself was the most meaningful experience I had during the summer. I had the opportunity to design, write, and perform my own project under the guidance of two great mentors, Dr. Anthony Molina and Howard Phang. During the school year Howard trained me so that I may become more independent and capable of working without constant supervision. My training was put to the test when Howard left for Austria for a two week research conference.

My first time doing an experiment without my mentor nearby was exciting and terrifying. It wasn't as smooth sailing or as straightforward as I'd like it to be or imagined it to be. I remember telling Howard that the optimization process should only take 4 runs to perfect to which he replied "yeah.... well see about that, maybe in a perfect world". I remember a heart dropping moment when looking at my results and realizing that oligomycin was not effectively shutting down ATP synthase, and realizing I didn't know what to do. When complications presented I quickly realized that Austria was 9 hours ahead and my mentor couldn't get back to me in time. I was encouraged to email different labs about problems with my experiment, which caused me to think critically about my experimental process and biological mechanisms. After receiving input from partner labs, lab managers, and other experts in the field my results finally started looking something to be proud of. It turns out that cold Mitochondrial Assay Solution (MAS) affects how well ATP synthase can be shut off, keeping it room temperature did the trick in turning off ATP synthase. 10 assays and a lot of data analysis later I finally had a project to be proud of.

Over the summer I was immersed in a world of problem solving. I am proud to look back at all of the things I've learned and issues I've overcome. My complications and worries with oligomycin concentration, cell count, freeze that process, and worrying if the project was even going to work are things of the past and milestones I'm proud to have overcome. My research experience was wonderful, it gave me the opportunity to learn and grow not only as a researcher but also as a person.

Madison Beltran

Research Programs: CAMP

Class Standing/College: Junior, Revelle College

Major: Environmental Systems (EBE)

Field of Research: Climate and Atmospheric Sciences

Presentation Title: Marine Cloud Brightening and Its Potential Impacts on Drought Conditions in Coastal Western North America

Mentor: Jessica Wan, Dr. Kate Ricke

What has been the most meaningful experience you have had during the Summer Research Program?

Interacting with other researchers and hearing passion in people's voices about their research was the most meaningful part of summer research. This discussion allows me to cultivate understanding of emerging sciences in a way not possible to learn through class instruction/textbooks. Being immersed in the research environment as an undergraduate has allowed me to hone my analytical skills that are applicable to pressing and relevant climate challenges. Through the CAMP Program, I was able to gain experience under Jessica Wan in the Ricke Lab at Scripps Institute of Oceanography and immerse myself in the current state of climate research. As climate change is ever increasingly relevant, this has been such a rewarding experience. For my research, I was allowed an opportunity to look at drought, a familiar issue to us Californians. It is awesome to have been part of the potential climate change solutions discussion.

Christian Cortes

Summer Research Program: STARTneuro

Class Standing/College: Junior, Muir

Major: Clinical Psychology

Field of Research: Neuroscience

Presentation Title: Investigating the Links between Anhedonia, Unpredictable Childhood Experiences, and Effort-Based Decision Making in Veterans

Mentor: Dr. Victoria Risbrough

What has been the most meaningful experience you have had during the Summer Research Program?

Working in a lab that is answering questions surrounding PTSD has been an extremely satisfying intellectual experience. Receiving feedback from mentors has been invaluable and walking through every aspect of executing a research study; from coming up with a research question and hypothesis, to designing an experiment, and finally collecting data for analysis has opened my eyes to what being a scientist truly entails. My interactions with our participants have been nothing short of amazing, and I feel incredibly grateful to have been able hear their stories. This experience has reinforced my passion for research and has reassured me that I am on the right path towards becoming the first person in my family to pursue a career in science.

Dominic Jauregui Haynes

Summer Research Program: McNair

Class Standing/College: Junior, Muir

Major: Psychology Cognitive and Behavioral Neuroscience

Field of Research: Cognitive Development

Presentation Title: Interactions between Infants and Caregivers

Mentor: Gedeon Deak

What has been the most meaningful experience you have had during the Summer Research Program?

The most meaningful part for me has been being able to learn how to do research without any prior experience. The amount of support that I receive from my mentors as well as my program coordinators has helped me feel more confident in pursuing research and feeling capable of reaching a PhD.

Monica Jensen

Research programs: Genentech

Class Standing/College: Junior, Revelle College

Major: Neurobiology

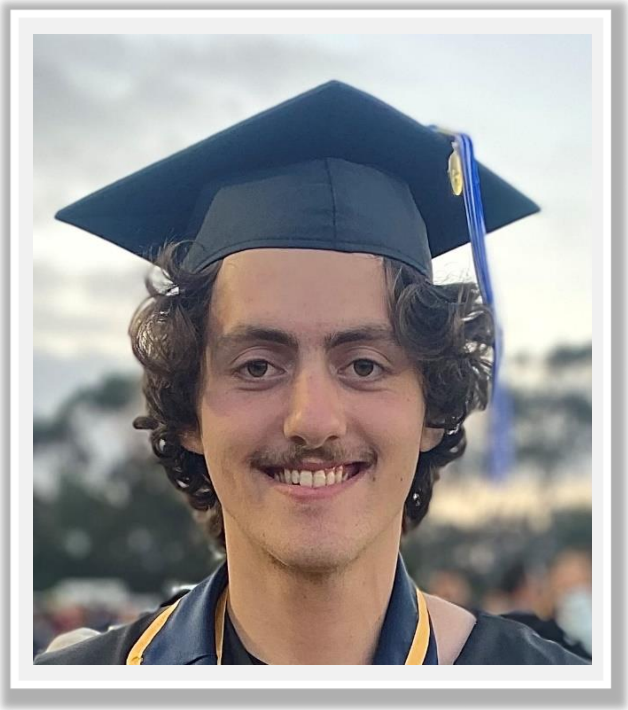
Field of research: Neuroscience

Presentation Title: Molecule X overexpression in astrocytes as an approach to rescue astrocyte reactivity and synaptic loss in Alzheimer's Disease

Mentors: Dr. Nicola J. Allen, Dr. Ashley Brandebura

What has been the most meaningful experience you have had during the Summer Research Program?

I got to learn from very knowledgeable and passionate scientists that share an interest in investigating the brain on a molecular level. I was fortunate enough to learn important skills that provided important data which my postdoc mentor would gladly discuss. I am extremely grateful to be a part of a lab that encourages growth, mentorship, and outstanding research. The scientist in me has definitely blossomed and I am excited for the future!



Joseph Kesler

Summer Research Program: LAEP

Class Standing/College: Senior, ERC

Major: Ecology, Behavior, and Evolution

Field of Research: Ecology

Presentation Title: Quantifying California Poppy Abundance Across Latitudes

Mentor: Professor Elsa Cleland

What has been the most meaningful experience you have had during the Summer Research Program?

The invaluable connection with people and place that was built throughout my research was by far the most meaningful part of it. With my lab coworkers turned great friends, we camped, toiled in the dirt, evaded rattlesnakes, and conducted research that will work towards the conservation of the California coastal prairie ecosystem. Moreover, the meetings I had with my advisor and Professor Elsa Cleland helped to build a professional relationship that I hope lasts my entire career. Lastly, the connection I formed with the grasslands, flowers, and cliffs above the coast of California were perhaps the most meaningful connection out of them all. These beautiful natural places are what drove the research in the first place and through that, allowed the rest to flourish.

Veronica Liu

Summer Research Program: McNair

Class Standing/College: Junior, Seventh

Major: Education Sciences and Urban Studies & Planning

Field of Research: Education

Presentation Title: How is "Readiness" Met?: The Case of Oakland Unified School District in Oakland, CA

Mentor: Dr. Sherice Clarke

What has been the most meaningful experience you have had during the Summer Research Program?

This summer, I worked on a research project relating to my experiences growing up in the Oakland Unified School District, a public school district located in the Bay Area. My brothers and I all grew up in the same schools, yet our experiences vastly differed because of the changes our school district was conducting every year. My project focuses on how "readiness", in the context of college and career, is defined, and how different programs or initiatives are changed, removed, or added to meet such standards. Over the course of the summer, I not only learned more about my educational upbringing, but also deepened my understanding of my research lab and my time management skills.

Grace Medina

Summer Research Program: TRELS

Class Standing/College: Senior, Revelle

Major: Chemistry

Field of Research: Biochemistry

Presentation Title: Fluorescence Labeling Tubercular Carrier Protein

Mentor: Dr. Michael Burkart

What has been the most meaningful experience you have had during the Summer Research Program?

The most meaningful experience so far has been the opportunity to work on a research project I am deeply fascinated with and excited about. This project brings together two of my most passionate ambitions; research and medicine. The astonishing mentorship I have received from my mentor and the people in the lab has been an essential part of my development personally and as a researcher. I would particularly like to express my gratitude to Desirae Mellor, Rebecca Re, and Dr. Michael Burkart that inspire me every day I come into the lab. From them, I have learned that every day might not be perfect, but every day is a step closer to something unimaginably exciting.

Jesús Jovani Medina Alcantar

Research Programs: Undergraduate Research Scholarships (URS)

Class Standing/College: Junior, Warren

Major: Mathematics - Computer Science; Education of Mathematics minor

Field of Research: Social Sciences, Education

Presentation Title: Gender and Racial Gaps Among Educators and the Effects These Could Have on Students

Mentor: Gerardo Arellano, PhD

What has been the most meaningful experience you have had during the Summer Research Program?

The Undergraduate Research Summer Program has challenged the way I think about education and helped me widen the lens through which I look at it. I've always known education is something valuable but did not really understand how or why. Through this research program I was able to see beyond the classroom environment and analyze the effects that our teachers have had on our society and the effects that our society has on our teachers. Teaching is one of the least luxurious professions a person with a degree can go into, yet it has been an instrumental part of social movements throughout history. This research project has reinforced my goal of becoming a Math High School teacher and shown me that I can make lasting change as one. My research project is dedicated to the educators and mentors that have encouraged me through my academic career, especially Dr. Gerardo Arellano who has mentored me through my first research project. I hope to one day be the steps on a ladder for others, like they were for me. I would also like to specially dedicate this project to my parents who always saw the potential in us, their children, and decided to start a new life in the U.S. so that we could achieve our highest potential.

Joaquin Mena Jr.

Summer Research Program: Underground Scholars Research Program

Class Standing/College: Senior, Seventh

Major: Ethnic Studies

Field of Research: Ethnic Studies

Presentation Title: Why Wasn't Education Instilled in My Life: Unraveling the Barriers Faced by Chicano Students in Pursuit of Higher Education

Mentor: Professor David Quijada

What has been the most meaningful experience you have had during the Summer Research Program?

The most meaningful experience during my Summer Research Program was delving into an in-depth literature review on the barriers faced by Chicano students in accessing higher education. Through this research, I had the opportunity to explore a wide range of scholarly articles and books that shed light on the challenges and disparities within the Chicano community.

Engaging with the literature allowed me to uncover the intersection of systemic violence, generational trauma, and the lack of positive role models as contributing factors to educational disparities. I was deeply moved by the resilience displayed by Chicano students and their communities in the face of such obstacles.

The literature review also led me to the concept of 'credible messengers,' individuals who can bridge the gap between the community and educational institutions. Understanding their potential impact on fostering a stronger relationship between Chicanos and higher education institutions was eye-opening.

Throughout this process, I was inspired by the work of scholars and researchers who have dedicated their efforts to understanding and advocating for educational equity. Their contributions have further fueled my passion for addressing educational disparities and promoting inclusivity in higher education.

Presenting my findings during the conference will be a moment of pride for me. It has been a fulfilling journey to dive deep into the literature and contribute to the ongoing conversation about empowering Chicano students and fostering supportive educational environments.

This literature review experience has solidified my commitment to being an advocate for positive change within the education system. I am excited to share the knowledge I have gained and hope that it will spark meaningful discussions and inspire further research in this vital area.

I am grateful for the opportunity to participate in the Summer Research Program and for the support I received throughout this journey. It has been a transformative experience that has deepened my understanding and passion for educational equity, and I look forward to continuing this important work in the future.

Victoria Morales Vargas

Summer Research Program: LAEP

Class Standing/College: Junior, Muir

Major: Psychology and Cognitive and Behavioral Neuroscience

Field of Research: Psychology

Presentation Title: Psychological Distress in the Menopause Transition and Dementia Risk

Mentor: Dr. Matthew S. Panizzon

What has been the most meaningful experience you have had during the Summer Research Program?

Getting to understand further what it means to work in research and finding enjoyment in my efforts.

Kristin Ngheim

Summer Research Program: IPATH

Class Standing/College: Junior, Sixth

Major: Molecular and Cell Biology

Field of Research:
Microbiology/Pathology

Presentation Title: Evaluating host ranges of jumbo vs. non-jumbo phages

Mentor: Dr. Pride

What has been the most meaningful experience you have had during the Summer Research Program?

Adapting to a new environment and gaining confidence in myself while engaging in research has been the most meaningful experience this summer. Thanks to everyone at the Pride Lab, I've experienced what research is like and what kinds of conversations happen when working towards a common goal. It's been a very immersive experience and I am grateful to be a part of the lab. The weekly cohort meetings have also been extremely helpful in navigating this research experience as I get to hear from my peers about their lab experiences and getting comfortable with the highs and lows that come with doing research.

Eric Oberholtz

Summer Research Program: UC Scholars

Class Standing/College: Senior, Warren

Major: Chemical Engineering

Field of Research: Renewable Energy

Presentation Title: Stability of Wide-Bandgap Organic-Inorganic Halide Perovskite Solar Cells

Mentor: Dr. David Fenning

What has been the most meaningful experience you have had during the Summer Research Program?

The most meaningful experience of the UC Scholars program has been the opportunity to devote significant time to pursuing my research interests. Through working closely with my mentors on the design of experiments and evaluation of results, I feel confident to continue my work in this field in the near and distant future. This program has helped me solidify my future career pathway, and get the most out of the research opportunities at UC San Diego.

Alyson Otañez

Summer Research Program: TRELS

Class Standing/College: Junior, Seventh

Major: Political Science: Data Analytics

Field of Research: Public Policy

Presentation Title: The Politics of Warehousing in the Inland Empire, CA: How did we get here?

Mentor: Dr. Marisa Abrajano

What has been the most meaningful experience you have had during the Summer Research Program?

Having the opportunity to conduct research on an issue that has long-affected my family, community, and myself, has been the most rewarding experience during the Summer Research Program. I decided the best way to research and address the politics surrounding warehousing in the Inland Empire was to conduct my research from home in Fontana, CA. This summer, and my whole life, I have experienced firsthand the negative effects of placing warehouses in low-income minority communities, and feel privileged to serve as a voice for my community. I am most grateful for my mentor, Marisa Abrajano, who has guided me through the process of political science research, and has always encouraged me to be proud of the work I create.

Farid Rezayat

Summer Research Program: Ahmadian Fellowship

Class Standing/College: Junior, Marshall

Major: Human Biology

Field of Research: Endocrinology

Presentation Title: Increased Glucose Uptake in Brown Fat Promotes Energy Expenditure

Mentor: Dr. Yuliya Skorobogatko

What has been the most meaningful experience you have had during the Summer Research Program?

The most meaningful aspect of this program has been the invaluable experience of learning how to present my findings in a clear and compelling manner. This transformative skill has boosted my confidence to communicate my research with a wider audience. Throughout the program, I had the privilege of working closely with Dr. Yuliya Skorobogatko, who guided me through refining my technical skills as well as problem-solving strategies that shaped the trajectory of my project. My mentor has continuously encouraged me to think creatively about the experiments and has provided me with her wealth of knowledge in the field. Her support has fostered a deeper understanding of the subject matter for which I am incredibly grateful. Moreover, the presence of other student researchers in the program has transformed the environment into a vibrant and engaging community, making the campus a place of inspiration and motivation.

India Robinson

Summer Research Program: UC-HBCU

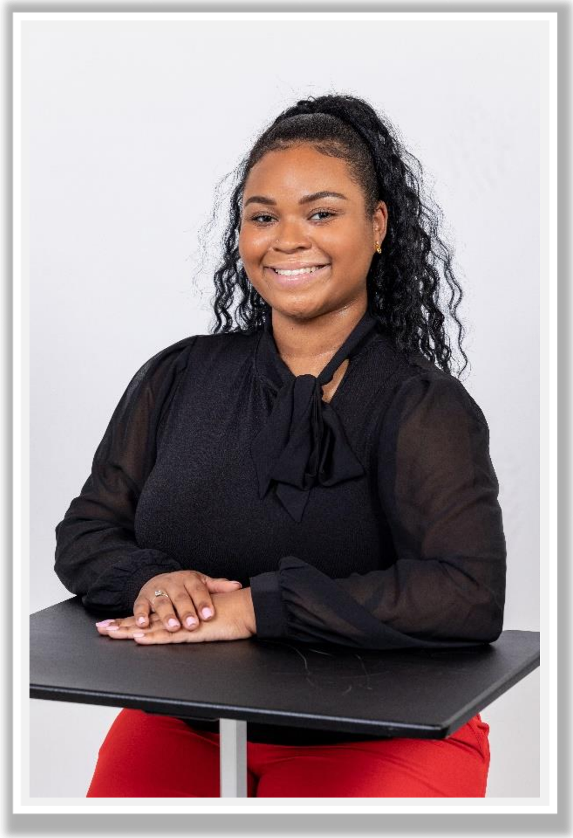
Class standing/College: Junior, Muir

Major: Biology

Field of Research: Pharmacy and Pharmaceutical sciences

Presentation Title: Human African Trypanosomiasis/Human Embryonic Kidney Cells

Mentor: Dr. Conor Caffrey



What has been the most meaningful experience you have had during the Summer Research Program?

I challenged myself to take on this research opportunity and coming from New Orleans, Louisiana as an HBCU student, it was a very hard decision for me to make as I would be away from home. I knew that if I had taken on this opportunity, this program would grant me the experiences of expanding my academic skills, connect with other students/mentors and gain greater expertise as which have happened. For me, I am grateful that I was granted this opportunity twice to do research at the UCSD Skaggs School of Pharmacy and Pharmaceutical Sciences. This program have put in prospect for me regarding decisions about career pathways and choices. I have met admirable people who have supported me all the way through this experience and have had conversations when it comes to degree choices and pathways to success.

Jennifer Shin

Summer Research Program: Ahmadian Fellowship

Class Standing/College: Sophomore, Sixth

Major: Human Biology

Field of Research: Medicine

Presentation Title: Exploring Syndecan-1 as a Diagnostic Marker for Hepatic Diseases in Plasma of Patients with Type 2 Diabetes

Mentors: Philip Gordts, PhD and Stephanie Leal

What has been the most meaningful experience you have had during the Summer Research Program?

As I started to work full time in the Gordts Lab for the Ahmadian Fellowship, I began to experience what it is like to work as a full time researcher alongside other undergraduates, graduate students, postgraduates, and doctors. By taking on my own project, where I am researching the correlation between Syndecan-1 and hepatic disease in human plasma, I felt a new sense of responsibility and independence. I feel that this experience is very meaningful, as I feel more significant in the research world. I am making a small, but real and direct impact in medicine, where this research could potentially help out patients with liver disease. Furthermore, I loved expanding my range of skills and research this summer, where I was essentially independent in designing, carrying out, and analyzing my own project, while adding on new skills such as being added to the animal protocol and helping out with mouse studies.

Ashley Thorshov

Summer Research Program: Undergraduate Research Scholarships (URS)

Class standing/College: Junior, Seventh

Major: Astrophysics with Math Minor

Field of Research: Material Physics

Presentation Title: Mapping the Time Development of Hydrogel Inhomogeneities using Laser Interference

Mentor: Dr. Alex Frañó

What has been the most meaningful experience you have had during the Summer Research Program?

The most meaningful experience I've had during the Summer Research Program has been working alongside the women in Dr. Frañó's lab. Women are widely underrepresented in Physics, and the lack of representation can be discouraging at times. Working in this research group, which is nearly 50% women, has made me feel more at home in my field than I ever have. Witnessing the intelligence, success, and resilience of my female colleagues has been truly inspiring, and the opportunity to receive their advice and mentorship is one I will always be grateful for.

Andres Vasquez

Summer Research Program: CAMP

Class Standing/College: Junior, Revelle

Major: Biochemistry

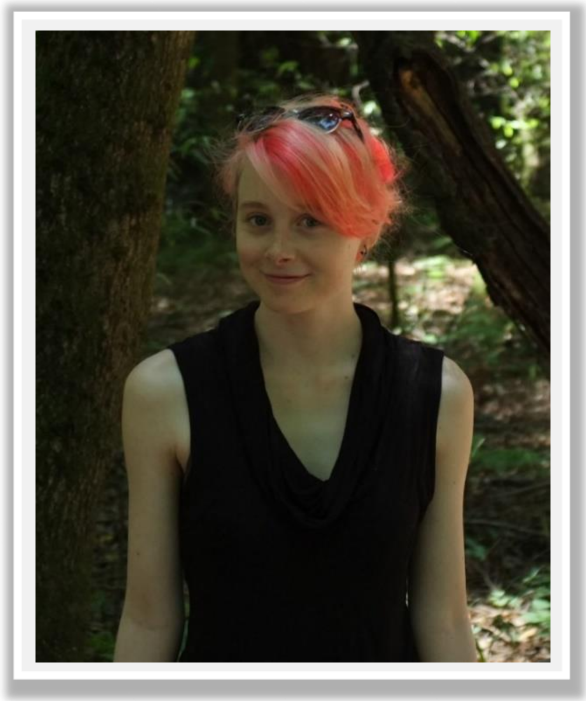
Field of Research: Protein Biochemistry

Presentation Title: Phosphorylation of BCL3 regulates transcriptional activity of p52:p52 complex

Mentor: Dr. Gourisankar Ghosh

What has been the most meaningful experience you have had during the Summer Research Program?

The opportunity to gain experience and network with the biochemistry and chemistry community has been the most meaningful experience during the Summer Research Program. The Ghosh lab has taught me a great amount on how to become a better scientist and how to advance my professional career as I finish my undergraduate years. Everyone in the Ghosh lab have provided a great mentorship to me and I am deeply grateful for their help. I also want to thank the Summer CAMP program and Edward Olano for the continuous support and resources during the summer. They worked very hard to support us in our research, and to find opportunities to expose us to post-undergraduate life.



Olivia Young

Summer Research Program: STARTneuro

Class Standing/College: Junior, ERC

Major: Neurobiology

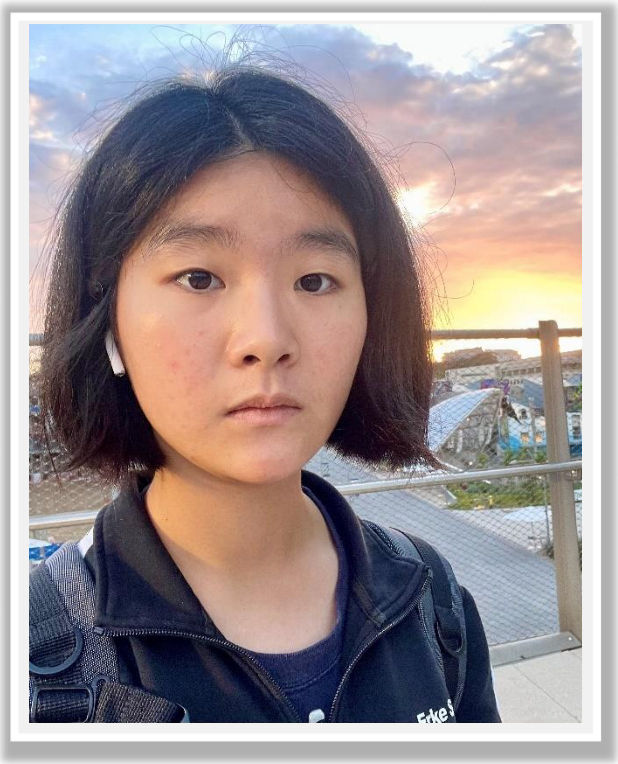
Field of Research: Psychiatry

Presentation Title: Nurturing Interoceptive Attention and Emotional Cognitive Control: The Impact of Breath-Focused Cooperative Compassion Training in Parent-Child Dyads

Mentors: Dr. Jyoti Mishra; Dr. Satish Jaiswal; Suzie Purpura; James Manchand

What has been the most meaningful experience you have had during the Summer Research Program?

One of my most meaningful experiences this summer has been discovering a sense of confidence in my research abilities and intuition by using these skills to create the change I want to see in the world. I am very grateful for the opportunity to conduct research that measurably impacts the lives of individuals suffering from mental illness. It has also been truly remarkable to be surrounded by a community of fellow science enthusiasts who share my passion for understanding the complexities of the human mind. These experiences have solidified my dedication to making a positive impact in this field, and I am excited about the future possibilities it holds for me and those I could help.



Yao Yu

Summer Research Program: UC Scholars

Class Standing/College: Sophomore, Seventh

Major: Philosophy & Ecology, Behavior, and Evolution

Field of Research: Philosophy of Mind, Microbial Ecology, Distributed Cognition

Presentation Title: One Mind, Many Bodies: How a Group of Interacting Microbes Shares a Mind

Mentor: Professor Rick Grush

What has been the most meaningful experience you have had during the Summer Research Program?

My experience in this program has been amazing so far. I couldn't pick out a "most meaningful experience", so below is a long response, partially about my experience, partially to thank the people who helped me along the way.

First, I would like to thank our awesome program coordinator Kirsten Kung and Sophia Tsai Neri. Their prompt reply to emails and help of all kinds made me feel more secure when doing a research project full of uncertainties.

Second, I would like to thank my mentor, Professor Rick Grush, for all the interesting conversations that we had in his office hours, for all the guidance in academics and beyond, and for mentoring me in this research project. My project in group mind has its root from the same topic he introduced in class. By explaining how a group of bees might implement a mind, he showed me what I take to be the most interesting way of doing interdisciplinary research. This class turned out having so much influence on me that I decided to switch my future goal from being a biologist to a philosopher. I am therefore incredibly happy that I can work with him on this topic for (almost) entire summer.

At last, I would like to thank all the people in the undergraduate research hub. The scholarship that I received this summer helped me make through some unexpected financial difficulties, and the supportive environment that they create together gave me the courage to explore the things I want to explore. And all the guidance in workshops and cohort meetings was extremely valuable to me, as someone who is the only one who has ever received some education in my family.

Panel Details

Thursday: Morning Session I

Panel 01: Healthcare: Birth and Children

Room: Bear Room
Thursday 9:15 AM – 10:15 AM
Moderator: Dr. Irene Su

Lucia Rejzek - UC San Diego
Mentor: Dr. Amy Non
Exploring causes behind reduced preterm birth during the pandemic

Peyton Cleaver - UC San Diego
Mentor: Dr. Amy Non
Changes in the Sex at Birth Ratio Following the Onset of the Covid-19 Pandemic

Sarah Naughten - UC San Diego
Mentor: Dr. Sydney Leibel
The Effects of A Multidisciplinary Severe Asthma Clinic on Asthma Medication Ratio Within the Pediatric Population

Rubi Gomez - UC San Diego
Mentor: Dr. Britta Larsen
Social Support and Physical Activity Attitudes

Panel 02: Your Brain on Drugs

Room: Roosevelt College Room
Thursday 9:15 AM – 10:15 AM
Moderator: Dr. Gail Heyman

Nora Alammari – CSU Bakersfield
Mentor: Dr. Michael Taffe
Characterizing behavioral effects of methamphetamine in Crayfish (Procambarus clarkii)

Manuel Vasconcelos - UC San Diego
Mentor: Dr. Kay Tye
Examining the acute effects of psilocybin on neural representations of valence in the medial prefrontal cortex

Daisy Hu - UC San Diego
Mentor: Hang Yao
Exploring the Effect of Basic Fibroblast Growth Factor on Methadone-Impacted Early Brain Development Using Human Cortical Organoids

Late additions:

Joel Wilkinson - Other
Mentor: Dr. Deanna Greene
Comparison of Subcortical Volumes Between Patients with Tourette Syndrome and a Control Group

Marissa Todesco - UC San Diego
Mentor: Dr. Timothy Gentner
The Magnetic Compass in Avian Brains: Exploring Neural Responses to Magnetic Fields

Panel 03: Physics and Chemistry

Room: Green Table Room
Thursday 9:15 AM – 10:15 AM
Moderator: Hayley Fong

Daniel Sandoval - Rio Hondo College
Mentor: Richard Averitt
Design and characterization of mechanical metamaterials with terahertz light

Evan Huang - UC San Diego
Mentor: Dr. Shaowei Li
Dosing and Study of O-BODIPY Dye in Scanning Tunneling Microscope

Mynel Gomez Alvarez - University of Texas at El Paso
Mentor: Krista Balto / Professor Joshua Figueroa
Investigating Solvent Impact of Selective Nanocrystal Surface Ligation Using Sterically-Encumbered Metal-Coordinating Ligands

Sophia Hsu - UC San Diego
Mentor: Professor Michael Sailor
Optimization of Lipid Coating on Porous Silicon Nanoparticles Using a Microfluidic Solvent Mixing System

Panel 04: Nanomaterials and Nanoparticles

Room: Marshall College Room
Thursday 9:15 AM – 10:15 AM
Moderator: Dr. Anvita Komarla

Ryan Jones - UC San Diego
Mentor: Nisarg Shah
Immunoregulatory Nanoparticles for Modulating Inflammatory Arthritis

Daniel Ryu - Yonsei University
Mentor: Professor Ji-Ho Park
The Potential of pSiNPs-based RNAi Delivery for siRNA and Oligonucleotide Delivery

Lilyane Stessman - California Polytechnic State University- San Luis Obispo
Mentor: Dr. Ester Kwon
A protease-based theranostic as a tool to understand and inhibit calpain in brain injury

Elizabeth Thompson - Truman State University
Mentor: Mentor: Dr. Maurice Retout, PI: Dr. Jesse Jokerst
Colorimetric Sensor Arrays Based on Peptide-Driven Plasmonic Nanoparticles Assembly

Kenndal Williams - The University of Texas at San Antonio
Mentor: Dr. Ester Kwon
ECM-Targeting Peptides as a Prophylaxis for the Treatment of Traumatic Brain Injury

Panel 05: Medical Applications of Machine Learning and Data Science

Room: Red Shoe Room
Thursday 9:15 AM – 10:15 AM
Moderator: Chandramouli Rajagopalan

Leah Moylan - University of Kentucky
Mentor: Dr. Daniela Valdez-Jasso
Predictors of Right-Ventricular Function in Pulmonary Arterial Hypertension Using Machine Learning

Giselle Perez - UC San Diego
Mentor: Dr. Ming Tai-Seale
Perspectives on AI-Assisted Response from Physicians to Patients from Members of the Public

Megha Kumar - UC San Diego
Mentor: Dr. Rob Knight
Investigating Microbial Associations with Anxiety and Depression Through Machine Learning

Gisel Larios - California State University Bakersfield
Mentor: Dr. Rodney Gabriel
Identifying Independent Preoperative Risk Factors for Mortality and Morbidity Following Hysterectomy for Gynecological Cancer

Saathvik Dirisala - UC San Diego
Mentor: Dr. Tsung-Ting Kuo
Decentralized Dynamic Patient Consent Management System for Hierarchical Data Elements

Panel 06: Gut Disorders

Room: Revelle College Room
Thursday 9:15 AM – 10:15 AM
Moderator: Leigh-Ana Rossitto

Amber Lawrence - UC San Diego
Mentor: Dr. Melinda Owens
Functional dissection of gut microbiota metabolites in the human-induced neuronal 2D model of Parkinson's Disease

Christopher Huerta - UC San Diego
Mentor: Dr. Ardem Patapoutian
Expression of Mechanosensative Ion Channels in the Gastrointestinal Tract

Madison Mitchell - UC San Diego
Mentor: Sreekanth Chalasani
Understanding Autism Associated Changes to Gut Health in C. elegans

Mohammad Sadegi - UC San Diego
Mentor: Dr. Amir Zarrinpar
Fecal Metabolites Correlated to Atherosclerosis in an Obstructive Sleep Apnea Mouse Model

Panel 07: Ecology and the Effects on Ocean Fauna

Room: Warren College Room
Thursday 9:15 AM – 10:15 AM
Moderator: Dr. Heather Daly

Kori Yun - UC San Diego
Mentor: Dr. Sara Jackrel
Effect of Temperature and Limited Diet Diversity on Growth of Rotifers

Saloni Dangre - UC San Diego
Mentor: Dr. Douglas Bartlett
Isolating Anaerobic, Extremophilic Microbes from Western Australia Transient Lakes

Anabell Espinosa - CSU Fullerton
Mentor: Dr. Octavio Aburto
Collaborative Management of Artisanal Fisheries in Mexico: Punta Abreojos case study

Chris Zhang - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Possible Relationship between Microplastics in Seafood and Cancer in Asian American Communities

Cecilia Ma Li - UC Davis
Mentor: Dr. Shermin de Silva
The Funding Landscape of Conservation and Ecology - An Analysis of Peer-Reviewed Literature

Panel 08: Stem Cells and Regenerative Medicine

Room: Dance Studio
Thursday 9:15 AM – 10:15 AM
Moderator: Dr. Laura Newman

Ashley Sevier - California Stare University Bakersfield
Mentor: Dr Adam Engler
Characterization of Satellite cells and Fibro-adipogenic progenitors isolated from patient muscle samples

Gloria Udogu - UC San Diego
Mentor: Dr. Shiri Gur-Cohen
Lymphatic Circuits Shape Stem Cell Fate in Health and Disease

Sarah Chavez – CSU Northridge
Mentor: Dr. Heidi Cook-Anderson
Chemical Reprogramming of Primed Pluripotent Stem Cells to Naive Pluripotent Stem Cells

Clarissa Jacobo Hernandez - UC Berkeley
Mentor: Dr. Karen Christman
Exploring the Regenerative Process of Injured Pelvic Floor Muscles in Pregnant Rat Model

Svetlana Kuznyetsova – CSU Northridge
Mentor: Adam J. Engler
Role of Breast Cancer Cells with Different Adhesive Phenotypes in Cancer Associated Fibroblast Activation

Panel 09: Social Psychology: Identity & Perception

Room: Forum
Thursday 9:15 AM – 10:15 AM
Moderator: Eva Zhang

Briana Gomez - UC San Diego
Mentor: Aftab Jassal
Transcending the Cycle: Exploring Karma, Yoga and the Healing of Generational Trauma

Alfonso Godínez Aguilar - Harvard University
Mentor: Dr. Melinda Owens
Investigating the Extent of Existing Opportunity Gaps and the Effectiveness of a Chemistry Intervention in Lower-Division Biology Courses

Gabriella Salvador - UC San Diego
Mentor: Professor Yến Lê Espiritu
Reclaiming Oaxacan Narratives through Oral History

Jacobo Cortes - UC San Diego
Mentor: Daphne Taylor-Garcia
Investigating the Effects that Machismo Ideologies that come from Mexico Play on Children and how it Psychologically Motivates or Kills their Will Power to Succeed.

Chester Olaes - UC San Diego
Mentor: Dr. Joo Ok Kim
Asian comedians in the U.S.: Disidentifying with stereotypes that harm Asian communities

Panel 10: Teaching & Learning

Room: Governance Chambers
Thursday 9:15 AM – 10:15 AM
Moderator: Prof. Adam Burgasser

Lia Sanchez - University of Georgia
Mentor: Dr. Thomas Bussey
Usability Analysis of BiochemAR: Exploring Biochemistry Students' Understanding of an Augmented Reality Visualization Tool of Hemoglobin

Ruqshana Amiri - CSU Sacramento
Mentor: Dr. Adam Burgasser, Dr. Genevive Bjorn
Student and Instructor Usage of Generative Artificial Intelligence (GAI) in STEM Education: The Learning Perspective

Girma Terfa - San Diego Miramar College
Mentor: Minhtuyen Mai, Dolores Lopez, Dr. Alberto "Beto" Vasquez
Equitable Pedagogical Approaches in K12 CS Learning Communities

Kevin Ly and Mollie Jordan - UC San Diego, North Carolina State University
Mentor: Adalbert Gerald Soosai Raj
Need a Programming Exercise Generated? ChatGPT's Got Your Back: Automatic Generation of Non-English Programming Problems Using OpenAI GPT 3.5

Panel 11: Music & Theatre

Room: Sixth College Room
Thursday 9:15 AM – 10:15 AM
Moderator: Ms. Jeanne Rawdin

David Raymond Mendoza - UC San Diego
Mentor: Dr. José I. Fusté
Criminalization of Rap in the Twenty-First Century

Joe'l Reyes - UC San Diego
Mentor: Monte Johnson
"Psychomusicology: Ancient Greek views about how the musical modes affect character and the soul"

Joshua Páez - UC San Diego
Mentor: Professor Robert Castro
Research & Dramaturgical Development for an Original Play Based off the 1917's Gasoline Baths in the U.S-Mexico Border

Claire McNerney - UC San Diego
Mentor: Professor Deborah Stein
Devised Theatre & Other Art Forms

Panel 12: Computer and Data Sciences I

Room: East Ballroom
Thursday 9:15 AM – 10:15 AM
Moderator: Dr. Wei Sun

Hojin Chang - UC San Diego
Mentor: Dr. Bill Lin
Selective Client Pruning in Federated Learning

Julia Epshtein - University of Massachusetts Amherst
Mentor: Dr. Michael Coblenz
The Kale Project: A Study of Spreadsheet Usability

Molly MacLaren - UC San Diego
Mentor: Michael Coblenz
Revisiting REVIS: Does visualizing errors help in learning Rust?

Panel 13: Medicine and Medical Applications

Room: Student Services Center, Room 260
Thursday 9:15 AM – 10:15 AM
Moderator: Tori Ribbens

Alyssa Olivares - UC San Diego
Mentor: Dr. Debanjan Dhar
Elucidate TREM2 Dependent Mechanisms that Facilitate NASH and Fibrosis Resolution

Jennifer Shin - UC San Diego
Mentor: Philip Gordts, PhD
Exploring Syndecan-1 as a Diagnostic Marker for Hepatic Diseases in Plasma of Patients with Type 2 Diabetes

Ericsson Cao - UC San Diego
Mentor: Dr. Alan Saltiel
The Effect of Drug BQU57 On High Fat Diet (HFD) Induced Obesity On Mice

Pranati Denduluri - UC San Diego
Mentor: Dr. Elsa Sanchez Lopez
Analysis of Human Synovial and Mice DMM Model Tissue

Panel 14: Healthcare: Cancer Inequities

Room: Student Services Center, Room 300
Thursday 9:15 AM – 10:15 AM
Moderator: Dr. Elaine Tanaka

Brenda Ochoa - UC San Diego
Mentor: Georgia Sadler
Reducing Cervical Cancer Screening Disparities Among Trans Men and Non-Binary People

Alyssa Zhang - UC San Diego
Mentor: Dr. Hui-chun Irene Su
Socioeconomic Disparities in Access to Fertility Preservation Benefits Among Adolescent and Young Adult Cancer Patients

Duncan Hong - UC San Diego
Mentor: Georgia Sadler
Multiple Myeloma's Prevalence in China

Irisa Jin - UC San Diego
Mentor: Dr. Georgia Sadler, Dr. Miguel Lopez-Ramirez
The Silent Influence of Mental Health Disorders on Cancer Care

Emily Smith - UC San Diego
Mentor: Dr. Georgia Sadler, Dr. Sandra Leibel, Dr. Evan Snyder
Cancer in Post-Roe America: It is beyond abortion rights

Thursday: Morning Session II

Panel 15: Cancer

Room: Bear Room
Thursday 10:30 AM – 11:30 AM
Moderator: Dr. Irene Su

Alex Lee - UC San Diego
Mentor: Mark Fuster
Exploring the Effects of Pulsed Magnetic Fields on Tumor Cell Growth and Apoptosis

Matthew Uzelac - UC San Diego
Mentor: Dr. Weg M. Ongkeko
tRNA-Derived Fragments as Translational Regulators in Head and Neck Carcinoma

Esperanza Quiñones Baltazar - UC San Diego
Mentor: Dr.Fotis Asimakopoulos
Accessing the Effect of Bromodomain Inhibitor, JQ1, on Multiple Myeloma Cell Lines

Anna Rapp - UC San Diego
Mentor: Dr. Georgia Robins Sadler, Dr. Leslie Crews
Allostatic Load as a Risk Factor for Cancer

Garrett Feng - UC San Diego
Mentor: Dr. Amir Zarrinpar
Evaluating Engineered Native E. coli's Tumor-Homing Ability for Colorectal Cancer Therapy

Panel 16: Women's Health

Room: Roosevelt College Room
Thursday 10:30 AM – 11:30 AM
Moderator: Dr. Kathleen Fisch

Arya Lalezarzadeh - UC San Diego
Mentor: Dr. Zhimin Hu
The Role of INFAR1 in Breast Cancer Metastasis

Hector Chavez - UC San Diego
Mentor: Dr. Kathleen Fisch
Molecular Mechanisms of Placental Dysfunction in Preeclampsia

Samira Feili - UC San Diego
Mentor: Dr. Kellie Breen Church
Mapping Neural Pathways Whereby Stress Impairs Fertility

Marjorie Pradhan - UC San Diego
Mentor: Dr. Alexander Kauffman
Examining the Feedback of DHT on the HPG axis during the GnRH/LH Surge in Female Mice

Julian Rodriguez - UC San Diego
Mentor: Professor Alexander Kauffman
Does Inhibition of Kiss1 Neurons Improve LH Levels, Hypererandrogenemia, and Body Weight in a Mouse Model of PCOS

Panel 17: Robotics Engineering

Room: Green Table Room
Thursday 10:30 AM – 11:30 AM
Moderator: Dwait Bhatt

Jason Stanley - UC San Diego
Mentor: Assistant Professor Nikolay Atanasov
Hamiltonian-based Neural ODE Networks for Adaptive Control of Differential Drive Robots

Alex Lu - UC San Diego
Mentor: Tania K. Morimoto
Design and Fabrication of a Robust and Compact Actuation System for Concentric Tube Robots

Matthew Kim - UC San Diego
Mentor: Professor Sylvia Herbert
Safe Multi-Agent Guidance using Koopman-Hopf Control of Nonlinear and Stochastic Systems for Robotic Applications

Kaitlyn Lavarias and Nina Sediki - UC San Diego, San Diego Miramar College
Mentor: Dr. Tania Morimoto
Haptic Grasper for Variable Force Rendering via Pneumatic Actuation

Panel 18: Intersections of Bioscience and Engineering

Room: Marshall College Room
Thursday 10:30 AM – 11:30 AM
Moderator: Dr. Anvita Komarla

Kristopher Ngo - UC San Diego
Mentor: Hanh-Phuc Le
A Current-Mode Stimulation Circuit with Integrated SPI and DAC for Neural Stimulation

Erin Shen - UC San Diego
Mentor: Prof. Shaochen Chen
3D BioPrinting Cardiac Micro-Tissues Reveals Direct Promoter Competition in Switching from MYH6 to MYH7 in Human Cardiomyocytes

Yair Diaz - Cypress College
Mentor: Dr. Matteo D'Antonio
GWAS/PRS & The Road to Inclusion

Arlan Aquino - CSULB
Mentor: Professor Susan Golden and Professor James Golden
Characterization of Cyanobacterial Strains Grown in Hydrogel Matrices

Camilla Hong - UC San Diego
Mentor: Professor Prashant Mali
In-Situ Circularized RNA Optimization To Tackle Gene Dysregulation

Panel 19: Mathematics, Data Science, and Machine Learning

Room: Red Shoe Room
Thursday 10:30 AM – 11:30 AM
Moderator: Chandramouli Rajagopalan

Thomas Allen - UC San Diego
Mentor: Professor Alireza Salehi Golsefidy
Studying Surface Groups via Character Theory

Mica Li - UC San Diego
Mentor: Professor Albert Chern
Harmonic Functions in Lie Sphere Geometry

Nhat Pham - UC San Diego
Mentor: Professor Alexis Toda
Computational Analysis of Bubbles with Overlapping Generations Model

Emmanuel Gutierrez - UC San Diego
Mentor: Dr. David Danks
Developing Fairness Criteria for Ethical Artificial Intelligence: Generalizing Harm Mitigation across Diverse Groups

Colin Tran - UC San Diego
Mentor: Professor David Danks
Enhancing Suicide Prevention: Addressing Data Integration Challenges in Multi-source Analysis

Panel 20: Motor Neurons and Movement

Room: Revelle College Room
Thursday 10:30 AM – 11:30 AM
Moderator: Leigh-Ana Rossitto

Aakash Bhegade - UC San Diego
Mentor: Dr. Eiman Azim
Investigating Differential Encoding of Limb Movements by Pre-cerebellar Lateral Reticular Nucleus Parvocellular Neurons

Madelyn Peck - UC San Diego
Mentor: Dr. Eiman Azim
Evaluating the Role of Cerebellar Nuclei Inhibitory Projections in Maintaining Internal Models for Skilled Movement

Nadeen Youhanan - UC San Diego
Mentor: Dr.Jody Corey-Bloom
Using a Simple Balance Device, the BTrackS™, to Predicting Disease Progression and Fall Risk in Huntington's Disease

Jared Stearns - UC San Diego
Mentor: Dr. Deena Greene
Correlation of subcortical volume and tic severity in patients with Tourette Syndrome

Panel 21: Biomedical Applications of Silicon Nanoparticles

Room: Warren College Room
Thursday 10:30 AM – 11:30 AM
Moderator: Ji Ho Park

Ethan Lucsik - CSU Long Beach
Mentor: Dr. Micheal Sailor
Modification of Mesoporous Silicon Nanostructures by Trihydridosilanes for CLZ Drug Delivery

Ahmad Turkistani - UC San Diego
Mentor: Michael Sailor
Clofazimine-loaded porous Si NPS for the treatment of tuberculosis and leprosi

Thomas Sendino and Anais Johnson - UC San Diego, CSU Long Beach
Mentor: Professor Michael Sailor, Ji-Ho Park / Gabriella Stark
Optimization of Zwitterionic Polymer Stealth Coating on Silicon Nanoparticles to Extend Nanoparticle Residence Time

Panel 22: Electrical and Computer Engineering I

Room: Forum
Thursday 10:30 AM – 11:30 AM
Moderator: Haoxing Du

Kobe Yang - UC San Diego
Mentor: Dr. Michael Yip
Robotic Catheter Reconstruction from Mono-Endoscopic Image

Meihui Liu - UC San Diego
Mentor: Dr. Yang Zheng
Smoothing Mixed Traffic Flow via Data-driven Predictive Control of Autonomous Vehicles

JD Heidenrich - UC San Diego
Mentor: Dr. Nicholas Antipa
Miniscope

Sonny Cao - UC San Diego
Mentor: Professor Dinesh Bharadia
Developing a new antenna array architecture to increase 5G access

Panel 23: Galaxies & Stars

Room: Governance Chambers
Thursday 10:30 AM – 11:30 AM
Moderator: Prof. Adam Burgasser

Bretton Simpson - UC San Diego
Mentor: Dr. Adam Burgasser
Examining Seyfert Galaxies with Archival Infrared Spectra from IRTF/SpeX

Weston Chester - UC San Diego
Mentor: Professor Adam Burgasser
Red Giants in Disguise: Differences in the Near-Infrared Spectra of Obscured Red Giants and Low Mass Brown Dwarfs

Joman Wong - UC San Diego
Mentor: Professor Adam Burgasser
Expanding the SpeX Prism Library Analysis Toolkit (SPLAT) for Asteroid Classification

Haley Steuber - CSU Sacramento
Mentor: Dr Adam Burgasser
The Reduction and Analysis of New Brown Dwarf Spectra Contained in the IRTF/SpeX Archive

Camille Dunning - UC San Diego
Mentor: Adam Burgasser
Deep Learning-Based Decomposition of Unresolved Ultracool Dwarf Binary Systems

Panel 24: Healthcare: Literacy & Communication

Room: Sixth College Room
Thursday 10:30 AM – 11:30 AM
Moderator: Dr. Betty Ramirez

Joshua Hartman - UC San Diego
Mentor: Dr. Georgia Sadler
Facilitating Hybrid Learning in Support Groups for Patients with Multiple Myeloma

Sara Gonzalez - UC San Diego
Mentor: Dr. Georgia Sadler
How to Reduce Areca Nut Attributable Oral Cancers in Western Pacific/Southeast Asia Regions

Jenna Garcia - UC San Diego
Mentor: Dr. Georgia Robins Sadler
First Do No Harm: Discussing Cancer Screening With People Coping with Advancing Dementia

Natasha Bisarya - UC San Diego
Mentor: Dr. H. Irene Su & Sally Romero
Development & Usability Testing of a health insurance literacy education intervention for adolescent and young adult cancer patients.

Bianca Chen - UC San Diego
Mentor: Dr. Georgia Sadler, Dr. Miguel Lopez-Ramirez
Resources to Help Cancer Patients are at Our Fingertips

Panel 25: Computer and Data Sciences II

Room: East Ballroom
Thursday 10:30 AM – 11:30 AM
Moderator: Dr. Wei Sun

Ulia Zaman - UC Irvine
Mentor: Dr. Michael Coblenz
Investigating Computational Scientists' Struggles with Scientific Programming

Latanya Khissy Beyniouah - Howard University
Mentor: Dr. Imani Munyaka
User Privacy in Android Apps

Ryan Kosta - UC San Diego
Mentor: Professor Yiying Zhang
Catena: A Scheduling System for Microsecond-Level Microservice DAGs

Melody Gill and Kristin Ebuengan - UC San Diego
Mentor: Dr. Pat Pannuto
Dirt Cheap: Timekeeping with Soil and Friends

Panel 26: Biomedical Sciences

Room: Student Services Center, Room 260
Thursday 10:30 AM – 11:30 AM
Moderator: Tori Ribbens

Jerry Wu - UC San Diego
Mentor: Pallav Kosuri
Enhancing Cell Segmentation for Spatial Transcriptomics in the Heart

Adie Parinas - Cypress College, CSU Long Beach
Mentor: Dr. Jejo Koola
Using Wearable Technology to Follow Patient Centered Outcomes After Kidney Injury

Mya Verrett - UC San Diego
Mentor: Dr. Tina Ng
Improvement of User Interface for a Multi-Modal Glove

Dhruvi Desai - UC San Diego
Mentor: Dr. Frank Talke
Development of a Murine-Sized Inflatable Vaginal Dilator for the Measurement of Vaginal Tissue Properties

Athena Wu - UC San Diego
Mentor: Dr. Karcher Morris
Assessing Surgical Ergonomics with Inertial Sensors

Panel 27: Racial & Ethnic Inequalities

Room: Student Services Center, Room 300
Thursday 10:30 AM – 11:30 AM
Moderator: Dr. Elaine Tanaka

Fatima Maciel - UC San Diego
Mentor: Dr. Simeon Man
Equitably in San Diego: An Analysis of Get It Done

Anakaren Perez - UC San Diego
Mentor: Penelope J. Quintana
Pollution in the Tijuana-San Diego and Imperial Valley regions and their impact on the public's health

Alyson Otañez - UC San Diego
Mentor: Marisa Abrajano
The Politics of Warehousing in the Inland Empire, CA: How did we get here?

Alycia Raya - UC San Diego
Mentor: Dr.Heather Daly
The social and ecological determinants of gang violence in Stockton California

Leslie Vallejo-Avila - UC San Diego
Mentor: Dr Gerardo Arellano
A transformed neighborhood: understanding how cultural displacement continuously affects the Latinx community in San Francisco's Mission district

Thursday: Afternoon Session I

Panel 28: Language, Communication, and Memory

Room: Roosevelt College Room
Thursday 1:00 PM – 2:00 PM
Moderator: Dr. Tal Waltzer

Jonathan Rodriguez - UC San Diego
Mentor: Dr. Carrie McDonald
Co-Lateralization of Language and Memory: Is Knowing Language Dominance Enough for Pre-Surgical Planning?

Jose Beltran - UC San Diego
Mentor: Professor Federico Rossano
Interspecies Communication: Use of Gestures Between Orangutan and Siamangs

Britney Martinez - CSU Northridge
Mentor: Dr. Sarah Creel
How does perception relate to production: do speakers understand themselves?

Constanza Perez Romero - CSU Northridge
Mentor: Dr. Minju Kim
Gesture production and engagement in preschooler's analogical reasoning

Panel 29: Biological Studies Involving the Microbiome

Room: Roosevelt College Room
Thursday 1:00 PM – 2:00 PM
Moderator: Dr. Omar Mesarwi

Cathy Chen - UC San Diego
Mentor: Dr. Weg Ongkeko
Characterization of the intratumoral archaea microbiome with subtypes of Papillary Thyroid Carcinoma

Marisol Paulino - UC San Diego
Mentor: Dr. Hiutung Chu
Expression of type I IFNs varies among different microbial communites

Rishi Yalamarty - UC San Diego
Mentor: Dr. Weg Ongkeko
Analyzing Dysregulation of the Archaeome in Head and Neck Squamous Cell Carcinoma

Ella Ryan - UC San Diego
Mentor: Dr. Amir Zarrinpar
The Role of Gut Microbial Bile Acid Deconjugation on Polycystic Ovary Syndrome

Panel 30: Astronomy & Astrophysics

Room: Green Table Room
Thursday 1:00 PM – 2:00 PM
Moderator: Prof. Adam Burgasser

Krystyn Roldan - Chabot College
Mentor: Dr. Carl Melis
Relationships Are Complicated: Magnetically-Driven Ultraviolet Activity and Stellar Age

Efrain Alvarado - UC Berkeley
Mentor: Dr. Adam J. Burgasser
Probing the Early History of the Milky Way through PHOENIX/ATLAS/MESA Models of Ultracool Dwarfs

Gavin Zhao - UC San Diego
Mentor: Professor Theissen
Spectral Typing All of Gaia Data Release 3: A Study of Low-Resolution Spectra

Sky Zhou - UC San Diego
Mentor: Dr. Chris Theissen
A Machine Learning Approach to the Spectral Classification of Ultracool Dwarfs

Hunter Brooks - Northern Arizona University
Mentor: Dr. Adam Burgasser
Exploring Optimal Color Selection for Candidate Substellar Subdwarfs Using New Spectral and Evolutionary Models

Panel 31: Aging in Metabolism and Mitochondria

Room: Marshall College Room
Thursday 1:00 PM – 2:00 PM
Moderator: Dr. Darren Casteel

Sirasit Prayotamornkul - UC San Diego
Mentor: Dr. Lingyan Shi
Investigating the Anti-Aging Effect and Metabolic Dynamics Regulated by Metformin in Drosophila with Raman Imaging

Joseph Romero - UC San Diego
Mentor: Dr. Nicola Allen
Cholesterol Metabolic Dysregulation in Aged Mouse Astrocytes

Shaun Konganda - UC San Diego
Mentor: Dr. Jacqueline Bonds
Mitochondrial dynamics of neural stem cells

Adrian Arciniega - UC San Diego
Mentor: Dr. Anthony Molina
Age-Related Differences in Complex V-Mediated ATP Hydrolysis

Katrina Jensen - CSU Long Beach
Mentor: Chengbiao Wu
Investigating the Differences in Mice With and Without Alzheimer's Disease Genotype

Panel 32: Neurodegenerative Diseases

Room: Red Shoe Room
Thursday 1:00 PM – 2:00 PM
Moderator: Dr. Melinda Owens

Calvin Xiao - UC San Diego
Mentor: Dr. Stefan Leutgeb
Control of circuit computations for cue-guided movement initiation by dopamine

Vincent Hernandez - UC Merced
Mentor: Dr. Vivian Hook
Development of Cathepsin B Assay Over a Broad pH Range in Human Brain Disorders

Katie Prinkey - UC San Diego
Mentor: Dr. Kim Dore
Blocking PSD-95 depalmitoylation rescues memory deficits in female APP/PS1 mice

Jazlynn Meza - UC San Diego
Mentor: Nicola Allen
Characterization of astrocyte reactivity during aging in the Ts65Dn mouse model of Down Syndrome

Neha Athavale - UC San Diego
Mentor: Professor Xu Chen
Beta hydroxybutyrate rescues pathophysiology and behavioral phenotypes in Alzheimer's mice

Panel 33: Migration

Room: Warren College Room
Thursday 1:00 PM – 2:00 PM
Moderator: Dr. Heather Daly

Leticia Guzman - UC San Diego
Mentor: Professor Amy Cimini
undetonated borderlands: ancestral rage, healing and artistic practices against state violence in stolen and border-militarized Kumeyaay territory

Nadia Celaya Carrillo - UC San Diego
Mentor: Dr. Chadwick Campbell
The health implication of labor-intensive work for Latinx immigrant workers within the San Gabriel Valley

Akelah Reeves - Spelman College
Mentor: Professor Marisa Abrajano
To what extent does the state of Florida provide fair immigration policy to immigrants from the African diaspora?

Josue Vega-Jungo - UC San Diego
Mentor: Dr. Haines
UC San Diego's Alacrán Community Station: A Migrant Community with Knowledge on Diversity and Food

Genesis Lopez Morales - UC San Diego
Mentor: Professor Neil M. Gong
Root Causes of Central American Migration

Panel 34: Molecular Biology I

Room: Dance Studio
Thursday 1:00 PM – 2:00 PM
Moderator: Dr. Kathleen Fisch

Raghad Albawab - UC San Diego
Mentor: Dr. Sonya Neal-Dr. Satarupa Bhaduri
Characterization of an intramembrane mammalian rhomboid protease RHBDL4

Nam Nguyen - UC San Diego
Mentor: Professor JoAnn Trejo
Identifying Proteins that Interact with ARRDC3

Daniel John - UC San Diego
Mentor: Dr. Weg Ongkeko
Integrative Liquid Biopsy Diagnosis of Head and Neck Squamous Cell Carcinoma

Yao Bi - UC San Diego
Mentor: Dr. Geoffrey Chang
Discovering NaCT-selective nanobodies

Vita Chou - UC San Diego
Mentor: Dr. Colleen McHugh
GRAS1 non-coding RNA controls cancer cell growth

Panel 35: Electrical and Computer Engineering II

Room: Forum
Thursday 1:00 PM – 2:00 PM
Moderator: Prof. Michael Coblenz

Junyi Xu - UC San Diego
Mentor: Professor Dinesh Bharadia
Navigating 5G Millimeter Wave through Multi-User Mobility Tracking and Path Prediction with Radar and Camera Fusion

YungYi Sun - UC San Diego
Mentor: Dinesh Bharadia
Smurfs: A Smart Surface-based Privacy Attack for Machine Learning-enabled Wireless Sensing Systems

Sharfa Pital - UC San Diego
Mentor: Dr. Dinesh Bharadia
Cylindrical Capacitive Sensor-Infused Baby Pacifier to Measure Baby's Biting Force.

Satvik Singh - UC San Diego
Mentor: Prasad Gudem
Image Processing for Boomerang flight dynamics

Ariel Jeon - UC San Diego
Mentor: Professor Tina Ng
Visualizing Pressure Maps for Hypertonicity Assessment

Panel 36: Oceanography & Geochemistry

Room: Governance Chambers
Thursday 1:00 PM – 2:00 PM
Moderator: Prof. Doug Bartlett

Noah Brown - UC San Diego
Mentor: Mark Merrifield
An Overview & Analysis of the Oceanside Littoral Cell

Brian Ferrante - UC San Diego
Mentor: Dr. Sarah Purkey
Ocean Circulation: Temperature and Oxygen Levels Changing Over Time

Elise Miyahara - UC San Diego
Mentor: Professor Isabel Rivera-Collazo
The Examination of Ecosystem Health through XRF and Microfaunal Analysis

George Lee - UC San Diego
Mentor: Dr. Emily Chin
Translating what rocks say: learning the magmatic history of the Golden Trout Volcanic Field (CA, USA) from chemical analyses of lava-hosted olivine crystals.

Sneha Korat - UC San Diego
Mentor: Jeff Gee
Weak, variable geomagnetic field from a Jurassic (182 Ma) intrusion in Antarctica

Panel 37: Neurodevelopment

Room: Sixth College Room
Thursday 1:00 PM – 2:00 PM
Moderator: Dr. Melissa Campbell

Leanna Rondon - UC San Diego
Mentor: Dr. Yishi Jin
The Functional Impacts of Mutant Pacs-1 on Neuronal Morphology

Ananya Achanta - UC San Diego
Mentor: Dr Melissa Campbell
Effects of Oxidative Stress During Cortical Development

Samuel Kahn - UC San Diego
Mentor: Associate Professor Nicola Allen
Validation of an Astrocyte Specific Smad4 cKO in Fragile X Syndrome Mice

Kevin Moreno - UC San Diego
Mentor: Dr. Stacey Glasgow
The Effect of the NF1A Gene on Motorneuron Development

Panel 38: Computer and Data Sciences III

Room: East Ballroom
Thursday 1:00 PM – 2:00 PM
Moderator: Cyril Gorlla

Evelyn Yee - UC San Diego
Mentor: Dr. Leon Bergen
The Role of Reasoning and Truthfulness in Large Language Models

Ishita Kakkar - University of Massachusetts
Mentor: Dr. Mai ElSherief
Examining Mental Burnout Discourse Across Reddit Online Communities

Ali Alani - UC San Diego
Mentor: Dr. Curt Schurgers
Development of Educational Technologies for Pedagogical Use

Samantha Prestrelski - UC San Diego
Mentor: Dr. Curt Schurgers
Machine Learning Models for Acoustic Species Identification of Avian Biodiversity

Marco Bazzani - UC San Diego
Mentor: Professor Curt Schurgers
Acoustic Bird Species Classification

Panel 39: Silicon Nanoparticles

Room: Student Services Center, Room 260
Thursday 1:00 PM – 2:00 PM
Moderator: Paula Kirya

Colby Rambo - San Diego Miramar College
Mentor: Dr. Michael Sailor
Temperature Dependence on Thermal Recovery of Off-Blinked Porous Silicon Quantum Dots

Seyeon Park - UC San Diego
Mentor: Michael Sailor
Photoluminescence blinking of n-type and p-type silicon quantum dots

Miranda Zhou and Julia Stoneburner - UC San Diego, UCLA
Mentor: Professor Michael J. Sailor
Stability and Protein Adsorption of Lipid-Coated Porous Silicon Nanoparticles

Panel 40: Organic Chemistry

Room: Student Services Center, Room 300
Thursday 1:00 PM – 2:00 PM
Moderator: Ava Henry

An Truong - UC Riverside
Mentor: Dr. Erik Romero
Exploring the potential of aryl thianthrenium salts for Pd-catalyzed C–H arylation reactions

John Greene - UC San Diego
Mentor: Dr. Emmanuel Theodorakis
Total Synthesis of Natural Products

Jose Lucas - Palomar College
Mentor: Dr. Valerie Schmidt
Towards the Synthesis of Bismuth Compounds at Multiple Oxidation States Using Redox-Active Ligands

Amber Williams - Fisk University
Mentor: Dr.Dionicio Siegel
Glioblastoma Multiforme Potential Compounds

Carlos Villalobos Nava - CSU Long Beach
Mentor: Dr. Michael Burkart
Scalability of sustainable polymer synthesis

Thursday: Afternoon Session II

Panel 41: Learning and Education

Room: Bear Room
Thursday 2:15 – 3:15 PM
Moderator: Dr. Tal Waltzer

Jessica Benson - UC San Diego
Mentor: Dr. Caren M. Walker
Word Learning Biases and Relational Reasoning in Typically-Developing Children and those with Autism Spectrum Disorder

Jaylen Allison - UC San Diego
Mentor: Dr. Celeste Pilegard
Do Lapses In Coherence Within Science Lessons Lead To Mind Wandering?

Lucy Ishkhanian and Andrew Salcedo Alvarez - CSU, Northridge
Mentor: Dr. Gail Heyman
"It's like an all-knowing oracle!": Beliefs about how ChatGPT works and how its use will impact education

Panel 42: Public Health

Room: Roosevelt College Room
Thursday 2:15 – 3:15 PM
Moderator: Dr. Omar Mesarwi

Zaira Leal - UC San Diego
Mentor: Carolina Marchetto
Studying Mood Disorders Using Stem Cells

Joseph Sadiki - UC San Diego
Mentor: Dr. Tala Al-Rousan
Knowledge, Attitude, and Behavior Toward Hypertension Management Among East African Refugees in San Diego: A Mixed-Method Study

Coby Dodson - UC San Diego
Mentor: Dr. Cheryl Anderson
Sodium regulation in individuals on known dietary sodium intake

Nicolas Morales - CSU San Marcos
Mentor: Dr. Eric Leas
Assessing compliance to in-person tobacco sales requirements in San Diego County

Megan Hosfield - CSU San Marcos
Mentor: David Fortunato
How does the administrative burden of prior authorization of health insurance policies impact the quality of care in the United States for marginalized communities?

Panel 43: Materials Science and Engineering

Room: Green Table Room
Thursday 2:15 – 3:15 PM
Moderator: Bingyuan Bai

Rohan Nambimadom - UC San Diego
Mentor: Professor Nicholas Antipa
Single-shot High Dynamic Range image via End to End Machine Learning model

Alex Lopez - UC San Diego
Mentor: Dr. Nicholas Boechler
Modifying Data Collection and Methods of a Split-Hopkinson Pressure Bar for High Strain Rate Testing

David Sung - UC San Diego
Mentor: Professor Patrick Mercier
Power Distribution Microgrid on eTextiles

Sascha Stevens and Matt Dulansky - UC San Diego
Mentor: Professor Hyonny Kim
Optimizing Sandwich Composite Structures for Resilient Surfboard Design: A Study on Buckling Resistance and Material Properties

Panel 44: Medicine And Viruses

Room: Marshall College Room
Thursday 2:15 – 3:15 PM
Moderator: Dr. Darren Casteel

Hillary Calderon - UC San Diego
Mentor: Dr. Rodney Gabriel
An Analysis on the Differences in Nerve Block Utilization for Radial Fracture Surgery Between Hispanic and Non-Hispanic Patients

Kristin Nghiem - UC San Diego
Mentor: Dr. David T Pride
Evaluating host ranges of jumbo vs. non-jumbo phages

Austin Gou - UC San Diego
Mentor: Dr. Matthew Daugherty
Unpacking PAK6

Meline Norquist and Kyle Thomas- UC San Diego
Mentor: Dr. Joe Pogliano
Investigating the Roles of Core Genes in the Nucleus-Forming Phage Life Cycle

Panel 45: Neuroscience and Behavior

Room: Red Shoe Room
Thursday 2:15 – 3:15 PM
Moderator: Dr. Melinda Owens

Brookelynn Reed - CSU Bakersfield
Mentor: Dr. Christina Gremel
Premotor cortex to dorsal medial striatum role in aberrant alcohol-seeking

Kelbi Banducci - CSU Bakersfield
Mentor: Dr. Kay Tye
The role of the mPFC in decision making and context-dependent behavior.

Alexandra Garcia - UC San Diego
Mentor: Dr. Kay Tye
Acute and chronic social isolation promote diverse behavior repertoires and differentially modify mPFC responses to social contact

Edwin Ruiz - UC San Diego
Mentor: Dr. Muotri
Predictive Model for Marker Genes of Pyramidal Neuron-Cells in the Prefrontal Cortex using Gene Expression Patterns

Panel 46: Materials Science

Room: Revelle College Room
Thursday 2:15 – 3:15 PM
Moderator: Dr. Adriana Nava Vega

Joshua Evans - UC San Diego
Mentor: Professor Alex Frano
Characterization of strongly correlated materials using synchrotron-based techniques and computational modeling

Kayla Pham - Columbia University
Mentor: Dr. Milan Delor
Imaging Ultrafast Exciton-Polariton Transport

Ashley Thorshov and Holden Bauer - UC San Diego
Mentor: Dr. Alex Frañó
Mapping the Time Development of Hydrogel Inhomogeneities using Laser Interference

Panel 47: Developmental and Cell Biology

Room: Warren College Room
Thursday 2:15 – 3:15 PM
Moderator: Prof. Vu Nguyen

Gloria Renaudin - UC San Diego
Mentor: Dr. Amro Hamdoun
Spatiotemporal expression of srcr142 throughout the development of Lytechinus pictus utilizing in situ HCR.

Monsserrat Pallan - UC San Diego
Mentor: Dr. Karen Oegema
Examining the role of RhoA in syncytial germline development

Shannon Cao - UC San Diego
Mentor: Professor Jing Yang
Proteomic Analysis of Epithelial Cell Polarity Complexes

Shreya Chandrasekhar - UC San Diego
Mentor: Dr.Sonya Neal
Investigation of sphingolipid interaction with yeast rhomboid protein Dfm1 and its implication on misfolded protein degradation

Esmeralda Rico - UC San Diego
Mentor: Dr. Mia Huang
Utilizing proximity labeling methods with Basigin, a cell surface-localized glycoprotein

Panel 48: Molecular Biology II

Room: Dance Studio
Thursday 2:15 – 3:15 PM
Moderator: Nkechinyere Iroanusi

Derrick Labidou - San Diego Miramar College
Mentor: Prof. Michael D. Burkart
Exploring the critical processes in fatty acid biosynthesis of the enoyl reductase (ER)

Kaitlyn Ng - UC San Diego
Mentor: Professor Brian Zid
The role of mitochondrial mRNA localization on mRNA stabilization

Elijah Khalil Rosales - UC San Diego
Mentor: Gene Yeo
U1 snRNA Transplicing

Farah Haleem - UC San Diego
Mentor: Dr. Shyamanga Borooah
Using Base-Editing as a Treatment Approach for Autosomal Dominant Inherited Retinal Degenerations

Sanjana Korpal - UC San Diego
Mentor: Dr. Alexis C. Komor
Evaluating the Impact of Reversions of Individual Mutations on Wild-Type TadA Efficiency

Panel 49: Electrical and Computer Engineering III

Room: Forum
Thursday 2:15 – 3:15 PM
Moderator: Dr. Ece Mayran

Aniket Bhosale - UC San Diego
Mentor: Professor Curt Schurgers
Development of Tower Electronics for Radio Collar Tracking

Michael Shao - UC San Diego
Mentor: Professor Dinesh Bharadia
UWB/IMU Sensor Fusion for Robust Motion Capture

Runpeng Jian - UC San Diego
Mentor: Dr. Xiaolong Wang
Denoising Diffusion Model: Exploration of Methods in Inverse Problem

Merlin Zhang and Emma Zhu - UC San Diego
Mentor: Professor Curt Schurgers
Enhancing Efficiency and Communication across UCSD's Makerspaces through a Centralized Database and Server Infrastructure

Panel 50: Atmospheric Chemistry

Room: Governance Chambers
Thursday 2:15 – 3:15 PM
Moderator: Prof. Doug Bartlett

Jenille Cruz - UC San Diego
Mentor: Dr. Vicki Grassian
Utilizing Surface Sensitive Techniques to Understand Properties of Surface-Active Species in Sea Spray Aerosols and the Sea Surface Microlayer

Steven Flemig - UC San Diego
Mentor: Dr. Andreas Andersson
Analyzing Ocean Alkalinity Enhancement and Marine Carbon Dioxide Removal through Calcium Carbonate Sediment Dissolution

Justin Han - UC San Diego
Mentor: Dr. Sarah Aarons
Tracing Zirconium Stable Isotopes: River to Sea

Madison Beltran - UC San Diego
Mentor: Katharine Ricke
Marine Cloud Brightening and its Potential Impacts on Drought Conditions in Coastal Western North America

Panel 51: Neurobiology and Neuroscience

Room: Sixth College Room
Thursday 2:15 – 3:15 PM
Moderator: Dr. Melissa Campbell

Mayra Mendiola - UC San Diego
Mentor: Dr. Jennifer Lippincott-Schwartz & Dr. Ron Vale
Understanding the contribution of mitochondrial transport to neuronal mitostasis

Esaul Garcia - UC San Diego
Mentor: Eugene Yeo
Investigating the effects of RNA binding proteins on neuronal RNA transport

Aren Khachatryan - UC San Diego
Mentor: Dr. Gene Yeo
Stress Granules interaction with CAG repeats RNA in Huntington's Disease

Verina Leung - UC San Diego
Mentor: Dr. Li Ye
Somatosensory remodeling in adipose tissues

Panel 52: Mechanical and Aerospace Engineering

Room: East Ballroom
Thursday 2:15 – 3:15 PM
Moderator: Dr. Kai Qian

Anna Nguyen - UC San Diego
Mentor: Professor Lisa Poulikakos
Giving "L"s to Mie Resonator Arrays Senses Circularly Polarized Light

Savannah Rhoades - UC San Diego
Mentor: Dr. Oliver Schmidt
Modal Analysis of Twin Rectangular Jet Flow Schlieren Data

Tin Nguyen - UC San Diego
Mentor: Professor James Friend
Novel Omnidirectional Spiral Surface Acoustic Waves for Efficient Underwater Silent Propulsion

Preston Gomersall and Devanshi Jain - UC San Diego
Mentor: Professor Oliver Schmidt
Robust Design and Optimization of Turbomachinery Compressors

Panel 53: Physical Chemistry & Nanotechnology

Room: Student Services Center, Room 260
Thursday 2:15 – 3:15 PM
Moderator: Paula Kirya

Angeline Kim - UC San Diego
Mentor: Professor Sailor
Stability of Styrenic Carbon Double-Grafted Porous Silicon Particles for Lithium-storage Anode Materials

Jacob Mapa - UC Riverside
Mentor: Dr. Michael Sailor
Enzyme-loaded modified porous silicon nanoparticles in polymer scaffolds synthesized via spray nebulization for improved performance in nerve agent detoxification.

Eduard Shkulipa - UC San Diego
Mentor: Dr. Vitaliy Lomakin
Fast evaluation of Helmholtz potential

Ian Jayachandran and Will Zhao - UC San Diego
Mentor: Professor Saharnaz Baghdadchi
Optical Voice Recorder Using Digital Holography

Panel 54: Neurological Studies on Alzheimer’s

Room: Student Services Center, Room 300
Thursday 2:15 – 3:15 PM
Moderator: Dr. Christine Smith

Laura Noronha - UC San Diego
Mentor: Dr. Nicola Allen
Altered Cholesterol Metabolism in Alzheimer’s Disease Astrocytes

Monica Jensen - UC San Diego
Mentor: Dr. Nicola Allen
MoleculeX overexpression in astrocytes as an approach to rescue astrocyte reactivity and synaptic loss in Alzheimer’s Disease

Amanda Gonzalez - UC San Diego
Mentor: Dr. Katherine Bangen
Objectively-Defined Subtle Cognitive Decline and its Association with CSF GAP-43

Michelle Gomez - UC San Diego
Mentor: Dr. Christine Smith
Hippocampal Subregions and their relationship to news event memory in older adults with normal cognition or mild cognitive impairment

Guadalupe Rodriguez - CSU, Fullerton
Mentor: Xu Chen
Tau Mouse Model of Alzheimer's Disease and Reducing Tau Pathology

Friday: Morning Session I

Panel 55: Mental and Physical Well-Being and Healthcare

Room: Bear Room
Friday 9:15 AM - 10:15 AM
Moderator: Oliva Mota Segura

Jessica Young - UC San Diego
Mentor: Dr. Jyoti Mishra Ramanathan
Nurturing Interoceptive Attention and Emotional Cognitive Control: The Impact of Breath-Focused Cooperative Compassion Training in Parent-Child Dyads

Brandi Dickens - UC San Diego
Mentor: Professor Karen Dobkins
Positive Personality Traits, Connection to Nature, and Wellbeing

Joseph Awad - Mt San Jacinto Community College
Mentor: Dr. Laramie Smith
Exploring Factors of Depressive and Anxiety Symptoms Amongst Latino Men who have Sex with Men (LMSM): Assessing the Role of Internalized Sexuality Stigma

Nicole Bardales - UC San Diego
Mentor: Georgia Sadler
Measuring Barriers and Facilitators of African Americans

Seth Almaraz - CSU, Northridge
Mentor: Dr. Sarah Banks
The Importance of Diversity in Alzheimer's Disease Research

Panel 56: Medical Application of Engineering

Room: Roosevelt College Room
Friday 9:15 AM - 10:15 AM
Moderator: Dr. Yatish Turakhia

Matisohn Huynh - Palomar College
Mentor: Abdullah Albatta / Professor Truong Nguyen
Effect of CT Scan Image Enhancement on The Ability of Deep Learning Models to Segment Lesions in the Liver.

Grace Jin - UC San Diego
Mentor: Professor Edward Wang
Revolutionizing Medical Activity Tracking: A Novel Wearable Hardware and Software Ecosystem for Irritable Bowel Syndrome Patients

Tina Tahiraj - UC San Diego
Mentor: Professor Frank Talke
Developing a Multi-Chamber Soft Robotics Inspired Dilator for Treating Radiation Induced Vaginal Stenosis

Girish Krishnan and Carolyn Zhang - UC San Diego
Mentor: Prof. Yatish Turakhia
Large-scale Genomic Surveillance of SARS-CoV-2 via Wastewater-based Epidemiology

Panel 57: Fat and Metabolism in Health

Room: Green Table Room
Friday 9:15 AM - 10:15 AM
Moderator: Dr. Oksana Polesskaya

Sunny Zhu - UC San Diego
Mentor: Dr. Nicholas Webster
In Vitro Study of Loss of cAMP Signaling in CD11c Immune Cell Leads to Protection Against Diet Induced-Obesity Through Sebum Secretion

Angela Liu - UC San Diego
Mentor: Dr. Amit Majithia
The Effect of UBE2G2 Knockout on VLDL Secretion

Farid Akhavan Rezayat - UC San Diego
Mentor: Dr. Yuliya Skorobogatko
Increased glucose uptake in brown fat promotes energy expenditure

Cindy Xu - UC San Diego
Mentor: Dr. Seunghwan Son
Insulin and Its Inflammatory Properties in Adipocytes

Saba Heydari Seradj - UC San Diego
Mentor: Dr. Li Ye
Investigating changes in neuronal activity of fat-innervating sensory neurons

Panel 58: PTSD and Fear

Room: Marshall College Room
Friday 9:15 AM - 10:15 AM
Moderator: Dr. Jessica Bomyea

Christian Cortes - UC San Diego
Mentor: Dr. Victoria Risbrough
Investigating the Presence of Anhedonia in Veterans with Varying Levels of PTSD using the Effort Expenditure for Rewards Task (EEfRT)

Sara Northup - UC San Diego
Mentor: Dr. Jessica Bomyea
Differences in Working Memory Performance Before and After Cognitive Training in Veterans with PTSD, Both with and Without Comorbid Anxiety or Depression

Linisa Williams - UC San Diego
Mentor: Dr. Daniel Stout, Dr. Victoria Risbrough
Effects of Working Memory Training on Fear Extinction

Josh Park - UC San Diego
Mentor: Dr. Sreekanth Chalasani
Comparing Sex Differences for Fear Response Neural Activations

Tanzi Terry - UC San Diego
Mentor: Dr. Matthew Lovett-Barron
The Influence of Internal States and External Stimuli on Visually-Evoked Behavior in Larval Zebrafish

Panel 59: Lung Health

Room: Red Shoe Room
Friday 9:15 AM - 10:15 AM
Moderator: Dr. Nicholas Thiault

Aatash Pestonjamasp - UC San Diego
Mentor: Dr. Edward Wang
Evaluation of Low-Cost, Accessible Materials for Ubiquitous Spirometry

Josue Castellanos - Palomar College
Mentor: Dr. Daniela Valdez-Jasso
Investigating Pulmonary Arterial Hypertension in rats while accounting for sex difference

Justin Xu - UC San Diego
Mentor: Dr. Jorge Espinoza-derout
Electronic cigarette with nicotine induces a transcriptomic shift in adipose tissue

Shruti Magesh - UC San Diego
Mentor: Dr. Weg Ongkeko
Characterization of tRNA derived fragments in Smoking Induced and Non-Smoking Induced Lung Squamous Cell Carcinoma

Panel 60: Work & Education

Room: Revelle College Room
Friday 9:15 AM - 10:15 AM
Moderator: Alexis Reed

Matthew San Pedro - UC San Diego
Mentor: Dr. Saiba Varma
Care and Occupational Stressors of Filipino Registered Nurses

Jesús Medina Alcantar - UC San Diego
Mentor: Dr. Gerardo Arellano
The Gender and Racial Gaps Among Educators and the Effects These Have on Students

Dannia Saldivar - MiraCosta College
Mentor: Dr. Osvaldo "Ovie" Soto
Summer Math Academies: Collaborating to Enrich and Elevate Mathematical Teaching and Learning

Chen Zhang - UC San Diego
Mentor: Professor Christena Turner
Social Development and Post-Graduation Decisions of Chinese Students

Panel 61: Nanoengineering and Materials Science I

Room: Warren College Room
Friday 9:15 AM - 10:15 AM
Moderator: Dr. Joaquin Camacho

James Young - UC San Diego
Mentor: Dr. Andrea Tao
Two-dimensional binary superlattices from self-assembling gold nanoparticles

Eric Oberholtz - UC San Diego
Mentor: Dr. David Fenning
Development of novel perovskite solar cells for tandem applications

Emily Infante - UC San Diego
Mentor: Professor Andrea Tao
A general method for the fabrication of binary nanoparticle assemblies

Thomas Young - Boston University
Mentor: Professor Zheng Chen
Engineering Metal-Organic Framework-based Composites for Novel Ionic Conductors

Ethan Doan - UC San Diego
Mentor: Professor Kesong Yang
First-Principles Investigation of Size Effect on Cohesive Energies of Transition-Metal Nanoparticles

Panel 62: Neuroimaging, Inflammation, and Repair

Room: Dance Studio
Friday 9:15 AM - 10:15 AM
Moderator: Dr. Michael Rieger

Tyler Diep - UC San Diego
Mentor: Dr. Binhai Zheng
The Role of DLK and LZK in the Survival of Injured Corticospinal Neurons

Colby Fagan - UC Santa Barbara
Mentor: Dr. Rusty Gage
The Role of LINE-1 Retrotransposons in Neuroinflammation and Alzheimer's Disease

Andrea Guerra Chong - UC San Diego
Mentor: Dr. Daniel Whittaker
Cellular Senescence in the Aging Brain

Leena Al-Jawad - UC San Diego
Mentor: Dr. Miguel Lopez-Ramirez
Inhibition of CCMs Through Gene Silencing

Kevyn Aguilar Ramirez - UC San Diego
Mentor: Dr. Binhai Zheng
Investigating the role of TIA1 and G3BP1 in stress granule formation and axonal regeneration

Panel 64: Olfaction and Social Cues

Room: Forum
Friday 9:15 AM - 10:15 AM
Moderator: Dr. Chengbiao Wu

Pansée ElGhayati - UC San Diego
Mentor: Sourish Mukhopadhyay
Investigating Scent Marking Behavior in Female Mice: Potential for Female Pheromonal Communication

Jonathan Choy - UC San Diego
Mentor: Dr. Chih-Ying Su
Morphometric and morphological characterization of CO2-sensing neurons

David Melendez-Perdomo - UC San Diego
Mentor: Dr. Lisa Stowers
Internal Physiological State Adaptively Shapes Responses to Social Stimuli

John Ratliff - UC San Diego
Mentor: Dr Takaki Komiyama
Temporal Dynamics of Serotonergic Modulation in the Olfactory Bulb During Olfactory Perceptual Learning

Crystine Sobrian - UC San Diego
Mentor: Dhananjay Bambah-Mukku
The Impact of Maternal Touch on Infant Development: Insights into Neural Processing and Social Behavior

Panel 64: Higher Education 1

Room: Governance Chambers
Friday 9:15 AM - 10:15 AM
Moderator: Dr. Piya Bose

Joana Fang - UC Los Angeles
Mentor: Dr. Mia Minnes
Moving Toward a More Supportive Field: A Community-Building Program in a Large Undergraduate Computer Science and Engineering Department

Veronica Liu - UC San Diego
Mentor: Sherice Clarke, PhD
How is "Readiness" Met?: The Case of Oakland Unified School District in Oakland, CA

Dan Sun - UC San Diego
Mentor: Lakshmi Chilukuri
Foundation: The Origin of Sixth College

Simone Wright and Christa Lehr - UC San Diego, Southern Connecticut State University
Mentor: Professor Christine Alvarado
How Do I Get There From Here? A New Tool for Evaluating How Well Community College Articulations Match Computer Science Bachelor's Degree Requirements in California

Panel 65: Particle Physics

Room: Sixth College Room
Friday 9:15 AM - 10:15 AM
Moderator: Dr. Randy Dumas

Micah De la Pena - UC San Diego
Mentor: Professor Javier Duarte
Self-Supervised Machine Learning for LHC Jet Physics

Tanya Dwivedi - UC San Diego
Mentor: Dr. Farhat Beg
Stability Analysis for Gas Puff Z-Pinches

Kaitlyn White - UC San Diego
Mentor: Professor Javier Duarte
Discover Momentum Conservation via Knowledge Distillation

Julian Ramirez - UC San Diego
Mentor: Dr. Alexey Arefiev
Geant4 Modeling and Experimental Demonstration of an Energy-Resolved Electron-Beam Profiler for Rep-Rated High-Energy-Density Physics Experiments

Panel 66: Cognitive Science, Neuroscience, and Psychology

Room: East Ballroom
Friday 9:15 AM - 10:15 AM
Moderator: Dr. Sarah Creel

Jaden Huynh - UC San Diego
Mentor: Dr. Greg Appelbaum
Exploring EEG Biomarkers for Treatment Prediction in Obsessive-Compulsive Disorder: A Comprehensive Review

Jennifer Alvarez - UC San Diego
Mentor: Dr. Christina Gremel
Inhibiting Mediodorsal Thalamus inputs into Dorsomedial Striatum in Decision-making

Brenda Meza - CSU Northridge
Mentor: Deanna Greene
Comparison of subcortical volumes between patients with Tourette Syndrome and a control group

Panel 67: Climate and Plant Studies

Room: Student Services Center, Room 260
Friday 9:15 AM - 10:15 AM
Moderator: Taryn Broe

Tulio Magana - UC San Diego
Mentor: Dr. Julian Schroeder
Identification and Functional Analysis of Closely Homologous F-box Protein Genes in the CO2 Signal Transduction Pathway in Arabidopsis thaliana

Aaron Saavedra - UC San Diego
Mentor: Dr. Eric Schmelz
Development of a simple comprehensive metabolic profiling method for diverse biological samples

Samantha Dyer - UC San Diego
Mentor: Dr. Alexandra Jazz Dickinson
Itaconate Treatment in Native Plants of California to Mitigate Effects of Climate Change

Joe Kesler - UC San Diego
Mentor: Professor Elsa Cleland
Quantifying California Poppy Abundance Across Latitudes

Panel 68: Biochemistry

Room: Student Services Center, Room 300
Friday 9:15 AM - 10:15 AM
Moderator: Patrick Yorkgitis

Andres Vasquez - UC San Diego
Mentor: Dr. Gourisankar Ghosh
The phosphorylation of BCL3 regulates transcription of the p52:p52 NF-kB complex

Cat Avarvarei - UC San Diego
Mentor: Dr. Marco Mravic
Chemical Biological Study of Toll-like Receptor (TLR) Structure and Activity in Pharmaceutically Significant Transmembrane Proteins

Grace Medina Perez - UC San Diego
Mentor: Dr. Michael Burkart
Fluorescence labeling tubercular carrier protein

Paris Eberwein - Palomar College
Mentor: Matthew Miyada
Exploring carrier protein-dependent biosynthesis with solvatochromic fluorescent probes

Friday: Morning Session II

Panel 69: Autism

Room: Bear Room
Friday 10:30 AM - 11:30 AM
Moderator: Oliva Mota Segura

Cameron Manard - UC San Diego
Mentor: Dr. Leslie Carver
Reward Anticipation to Social and Nonsocial Dynamic Stimuli in Preschool-Age Children With and Without Autism Spectrum Disorders

Stephanie Washburn - University of Central Florida
Mentor: Dr. Lindsey Powell
Using Joint Attention in Infancy as an Early Indicator of Autism Spectrum Disorder

Veronica Gutierrez - CSU Northridge
Mentor: Lindsey Powell
Joint Attention in Early Infancy

Jerilyn Dickens - UC San Diego
Mentor: Dr. Lauren Brookman-Frazee
Behavioral Sex Differences in Autism

Panel 70: Computational Biology

Room: Roosevelt College
Friday 10:30 AM - 11:30 AM
Moderator: Dr. Yatish Turakhia

Ellen Wrightsman - UC San Diego
Mentor: Gene Yeo
Development of Bioinformatic tool for spatial transcriptomics

Brandon Krieg - CSU Bakersfield
Mentor: Dr. Abraham Palmer
Unraveling the Genetics of Substance Use Disorder: A Study on Heterogeneous Stock Rats

Pranava Gande - UC San Diego
Mentor: Dr. Weg Ongkeko
Characterization of extracellular vesicle microRNA dysregulation and immune response in the HPV and smoking etiologies of Head and Neck Squamous Cell Carcinoma

Kenya Espinoza - CSU Bakersfield
Mentor: Dr. Matteo D'Antonio
Using fine-mapping to understand the differences between different populations on GAWS loci.

Panel 71: Genome Editing

Room: Green Table Room
Friday 10:30 AM - 11:30 AM
Moderator: Dr. Oksana Polesskaya

Pablo Segundo - CSU Northridge
Mentor: Dr. Amir Zarrinpar
Implementation of Novel CRISPR-Cas System to Engineer Native Bacteria as Live Bacterial Therapeutics (LBTs)

Harry Li - UC San Diego
Mentor: Professor Elizabeth Komives
Study of mechanisms and roles of INS domain

Tina Tebyanian - San Diego Miramar College
Mentor: Dr. Sonya Neal
Investigating the role of rhomboid protease in neuronal function using targeted CRISPR/Cas9 technology

Rosa Chavez - UC San Diego
Mentor: Dr. Sonya Neal
The Study of Rhomboid Proteases using CRISPR and Fluorescent Proteins in a Zebrafish Model

Panel 72: Social Interactions

Room: Marshall College Room
Friday 10:30 AM - 11:30 AM
Moderator: Mr. Jesús Ayala-Candia

Ivan Ramirez - University of Oklahoma
Mentor: Shane Conelly
Effects of Online Ideological Group Rhetoric on Perceptions of Credibility

Oscar Cerpa Avina - UC San Diego
Mentor: Professor Michael E. McCullough
Literature Review on Social Evaluation Manipulations

Sarah Flores - UC San Diego
Mentor: Dr. Kay Tye
Influence of Competitive Competence in Rearranging Social Hierarchies

Ella Say - UC San Diego
Mentor: Dr. Kay Tye
Social Exclusion Modifies the Neural Representation of Physical Pain

Yao Yu - UC San Diego
Mentor: Professor Rick Grush
One mind, many bodies: How a group of interacting microbes shares a mind

Panel 73: Immunology

Room: Red Shoe Room
Friday 10:30 AM - 11:30 AM
Moderator: Dr. Nicole Scharping

Gabriela Ceron - UC Merced
Mentor: Dr. Nicolas Thiault
Role and Regulation of CD4-CTL in Chronic Inflammatory Diseases

Allison Cafferata - UC San Diego
Mentor: Dr. Ananda Goldrath
Investigating the role of WSB1 in T cell exhaustion

Megha Srivatsa - UC San Diego
Mentor: Dr. Sara Gianella and Dr. Sarah LaMere
Testosterone Shaping the Immune System: A Comparative Analysis of Cytokine Expression Between Transgender Men and Cisgender Women

Kyle Walter - UC San Diego
Mentor: Drs. Georgia Robins Sadler and Jerel Adam Fields
TREM2: A New Element of Targeted Cancer Therapy

Samvel Gaboyan - UC San Diego
Mentor: Dr. Laura Crotty Alexander
Fourth Generation E-cigarettes Present Immunosuppressive Properties in Mouse Models of Allergic Asthma

Panel 74: Political Science

Room: Revelle College Room
Friday 10:30 AM - 11:30 AM
Moderator: Dr. Phil Poeder

Brianna Angulo - UC San Diego
Mentor: Dr. Claire Adida
What shapes the United States' public opinion toward asylum seekers?

Delbert Longino - Morehouse College
Mentor: Dr. Lagina Gause
Which Party Lies more

Jingyi Chen - UC San Diego
Mentor: Professor Fonna Forman
The Interplay of Social Norms and Legal Systems: Unraveling the Complexity of Domestic Violence in China and Paving the Path for Change

Noah Balderrama - CSU, Fullerton
Mentor: Dr. Lane Kenworthy
A Sociological Analysis of Democratic States on Clean Air, Water, and Land

Panel 75: Nanoengineering and Material Science II

Room: Warren College Room
Friday 10:30 AM - 11:30 AM
Moderator: Dr. Joaquin Camacho

Yulianna Estrada - Boston University
Mentor: Professor Jon Pokorski
Conducting Polymer Based Biohybrid Systems for Bioelectronic Plants

Jordan Bunch - UC San Diego
Mentor: Dr. Darren Lipomi
The Effect of Additives on the Contact Resistance and Morphology of PEDOT:PSS

Hailey Tran - UC San Diego
Mentor: Professor Jon Pokorski
Design and Development of Cellular Scaffolds for Examining Phototactic Movement of Cyanobacteria in Hydrogels

Deiya Paul - CSU, Long Beach
Mentor: Robert Ramji
Computational Analysis of Nano-Structured Polyurethane Materials Through Molecular Dynamics Simulations

Rohan Luthra - Northwestern University
Mentor: Jinhye Bae
Programmable stimuli-responsive shape morphing hydrogel actuators through 3D printing

Panel 76: Child Development and Social Interactions

Room: Dance Studio
Friday 10:30 AM - 11:30 AM
Moderator: Mr. Stephen Kooshian

Kevin Soto - UC San Diego
Mentor: Dr. Lindsey Powell
Children's evaluations of empathizers and counter-empathizers

Dominic Jauregui Haynes - UC San Diego
Mentor: Gedeon Deak
Responsiveness of Caregivers affecting play

Nico Navarro - UC San Diego
Mentor: Dr. Lindsey Powell
The Neural Foundations of Empathy

Jamie Park - UC San Diego
Mentor: Assistant Professor Lindsey J. Powell
Social Interaction Processing in Infants

Carlos Aguilar - UC San Diego
Mentor: Dr. Lindsey Powell
Comparing univariate and multivariate approaches to analyzing infant functional neuroimaging data

Panel 77: Neuroplasticity and Learning

Room: Forum
Friday 10:30 AM - 11:30 AM
Moderator: Dr. Chengbiao Wu

Shayne Mayo - UC San Diego
Mentor: Dr. Kim Dore
Synaptic Long-term depression in aged AD mice

Veronica Hernandez - UC San Diego
Mentor: Dr. Boaz Mohar, Dr. Gabriela Michel, Dr. Nelson Spruston
Protein Turnover Measures Location of Synaptic Plasticity in Mice Learning a Task

Nandini Seth - UC San Diego
Mentor: Dr. Richard Daneman
The Effect of a Western Diet on the Blood-Brain Barrier

Hannah Kim - UC San Diego
Mentor: Professor Takaki Komiyama
Exploring the contribution of motor cortex and thalamus on striatal activity during movement

Panel 78: Higher Education II

Room: Governance Chambers
Friday 10:30 AM - 11:30 AM
Moderator: Dr. Claire Meaders

Cristian Fuentes Hernandez - UC San Diego
Mentor: Dr. Gerardo Arellano
Undergraduate Latinx Research Barriers at UC San Diego

Joaquin Menas - UC San Diego
Mentor: David Quijada
"Unlocking Potential: Overcoming Barriers to Higher Education for Formerly Incarcerated Chicanos."

Yvania Rubio - UC San Diego
Mentor: Professor Michel Estefan
Exploring Cultural Capital as a Catalyst for Empowerment and Academic Success among First-Generation, Low-Income Scholars in a 4-Year College or University: A Research Proposal

Yaya Jiang and Richa Kafle - UC San Diego
Mentor: Professor Christine Alvarado
Understanding the Landscape of California Computer Science Transfer Pathways: A study of Transfer Agreements between California Public Universities and Community Colleges

Panel 79: Nanotechnology

Room: Sixth College Room
Friday 10:30 AM - 11:30 AM
Moderator: Dr. Michael Sailor

Gio Sarabia - San Diego Miramar College
Mentor: Dr. Vazquez-Mena
Efficacy of graphene and quantum-dot hybrid devices under varying light conditions

Beneen Fune - UC San Diego
Mentor: Professor Tod Pascal
DMAx: a high-throughput workflow for dynamic mechanical analysis simulations with LAMMPS

Rita Kret - The Ohio State University
Mentor: Professor David Fenning
Optimizing Synthesis Conditions of Nickel Oxide Hole Transport Layers (HTLs) in Perovskite Solar Cell Devices

Jadon Salazar - San Diego City College
Mentor: Dr. David P. Fenning
"Detecting Differences in Operational Stability of Perovskite Solar Cells"

Panel 80: Post-translational Modification in Biology

Room: East Ballroom
Friday 10:30 AM - 11:30 AM
Moderator: Beverly Naigles

Dina Kianiazar - UC San Diego
Mentor: Dr. Kim Dore
APOE Post Translational Modification & its Potential Role in Alzheimer's Disease

Daniela Alonzo - CSU Northridge
Mentor: Dr. Alon Goren
Investigating the effects of local mitotic histone acetylation on transcription and reactivation kinetics

Kelly Wang - UC San Diego
Mentor: Dr. Cole Ferguson
Effect of BAP1 on Histone Ubiquitination and Neurodevelopment

Taújay Davis - Howard University & Anetzy Bermudez Torales - UC San Diego
Mentor: Dr. Vu Q. Nguyen
The Functional Dynamics of Histone Modifiers in Living Cells

Panel 81: Behavior, Developmental and Evolutionary Biology

Room: Student Services Center, Room 260
Friday 10:30 AM - 11:30 AM
Moderator: Taryn Broe

Mildred Meza - San Diego Miramar College
Mentor: Dr. James Nieh
Omega-3 and 6 Fatty Acid Ratio's Impact on Honeybee Learning

Tessa Sterns - San Diego Miramar College
Mentor: Dr. Sonya Neal
Exploring the Role of Rhomboid Protease in a Novel Model

Anthony Ayala - UC San Diego
Mentor: Dr. Sergey Kryazhimskiy
Measuring the Variation in the Distribution of Fitness Effects of New Beneficial Mutations in Yeast

Grant Wass - Palomar College
Mentor: Dr. Gonzalo Giribet
Thinking of Thrasychirus: Evolutionary and Phylogenetic Analysis of South American Long-Legged Harvesters (Arachnida, Opiliones, Neopilionidae)

Panel 82: Inorganic Chemistry

Room: Student Services Center, Room 300
Friday 10:30 AM - 11:30 AM
Moderator: Patrick Yorkgitis

Marina Kartono - Imperial Valley College
Mentor: Prof. Alina Schimpf
The Role of Countercations on the Assembly of the Preyssler-type Polyoxometalate

Sarah Ruth Lopez - Mira Costa
Mentor: Dr. Alina Schimpf
Cation Effects on the Assembly of Preyssler-type Polyoxometalates

Jenny Lee and Shawn McClure- Oberlin College, UC San Diego
Mentor: Dr. Julia Stauber
Utilizing a well-defined metallacage as a precursor for an extended network

Abstracts

Ananya Achanta

Neurobiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr Melissa Campbell

Effects of Oxidative Stress During Cortical Development

The balance of oxidation and reduction (redox) reactions are critical for normal cellular function. An excess of reactive oxygen species (ROS) creates a redox imbalance, leading to oxidative stress. Oxidative stress can damage cellular components and disrupt normal cellular mechanisms, making it a critical cellular phenomenon to understand. To determine the natural redox state of developing cortical neurons, we electroporated mouse embryos with Grx1- roGFP2 at E13 and performed both live and modified fixed imaging of the embryo brains at E15. For the modified fixed imaging, brain slices were first alkylated by NEM treatment before fixation to lock the sensor's status. On the other hand, sequential detection of oxidized and reduced Grx-roGFP2 during live confocal imaging allowed the determination of neuronal redox states. After establishing the baseline redox states, we exposed the pregnant mice to different concentrations of known oxidants and reductants (diamide and DTT) to create a gradient of the redox state at those concentrations of the oxidants and reductants. We next sought to determine the developmental impact of the most commonly prescribed analgesic during pregnancy, acetaminophen. Our data shows that assessing the susceptibility of developing neurons to changes in the redox system is critical for understanding environmental stressors and their impact on neurodevelopment. This knowledge can further elucidate the mechanisms of many neurodevelopmental disorders as well as the potential environmental causes.

Carlos Aguilar

Neurobiology, UC San Diego
Colors of the Brain - KIBM
Mentored by Dr. Lindsey Powell

Comparing univariate and multivariate approaches to analyzing infant functional neuroimaging data

Children and infants are influenced heavily by their environment and social experiences. Measuring the cognition in infants faces various challenges, such as limited verbal communication and inability to remain stationary for long periods. However, recording brain activity may provide new insight into the development and learning processes of infants. Functional near-infrared spectroscopy (fNIRS) is a non-invasive neuroimaging

technique that measures the changes in the flow of oxygenated blood in the brain, which is closely tied to neural activity. fNIRS is a good option for neuroimaging in infants because it is less sensitive to motion than functional magnetic resonance imaging (fMRI) and provides better spatial localization than EEG. fNIRS also records brain activity in infants better than adults, because the infant cortex is closer to the scalp. There are limitations to note, such as a low spatial resolution compared to fMRI which limits the local precision of measured brain activity. This raises the question of which approach is best when analyzing infant brain data, univariate or multivariate analysis. Univariate analysis refers to the technique that focuses on detecting differences in single variable, such as how much the response in one specific location differs depending on the stimulus. Meanwhile, multivariate analysis is a type of technique that examines the relationship and interaction between multiple variables simultaneously to understand how the variables relate to each other (e.g. what pattern of activation stimuli produce across multiple cortical locations). This project investigates whether univariate or multivariate analyses are better for understanding infant brain function.

Kevyn Aguilar Ramirez

Human Biology, UC San Diego
Summer CAMP
Mentored by Dr. Binhai Zheng

Investigating the role of TIA1 and G3BP1 in stress granule formation and axonal regeneration

Spinal cord injury is a debilitating condition that affects thousands of individuals each year. Damaged axons are unable to regrow and make meaningful connections. In response to cellular stress, such as spinal cord injury, nucleation of stress granules is triggered in neurons. Stress granules are membraneless mRNA-protein assemblies that prevent trapped mRNA species from being actively translated. Two different proteins, TIA1 and G3BP1, are key factors in stress granule formation. The role of these components in axon regeneration is yet unknown. Here we show that stress granule formation is triggered in cortical neurons upon different stress treatments. Also, we show that G3BP1 and TIA1 colocalize and are present in these granular structures. Results suggest that sprouting is enhanced upon deletion of TIA1 in a pyramidotomy model in conditional knock-out animals for TIA1. Together, these data point towards the importance of stress granules after spinal cord injury and their role in limiting axonal recovery after damage.

Farid Akhavan Rezayat

Human Biology, UC San Diego
Ahmadian Summer Fellowship
Mentored by Dr. Yuliya Skorobogatko

Increased glucose uptake in brown fat promotes energy expenditure

Due to proprietary information this abstract has been redacted.

Nora Alammari

Psychology, CSU, Bakersfield
STARS
Mentored by Dr. Michael Taffe

Characterizing behavioral effects of methamphetamine in Crayfish (Procambarus clarkii)

The illicit substance methamphetamine is an addictive central nervous system stimulant that is used recreationally and is a major contributor to the continued increase in drug overdose deaths worldwide. Recent studies suggest Crayfish may be a suitable model to characterize behaviors associated with drug addiction. This study aims to extend limited prior research by developing novel techniques and assays for using Crayfish as a model to study the behavioral effects of drug exposure. The primary goal of this research is to evaluate the effects of methamphetamine on locomotion and anxiety-like behaviors using behavioral assays such as an open field arena and a light/dark transfer test. Crayfish will be injected with different methamphetamine doses and video-recorded for 30 minutes. Due to the dangerous nature of psychostimulants like methamphetamine, it is essential to develop preclinical and novel model systems that enhance our ability to study specific aspects of substance use disorders.

Ali Alani

Computer Engineering, UC San Diego
ECE SRIP
Mentored by Dr. Curt Schurgers

Development of Educational Technologies for Pedagogical Use

The Flipped Classroom teaching style is used by many instructors for its effectiveness and emphasis on active learning. In this approach, students first engage with course content like video lectures or textbook readings asynchronously and then participate in interactive activities during in-class lecture time. This method maximizes classroom time for collaboration rather than purely receiving information. To facilitate student participation, instructors often use iClickers, physical devices for voting on slide deck questions. However, the financial challenges posed by iClicker systems limit accessibility for many students. To address this issue, we have developed WebClicker, a free software system that enables students to participate using their personal devices. WebClicker offers the core features of iClicker and additional utilities for the benefit of both students and instructors. This summer, our focus is on enhancing WebClicker with new functionalities, such as the WebClicker Controls system, which streamlines the management of the polling system and displays results while allowing instructors to

present their slides seamlessly. We are also incorporating several other features like making the system standalone by relying on Wifi hotspots. Our goal is to expand on the set of tools in WebClicker to make it an even more valuable system for students and instructors.

Raghad Albawab

General Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Sonya Neal-Dr. Satarupa Bhaduri

Characterization of an intramembrane mammalian rhomboid protease RHBDL4

Rhomboid proteases are ubiquitous intramembrane serine proteases which play diverse roles in physiological processes like growth factor signaling, mitochondrial homeostasis, protein quality control, and parasite invasion. RHBDL4 is an essential mammalian rhomboid protease that is responsible for cleaving misfolded membrane and luminal proteins in the endoplasmic reticulum by a process called ER-associated degradation (ERAD) and has been, implicated in several diseases such as cancer and Alzheimer's disease. A broad range of different physiological substrates have been identified. However, Rhbdl4's catalytic properties and substrate sequence specificity haven't been characterized yet. Knowing the substrate and sequence preference for RHBDL4 activity would pave the way for future drug discovery against such life-threatening diseases. To address this question, we purified RHBDL4 from mammalian HEK 293F cells, both in active and inactive forms, and identified three soluble fluorogenic peptide substrates using a fluorescent peptide substrate library. We further characterized the enzymatic properties of RHBDL4 with the final aim to identify the substrate and sequence specificity of RHBDL4 using multiplex substrate profiling by mass spectrometry. Furthermore, we generated multiple RHBDL4 mutants with defective rhomboid features and purified them. We uncovered that the tested rhomboid motif mutants were inactive against the peptide substrates, indicating the conserved roles of the rhomboid structural motifs in the cleavage of the substrates. In summary, this comprehensive study will provide fundamental insights into the catalytic activities and substrate preferences of rhomboid proteases, paving the way for a better understanding of future drug targeting of this rhomboid protease.

Leena Al-Jawad

Bioinformatics, UC San Diego
Make UR MARC Fellowship
Mentored by Dr. Miguel Lopez-Ramirez

Inhibition of CCMs Through Gene Silencing

Cerebral cavernous malformation (CCM) is a neurovascular disease that can cause a variety of neurological issues such as seizures, strokes, hemorrhages, difficulty walking or talking, and more. CCMs are caused by a mutation in one of the three CCM genes (KRIT1/CCM1, CCM2, PDCD10/CCM3). This disease is characterized by lesions in the central nervous system (CNS) that can cause loss of cell-cell junction integrity, cytoskeletal arrangements and loss of barrier functions in the endothelium. CCMs are sporadic, meaning that they can occur as a single formation without an apparent cause and without any family history, but it can also be genetic and can be tested for very early. However, there are no pharmacological treatments available and the only other method of treatment is invasive neurosurgery, which cannot be performed in some instances where the lesion is inaccessible. In the Lopez-Ramirez lab, we are working on experimenting different ways of inhibiting the development of CCMs to find a non-invasive treatment for the disease. In particular, we are testing the silencing of genes that are related to neuroinflammation. To do this, we use a method of cloning plasmid vectors into bacteria, and then use a virus-based method in order to block the expression of the genes of interest in the brain endothelium of our animal model for CCM. We hope that our findings will eventually contribute to finding a safe and effective therapy for CCMs.

Thomas Allen

Mathematics, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Professor Alireza Salehi Golsefidy

Studying Surface Groups via Character Theory

Given an orientable surface of genus g with n punctures, we can describe its fundamental group as a presentation with 2g+n generators and one relation. The pure mapping class group and the character variety are two important objects associated with this fundamental group, and in particular, there is a group action of the pure mapping class group on the character variety. A major goal is to learn more about the orbits of this action. In order to do this, we aim to prove that a certain variety is irreducible using techniques from character theory for finite groups.

Jaylen Allison

Psychology (B.A), UC San Diego
McNair Scholars Program
Mentored by Dr. Celeste Pilegard

Do Lapses In Coherence Within Science Lessons Lead To Mind Wandering?

This study will investigate if college students' minds are more likely to wander when they are presented with science lessons that become difficult to comprehend. In this study, students will watch a single lesson divided into three unmarked sections. In the control group, each segment of the lesson will be highly coherent, meaning that each part of the lesson is written to be easy to understand. The experimental group will have an identical lesson, with the only difference being a lapse in coherence midway through:

sections 1 and 3 of the experimental lesson will be highly coherent, while the second section will be low in coherence. We will measure students' mind-wandering rate by using mind-wandering probes that ask the student if they are thinking about the lesson, something related to the lesson (but not the lesson itself), or something else. These probes will appear at pseudo random intervals. We hypothesize that the lapse in coherence in the experimental group will lead to increased mind wandering in the second section compared to the control group. Because the lesson content builds on itself, we predict a cascading effect with higher rates of mind wandering in the third section, despite the return to high coherence. We predict parallel results for learning outcomes. This study adds to previous research in this area by investigating the effect of a lapse in coherence within a single lesson.

Seth Almaraz

Psychology, CSU, Northridge
STARS
Mentored by Dr. Sarah Banks

The Importance of Diversity in Alzheimer's Disease Research

2/3 of cases of Alzheimer's disease in the USA are in women. There are also sex differences in pathology, especially in early stages of cognitive decline, with women accumulating more tau pathology than men. However, Blacks/African Americans (AAs) comprise only an estimated 7.3% of total individuals participating in Alzheimer's disease clinical studies, even though AA older adults are twice as likely to be diagnosed with the disease relative to their White counterparts. This is in part due to the design and implementation of studies being focused on the white experience of research, which differs from the AA experience, where incidents of abuse have led to mistrust, and studies are rarely designed to benefit the AA community. The "Black Women: Inflammation and Tau Study" (BWITS) aims to address these current health disparities and challenges to recruitment in Alzheimer's disease research. The project aims to understand how specific biological and lifestyle factors impact cognition and Alzheimer's disease pathology over time in AA women. Using the principles of Community Based Participatory Research, BWITS investigators have formed a community advisory board (CAB), comprised of women in leadership roles within the Black community, to address the needs and concerns of the AA women and to help guide the study design. Initial discussions and review of study materials with the CAB have merited insightful considerations for developing culturally appropriate strategies to reduce barriers to recruitment, increase access to research participation, and form relationships between academic institutions and communities traditionally underrepresented in clinical research.

Daniela Alonzo

Cell and Molecular Biology, CSU, Northridge
STARS
Mentored by Dr. Alon Goren

Investigating the effects of local mitotic histone acetylation on transcription and reactivation kinetics

It was previously believed that gene expression was turned off during the mitosis stage of the cell cycle and restored after. However, we now know that gene expression is not entirely turned off, but instead minimally reduced. Studies suggest that mitotic histone acetylation may play a role in regulating mitotic gene expression and transcription reactivation. During mitosis, nucleosomes enter the nucleosome depletion region (NDR), where a majority of genes will experience deacetylation. This study will analyze the regulatory effects of local mitotic histone acetylation on miotic gene expression and reactivation kinetics. We hypothesize that this histone deacetylation pattern during mitosis is the leading factor in regulating mitotic transcription and reactivation. By choosing Proline Rich Mitotic Checkpoint Control Factor (PRCC), a gene that enables protein binding and has been found to naturally deacetylated nucleosomes entering their NDR during mitosis; histone acetyltransferases (HATs) will be recruited to the NDR region to analyze the effects of acetylation state of the gene expression during and after mitosis. Evaluating changes in the epigenetic state by measuring histone acetylation (H3K9ac and H3K27ac levels) through ChIP-qPCR, ChIP-Seq, and CRISPR Cas-9 will cause an understanding of the regulation of histone acetylations that can help future studies understand oncogenetics.

Efrain Alvarado

Astrophysics, UC Berkeley
UC LEADS
Mentored by Dr. Adam J. Burgasser

Probing the Early History of the Milky Way through PHOENIX/ATLAS/MESA Models of Ultracool Dwarfs

Ultracool Dwarfs (UCDs) are stars and brown dwarfs with surface temperatures $\lesssim$ 3000K and masses $\lesssim$ 0.1 solar masses. The lowest-mass UCDs, brown dwarfs, are unable to undergo fusion reactions, causing them to gradually cool over time and making them potential Galactic "clocks". UCDs with low abundances of heavy elements, or metallicity, are ancient systems and offer a unique opportunity to study the formation and chemical evolution of the Milky Way, a time when heavy elements were less abundant. However, few atmosphere or evolutionary models exist for low-metallicity UCDs. In this study, I present new sets of low-metallicity models generated with the PHOENIX and ATLAS atmosphere codes and the MESA evolutionary code. I will evaluate how varying metallicity and alpha enrichment changes the colors and magnitudes of UCDs for different masses, ages, temperatures, and surface gravity. These new models will support studies of metal-poor UCDs discovered by deep surveys with the James Webb Space Telescope, the Nancy Grace Roman Space Telescope, and the Vera Rubin Observatory.

Jennifer Alvarez

Psychology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Christina Gremel

Inhibiting Mediodorsal Thalamus inputs into Dorsomedial Striatum in Decision-making

Mediodorsal Thalamus (MD) and Dorsomedial Striatum (DMS) are critical for using outcome value and action-outcome contingency to support goal-directed behavior. However, the role of the projection from MD to DMS has primarily been unexamined. To test this, we will attenuate the neural activity of this pathway using a designer receptor exclusively activated by a designer drug (DREADD). We will probe how MD-DMS activity facilitates behavioral strategies during a self-initiated and paced task where mice learn to hold down a lever. The mice will utilize prior action information to guide their decision-making across the task. Pilot lab data shows that MD-DMS inhibition did not disrupt an animal's ability to learn the task. A linear mixed effect model examining the factors that contribute to the duration of a given lever press showed that mice initially rely more on their immediate prior actions to guide their behavior, leading to repetitive actions. We hypothesize that inhibiting the MD-DMS pathway will change their early learning strategy by making their lever presses more repetitive. This experiment will inform our understanding of the role of MD inputs into DMS in shaping early decision strategies. MD-DMS neurons may have collaterals in external areas that could potentially be responsible for the effects of MD-DMS inhibition. To examine this, we will use a synaptophysin-linked fluorophore in MD neurons that project to DMS to label axon terminals and do microscopy to identify them. If MD-DMS has collaterals to other downstream areas, they may contribute to any behavioral effect observed.

Ruqshana Amiri

Mechanical Engineering, CSU, Sacramento
VERSA
Mentored by Dr. Adam Burgasser, Dr. Genevive Bjorn

Student and Instructor Usage of Generative Artificial Intelligence (GAI) in STEM Education: The Learning Perspective

Generative Artificial Intelligence (GAI) systems have emerged as powerful informational and educational tools across various disciplines, raising questions about responsible utilization for learning outcomes. In particular, an underlying tension exists between the positive use of GAI for personalized learning, and its negative use for cheating and plagiarism. This project aims to investigate the use of GAI systems from the learner’s perspective in Science, Technology, Engineering, and Mathematics (STEM) courses, with a particular focus on lower division physics courses. I evaluated the ease of use, accuracy, and learning feedback from multiple GAI systems, including ChatGPT3.5, Bing, and Bard, in solving reading quizzes, homework problems, problem-solving worksheets, midterm exams, and team-based projects in an introductory Physics course on Classical Mechanics. For each GAI, I evaluate what types of questions lead to immediate solutions (limited learning), detailed and accurate guidance (tutorial learning), or incorrect responses (misinformation), and explore how the last could be used as an opportunity for developing critical thinking. This experiment aims to provide guidance for students and instructors on the ethical and effective use of GAI systems for STEM learning.

Brianna Angulo

Political Science-International Relations, UC San Diego
USD McNair
Mentored by Dr. Claire Adida

What shapes the United States' public opinion toward asylum seekers?

This research project aims to examine Americans' public opinion and attitudes toward asylum seekers, with a particular focus on whether they are viewed as a national security threat. The study acknowledges the ongoing debate surrounding asylum seekers in the United States and the need for a better understanding of public sentiment to inform policy decisions. Different factors shape attitudes towards asylum seekers, including deservingness attributions, economic threats, and religious threats. Studies have shown that perceptions of deservingness, particularly in cases of persecution, tend to elicit more sympathetic and accepting attitudes. Economic and religious threats, on the other hand, can lead to more negative perceptions. The review also highlights the importance of framing in public opinion, with the term "refugee" being more widely accepted than other labels. However, there is a significant research gap regarding the perception of asylum seekers as a national security threat. The study aims to fill this gap by conducting extensive research on the public opinion of American citizens. The focus will be on understanding which threat—national security, economic, or cultural—is perceived as the most relevant by Americans. The analysis will focus on identifying patterns and trends in public opinion, specifically examining how Americans view asylum seekers as a national security threat compared to other threats. This research project aims to provide valuable insights into the divisive public opinion surrounding asylum seekers in the United States. The findings will inform policymakers and contribute to developing appropriate policies to support and protect asylum seekers while addressing national security concerns.

Arlan Aquino

Biomedical Engineering, CSU, Long Beach
MRSEC REU or RIMSE
Mentored by Professor Susan Golden and Professor James Golden

Characterization of Cyanobacterial Strains Grown in Hydrogel Matrices

One of the goals of designing engineered living materials (ELM) is to create programmable materials using genetically modified living organisms. An ideal candidate for this task is cyanobacteria, photosynthetic organisms common in nearly every environment on Earth, due to their ease of cultivation and genetic tractability. We tested different shapes of hydrogels, three-dimensional matrices of hydrophilic polymers capable of holding a large amount of water, to observe the phototaxis of diverse species of cyanobacteria as they move towards a unidirectional light source. We also characterized cyanobacterial mutant strains incapable of secreting exopolysaccharides and the effect that had on growth in a hydrogel. Finally, we examined a luciferase reporter fused to a cyanobacterial secretion signal to determine how proteins are secreted from cells in a hydrogel. Through these experiments, we were able to determine some physical and chemical properties of cyanobacteria which we can use later to create engineered living materials.

Adrian Arciniega

Neurobiology, UC San Diego
Genentech Scholars Program
Mentored by Dr. Anthony Molina

Age-Related Differences in Complex V-Mediated ATP Hydrolysis

ATP hydrolysis mediated by F1Fo-ATPase, or ATP Synthase (CV), has garnered attention as a novel mechanism underlying mitochondrial dysfunction. Normally, CV utilizes proton-motive force (PMF) to synthesize ATP in a forward reaction, but when the proton gradient becomes dysregulated, CV reverses its activity and hydrolyzes ATP into ADP to regenerate the proton gradient. This results in inefficient cellular energy production and an overall decrease in the cell’s total ATP output. While studies have investigated the relationship between CV-ATP hydrolysis and pathologies, its relationship with aging remains unclear. In this study we investigate the impact of aging on cellular CV-ATP hydrolysis in vitro. Given that mitochondria accumulate damage throughout the aging process, we hypothesize that cells from older donors demonstrate higher CV-ATP hydrolysis compared to cells of younger donors. Using the Agilent Seahorse XFe96, we performed the Hydrolysis in Frozen Samples assay (HyFS) and measured extracellular acidification rate (ECAR) in human dermal fibroblasts from younger and older adult donors. Cultured human fibroblasts retain key phenotypes of the aging process which allows in vitro study of biological aging. Upon study completion, statistical analyses will be performed using the Pearson Correlation to identify an association between CV-ATP hydrolysis and age, and the student’s t-test to identify a difference in average CV- ATP hydrolysis between cells from younger and older donors. We expect to observe a positive relationship between age and CV-ATP hydrolysis. Future research should focus on CV-ATP hydrolysis in non-frozen cells and expression of native CV-ATP hydrolysis inhibitors such as ATPIF1.

Neha Athavale

Cell and Molecular Biology, UC San Diego
Individual lab, Chen Lab

Mentored by Professor Xu Chen

Beta hydroxybutyrate rescues pathophysiology and behavioral phenotypes in Alzheimer's mice

A primary feature of Alzheimer's disease (AD) is the spread of aggregated tau protein across brain regions. Recent studies have demonstrated brain and body metabolic dysfunction in AD, sparking a growing interest in metabolism-based therapy. The ketogenic diet is currently in clinical trials for AD and tauopathy intervention and shows early promise. It induces a state of ketosis by the production of β-hydroxybutyrate (BHB), which provides energy when glucose is scarce. BHB is also now recognized as a key signaling molecule regulating inflammation, metabolism, and other processes relevant to AD. Still, the mechanism underlying the effects of the ketogenic diet on tau pathology is largely unknown. Identifying the key active components will allow for the development of ketone-based therapies for AD with improved efficacy and compliance and minimize side effects. We hypothesize that BHB can reduce tau spread and ameliorate neuropathological and cognitive phenotypes in tauopathy mice. To evaluate this, we fed PS19 mice expressing human tau with the P301S mutation a diet supplemented with a BHB precursor for six months and evaluated pre-mortem motor and memory deficits and post-mortem tau pathology. Our findings suggest that BHB and BHB-precursors may be sufficient to replicate the effects of the ketogenic diet in the treatment of AD and other tauopathies.

Cat Avarvarei

Molecular Synthesis, UC San Diego
McNair Scholars Program
Mentored by Dr. Marco Mravic

Chemical Biological Study of Toll-like Receptor (TLR) Structure and Activity in Pharmaceutically Significant Transmembrane Proteins

Due to proprietary information this abstract has been redacted.

Joseph Awad

Psychology, Mt San Jacinto Community College
URS - Undergraduate Research Scholarships
Mentored by Dr. Laramie Smith

Exploring Factors of Depressive and Anxiety Symptoms Amongst Latino Men who have Sex with Men (LMSM): Assessing the Role of Internalized Sexuality Stigma

This study aimed to quantitatively assess the associations between internalized sexuality stigmas on depressive and anxiety symptoms amongst Latino men who have sex with men (LMSM). Previous research has established the association between various stigma mechanisms related to MSM and adverse mental health outcomes, as conceptualized by the minority stress model. A sample of LMSM (N = 306) living in San Diego, California, completed an interviewer-guided online survey containing various self-report measures assessing internalized sexuality stigma, depressive symptoms (CESD-R-10), anxiety symptoms (GAD-7), and demographic information. Data was analyzed via two separate multiple linear regression models that controlled for demographic factors such as housing status, age, and income. The overall regression model for depressive symptoms was statistically significant (R2 = .185, F (4, 300) = 16.978, p =<.001). It was found that greater internalized sexuality stigma was significantly associated with higher depressive symptoms (β = .288, p =<.001). The overall regression model for anxiety symptoms was also statistically significant (R2 = 0.109, F (4, 300) = 9.188, p = <.001). Greater internalized sexuality stigma was significantly associated with greater anxiety symptoms (β = .214, p = <.001). These results facilitate a better understanding of the impact of internalized sexuality stigma as a determinant to mental health outcomes. Findings from this study may also inform mental health professionals, community organizers, and policymakers in tailoring specific stigma-reducing strategies and targeted interventions that address the mental health needs of Latino MSM.

Anthony Ayala

Ecology, Behavior, and Evolution, UC San Diego
Summer CAMP
Mentored by Dr. Sergey Kryazhimskiy

Measuring the Variation in the Distribution of Fitness Effects of New Beneficial Mutations in Yeast

The distribution of fitness effects of new beneficial mutations (bDFE) is a fundamental determinant of adaptive evolution in microbes. Individuals with different genotypes can have access to different adaptive mutations and the effects of adaptive mutations can also vary across genotypes. In particular, previous work suggests that adaptive mutations provide smaller benefits in more fit genotypes and that such genotypes have access to fewer beneficial mutations overall. However, how bDFE’s vary across genotypes is not well characterized. We use the recently developed barcode lineage tracking method to measure how the bDFE is in a collection of yeast strains with different genotypes and initial fitnesses. Specifically, we are testing two hypotheses. First, we will test whether the bDFE becomes narrower in more fit genotypes. Second, we will ask whether more genetically similar strains have more similar bDFE’s. This work will shed light on the process of adaptive evolution in microbes.

Noah Balderrama

Sociology, CSU, Fullerton
STARS

Mentored by Dr. Lane Kenworthy

A Sociological Analysis of Democratic States on Clean Air, Water, and Land

Environmental pollution is a growing concern among many countries as the world continues to experience technological advancements. Previous research suggests that democratic policies contribute to a healthier environment However, among democratic states, the United States is one of the worst in environmental quality and pollution, which is interesting because it has one of the richest democracies in the world. To gain a deeper understanding of the policies that promote a healthier environment for humans, a comparative analysis of democratic states' efforts toward clean air, water, and land will be conducted. This analysis will consider policy, governance, and social survey data, focusing on the role of public opinion in addressing environmental pollution. In addition, the analysis will consider factors that impact policy such as culture, urbanization, and religion to approach the topic of environmental health from multiple aspects. We anticipate that the United States of America will differ from other democratic states in its environmental policies and pollution management.

Kelbi Banducci

Biology, CSU, Bakersfield
STARS, URISE
Mentored by Dr. Kay Tye

The role of the mPFC in decision making and context-dependent behavior.

The medial prefrontal cortex (mPFC) has been implicated in modulating behavior adaptively based on the external context and internal state (Miller and Cohen, 2001, Vander Weele et al., 2018). To model these phenomena, our lab developed a behavioral paradigm to study distinct behavioral patterns of mice in a multi-context foraging task, where each context is characterized by high/low reward and cost values. First, we investigated the effect of independently changing the frequency and magnitude of shock delivery to emulate the two cost values to learn the different strategies mice employ to forage. Using SLEAP, a machine learning framework for pose estimation (Pereira et al., 2022), we tracked the movements of mice and extracted behavioral features relevant to decision-making and correlated them with the contexts. Second, we repeated the behavioral paradigm while simultaneously recording neural activity from the mPFC using 1-photon calcium imaging. We then studied how different task events are encoded in the mPFC at the single unit and population level. Combining the behavioral and neural data streams insights into how mPFC population activation patterns encode the complex computations needed to adapt behavior across multiple contexts. A successful outcome of this project would enable us to build a model of the mPFC mimicking its decision-making capabilities and shed light on how dysfunction of the mPFC would cause an impact on behavior simulating different neuropsychiatric conditions.

Nicole Bardales

Biochemistry, UC San Diego
Multidisciplinary Approach to Addressing Cancer Disparities
Mentored by Georgia Sadler

Measuring Barriers and Facilitators of African Americans

African Americans have low clinical trial participation rates, but much to gain from medical advances. This narrative literature review delves into the examination of psychosocial instruments utilized for assessing the obstacles and enablers affecting the involvement of African Americans in clinical trials. It identifies instruments that assess individual obstacles to considering clinical trial engagement. This review of English language, peer-reviewed research identified 20 full-text articles about psychosocial instruments that measure African Americans' barriers and facilitators to clinical trial participation. PubMed, CINAHL, and other databases were searched to discover relevant literature published from 2000 to 2023. Keyword searches included clinical trials, African Americans, perceptions, attitudes, participation, trust, cancer, surveys, and instruments. The literature review identified multiple validated and normed instruments for identifying African Americans' barriers and facilitators to clinical trial participation. Most of the instruments collected cross-sectional data using surveys that gathered cultural, environmental, and demographic elements and their responses to questions regarding clinical trial participation. One study coded individual interviews using the constant-comparative method of analysis. These instruments identified such factors as the quality of their medical care facilities, distrust of their healthcare system, and inadequate access to clinical trial information. Further research is needed to evaluate whether the data gathered by such instruments can help clinicians to use more patient-specific strategies for engaging them in discussions of whether a particular research study is right for them. Optimally informed patients can then make decisions based on a clear understanding of clinical trials, rather than fear, suspicion, and mistrust.

Holden Bauer

Physics, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Alex Frano

Mapping the Time Development of Hydrogel Inhomogeneities using Laser Interference

Hydrogels are materials composed of inhomogeneously crosslinked polymer chains. When exposed to aqueous solutions, hydrogels can expand up to ten thousand times their dehydrated size. The intense swelling of these materials, along with their inhomogeneous structure, results in widely varying polymer chain density in hydrated states. This unique property has made hydrogels a material of interest in many fields, such as biochemistry and Health care; hydrogels are used as contact lenses, tissue reinforcers, and even distributors of medicine within the body. However, the nonuniform swelling of hydrogels is still widely unexplored. To better understand the time evolution of the polymer chain structure, our team is using two laser interference techniques (Bragg scattering and coherent interference) to develop a three dimensional mapping of polymer chains within hydrogel samples. In each method, a light source is shone into a hydrogel sample, where it interacts with the polymer chains and scatters accordingly. The resulting interference pattern can then be analyzed to gain information about internal spacing between polymer chains. By employing these techniques at different sizes in the swelling process, we can quantify a sample's time evolution. Preliminary results suggest that these experiments produce valuable information on the density and structure of our samples. The ability to accurately study the internal configuration of hydrogels will allow us to explore how swelling changes in response to environmental conditions, such as temperatures, solvent pH level, etc. Better understanding the swelling of these materials may help advance their current applications and uncover other relevant uses.

Marco Bazzani

Electrical Engineering, UC San Diego
ECE SRIP
Mentored by Professor Curt Schurgers

Acoustic Bird Species Classification

Wildlife population estimates can be used to measure environmental change and overall ecosystem health. One way to get such estimates is by analyzing audio recordings of the environment. Collecting recordings by deploying long-term microphone arrays presents a low cost method for gathering population statistics as compared to traditional observer-based surveys. Given the massive scale of audio collected, machine learning systems are necessary to automate the labeling process to extract the types and number of species present in a field dataset.

However, deep machine learning models require large amounts of training data. Currently, open source audio datasets provide large amounts of field data labeled at a file level with no information on where the call appears. Previous work has developed the PyHa Python package, which generates training data from field data by precisely isolating species calls. Since time-specific annotations have been shown to improve the performance of deep learning classifiers, this project aims to outperform state-of-the-art classifiers by training models on this data. This work is done in collaboration with the San Diego Zoo Wildlife Alliance Population Sustainability group.

Jose Beltran

Cognitive Behavioral Neuroscience, UC San Diego
Summer CAMP
Mentored by Professor Federico Rossano

Interspecies Communication: Use of Gestures Between Orangutan and Siamangs

Due to proprietary information this abstract has been redacted.

Madison Beltran

Environmental Systems (EBE), UC San Diego
Summer CAMP
Mentored by Katharine Ricke

Marine Cloud Brightening and its Potential Impacts on Drought Conditions in Coastal Western North America

Marine Cloud Brightening (MCB) is a solar geoengineering (SG) proposal that aims to reduce the amount of incoming sunlight reaching the surface by forming brighter marine clouds. Most of the SG research to-date focuses on climate aspects such as global temperature targets. However, MCB is potentially amenable to targeting regional climate impacts. Using output from simulations run using the Community Earth System Model version 2 (CESM2), I will explore different climate responses from MCB deployment in the North Pacific on coastal Western North America. For this experiment, I will examine how MCB influences drought conditions in Coastal Western North America. The Coastal Western North American region frequently experiences extreme weather events, ranging from wildfires to flooding from atmospheric rivers. By modeling the potential impacts of MCB on drought conditions, it can provide insight on how the climate in the area will respond if MCB will ever be deployed. These simulations span two time periods, 2010 and 2050, to further understand how the potential impact and effectiveness of MCB will change over time.

Jessica Benson

Developmental Psychology, UC San Diego
McNair Scholars Program
Mentored by Dr. Caren M. Walker

Word Learning Biases and Relational Reasoning in Typically-Developing Children and those with Autism Spectrum Disorder

The shape bias is a well-studied word-learning mechanism that young children use to extend novel labels to objects of the same shape, and children who develop this bias are able to learn object names more effectively during their first years of language development (e.g. Niese & Brackenbury, 2020). Previous research has suggested that children with Autism Spectrum Disorder (ASD) do not develop a robust shape bias (e.g. Tovar et al., 2019) and that children with ASD may not depend on shape for word learning (e.g. Potrzeba et al., 2015). Other work has drawn connections between word learning and more general reasoning abilities (e.g., Hoyos et al., 2016), but this link has not been investigated in a neurodivergent context. Here, we seek to (1) further document

differences in shape bias between typically-developing children and children with ASD and (2) examine the relationship between shape bias and relational reasoning, across children expressing a range of behaviors associated with ASD. To measure the variables of interest, we will administer the child's version of the Autism Quotient (AQ-CHILD), an object sorting task used to measure shape bias, and a Relational Match-to-Sample (RMTS) task.

Anetzy Bermudez Torales

Biochemistry, UC San Diego
UC LEADS
Mentored by Dr. Vu Q. Nguyen

The Functional Dynamics of Histone Modifiers in Living Cells

Eukaryotic DNA is packaged around histones proteins which may suppress gene activity within the study of epigenetics. How do epigenetic factors modify these histone proteins? Here we sought to visualize the functional dynamics of these epigenetic machineries that are involved in histone modifications such as methyltransferases, ubiquitin-conjugation enzymes, structural maintenance and deacetylases. We used the experimental practices of PCR, Gel Electrophoresis, and Transformation in order to image live yeast cells at single-molecule resolution. The expected results of the experiment include being able to fluorescently label the factors in order to track their activities. Our findings about epigenetic factors in yeast cells will inform further experiments concerning complex organisms.

Aakash Bhegade

Human Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Eiman Azim

Investigating Differential Encoding of Limb Movements by Pre-cerebellar Lateral Reticular Nucleus Parvocellular Neurons

Precise control of limb movements is essential for performing various tasks, such as playing an instrument, conducting an intricate surgery, or simply going for a walk. Yet the neural mechanisms underlying these smooth, accurate movements remain unclear. The cerebellum is a crucial region of the brain that is known to receive sensory information and coordinate muscle activity, allowing for smooth, precise, and well-timed movements. Patients suffering from cerebellar damage or degeneration, often present with deficits in gait, impaired movement and balance, and difficulty performing tasks that require fine motor skills, highlighting the critical importance of the cerebellum in the regulation of movement. The lateral reticular nucleus (LRN) is a pre-cerebellar nucleus that processes inputs received from the spinal cord and is thought to receive a copy of internal motor signals from motor neurons that possibly play a role in the regulation of rapid control of ongoing limb movements. Previous work in this lab has shown that the LRN is thought to be comprised of at least two molecularly and anatomically distinct neuron subtypes. These subtypes differ in size and location within the LRN, and receive different ascending spinal inputs from the lumbar versus cervical spinal cord. This study aims to investigate the activity of neurons in the parvocellular region of the LRN while mice perform specific tasks that differentially engage forelimbs versus hindlimbs behavioral assays in order to determine what inputs are being received by this region and if this subtype region specifically plays a role in encoding limb movement of the hindlimbs.

Aniket Bhosale

Electrical Engineering, UC San Diego
ECE SRIP
Mentored by Professor Curt Schurgers

Development of Tower Electronics for Radio Collar Tracking

Radio telemetry is an important technique in ecological studies where it is used to locate and track the movements of individual or large groups of animals. Previous efforts using radio telemetry have included attaching radio transmitters to animals that send out periodic wireless signals. These wireless signals are then recorded using drones that are flown over the target area. This application performs well when the surveys don't have to be repeated frequently. However, it is less suited if the tracking has to be repeated often, due to the overhead of doing the drone flights. This project aims to solve this problem by replacing drones with a network of communication-equipped tower systems to survey the wireless trackers within the research area. With the tower network, the goal is to survey and locate the wireless trackers every 10 minutes. To achieve this, we need to develop an independently powered tower system. We are currently focused on developing the electronics for the towers. Specifically, we need to complete debugging and integration testing on the electronic subsystem for the power and sleep systems of the towers. One primary task will be setting up the sleep mechanism for the tower which will increase the amount of time for which a tower can be placed in the field. With this project, we expect to obtain an independently sustainable communication tower system that can be integrated into a network that can then be used to track animals like collared lizards in Arkansas with high survey frequency.

Yao Bi

General Biology, UC San Diego
Summer TRELS
Mentored by Dr. Geoffrey Chang

Discovering NaCT-selective nanobodies

The sodium-dependent citrate transporter NaCT (SLC13A5) is a mediator of cellular uptake of citrate, an important metabolite of the citric acid cycle. NaCT and subsequent protein defects have been shown to result in severe developmental disease. Loss-of-function (LOF) mutations in the NaCT gene lead to NaCT- mediated epilepsy or SLC13A5 Deficiency Disorder (SDD), which is a rare disease with currently no cure. The goal of this project is to discover nanobodies that can serve as binders to NaCT, which are useful as research probes to better understand the disease and can also be used to potentially modify the function of transporters to overcome SDD. I will be using techniques in the Chang lab regarding membrane protein expression and purification as well as leveraging a powerful nanobody discovery platform. We will over-express NaCT using viral infection of Sf9 cells in cell culture and extract NaCT proteins using mild detergents from these cell pellets. We will purify NaCT proteins using affinity chromatography. Our nanobody discovery platform features Fluorescence-Activated Cell Sorting (FACS) for selection and flow cytometry for validation of nanobody binders selective for NaCT.

Natasha Bisarya

Public Health w/ a Concentrate in Medical Sciences, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. H. Irene Su & Sally Romero

Development & Usability Testing of a health insurance literacy education intervention for adolescent and young adult cancer patients.

Adolescent and young adult (AYA) cancer patients experience a reduced quality of life in survivorship due to post-treatment infertility. Costly fertility preservation treatments add to financial and emotional hardships. Fertility preservation insurance benefits help resolve financial barriers, however, the low health insurance literacy rates amongst the US population complicate access to and utilization of these benefits. Marginalized populations, including Spanish-speaking individuals, are particularly vulnerable to these challenges due to external socioeconomic factors and language barriers. The objective is to design a multi-media education intervention focused on improving health insurance literacy and self-efficacy in accessing fertility preservation benefits. The intervention targets English and Spanish-speaking AYA cancer patients and their parents/guardians. Content for this educational intervention will be sourced from existing data and a paper-based health insurance literacy intervention from ongoing studies. Stakeholders and patients will be surveyed to prioritize specific barriers and facilitators to health insurance literacy and access. These determinants will be matched to implementation strategies, and the most feasible strategies for health insurance literacy and access education will undergo intervention design. VideoScribe animation software will be utilized. User experience research methodology will be applied to assess each patient's response to the intervention through short 15-minute interviews and surveys. The goal is to improve patient self-efficacy and navigation with health insurance and access fertility preservation benefits. Our goal is to test the intervention in a future clinical trial to determine if it helps to improve the utilization of fertility preservation health insurance benefits.

Hunter Brooks

Astrophysics, Northern Arizona University
STARS
Mentored by Dr. Adam Burgasser

Exploring Optimal Color Selection for Candidate Substellar Subdwarfs Using New Spectral and Evolutionary Models

Brown dwarfs are substellar objects that lack sufficient pressures and temperatures in their cores to sustain hydrogen fusion. Consequently, they gradually cool over billions of years while retaining their original composition. The atmospheres of ancient, or low-metallicity, brown dwarfs provide valuable insight into the original composition of the Milky Way during its formation, as well as the influence of composition on brown dwarf evolution and atmosphere properties.. In this study, I utilized a suite of spectral stellar atmosphere models to calculate the absolute magnitudes of brown dwarfs of various temperatures with low heavy-element compositions. To ensure the accuracy of our models, we compare them to the spectra and colors of confirmed low-metallicity brown dwarfs. The absolute magnitudes were computed using filters commonly employed by current and future surveys. By constructing color-color and color-reduced proper motion diagrams based on the model absolute magnitudes, we identified combinations that effectively differentiate brown dwarfs with solar metallicity and those with low metallicity. These diagrams allow for a targeted search for low-metallicity brown dwarfs, enabling study of brown dwarfs formed early in the history of the Milky Way.

Noah Brown

Oceanic & Atmospheric Science, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Mark Merrifield

An Overview & Analysis of the Oceanside Littoral Cell

Oceanside, situated within the Oceanside Littoral Cell stretching from La Jolla Cove to Dana Point, faces sand retention and beach preservation issues. Despite significant investments to protect the coastline, the situation is worsening. This presentation focuses on utilizing satellite data to track beach widths, providing insights into long-term trends, sand movement, and the unique sand retention issues specific to Oceanside. A prominent factor contributing to sand retention issues in Oceanside is the presence of the Oceanside Harbor. Located at the heart of the littoral cell, the harbor disrupts the natural flow of sand, significantly impacting the southern beaches, with Oceanside being the most affected. An examination of the historical context of the littoral cell, including human interventions like sand replenishment, offers valuable insights into the region's dynamics. The presentation emphasizes the integration of satellite data, sand volume measurements conducted by the Coastal Processes Group at the Scripps Institute of Oceanography, and sand elevation transects performed semiannually by Coastal Frontiers. By combining these datasets, a comprehensive understanding of sand movement patterns over time is achieved. This analysis facilitates the development of more effective strategies for managing the sand budget, addressing the unique challenges faced by Oceanside. The research aims to provide valuable insights into efficient approaches for addressing sand retention issues in Oceanside, reducing the financial burden while ensuring the long-term sustainability of the city's beaches and coastline. The findings of this study hold significant implications for coastal managers, policymakers, and researchers involved in beach management and preservation efforts.

Jordan Bunch

Nanoengineering, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Darren Lipomi

The Effect of Additives on the Contact Resistance and Morphology of PEDOT:PSS

Due to proprietary information this abstract has been redacted.

Allison Cafferata

Microbiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Ananda Goldrath

Investigating the role of WSB1 in T cell exhaustion

A major barrier to the immune system’s ability to fight cancer or chronic infection is the persistent activation of CD8+ T cells that lead them to become dysfunctional, a T cell state known as exhaustion. Previous experiments in our lab have shown that treating tumor-bearing mice with T cells overexpressing Wsb1, a gene present in tissue resident memory T cells, live longer or even clear their tumors. To understand the function of Wsb1 and how it improves T cell function in stressful environments, we will use retroviral transduction to overexpress WSB1 and CRISPR to knock out WSB1 and then observe their function in vitro and in mice infected with a model of chronic virus compared to control T cells. Understanding this gene in T cells could translate to less invasive and more effective treatments for patients receiving T cell immunotherapies in cancer or chronic infection.

Hillary Calderon

Biological Sciences, UC San Diego
STARS
Mentored by Dr. Rodney Gabriel

An Analysis on the Differences in Nerve Block Utilization for Radial Fracture Surgery Between Hispanic and Non-Hispanic Patients

The use of nerve blocks – which are an acute pain intervention - has not been examined

in terms of ethnic differences between Hispanic and non-Hispanic patients for radial fracture surgery. The association of ethnicity and the use of nerve blocks in patients undergoing radial fracture surgery was examined. The data was acquired through the American College of Surgeons National Surgical Quality Improvement Program. Patients that underwent open reduction and internal fixation of radial fractures surgery between the years 2014 to 2020 were identified. These patients were aged 18 years and older and were either Hispanic or non- Hispanic. Other characteristics such as age and body mass index were also examined. A multivariable logistic regression model was used to examine the relationship between the use of nerve blocks and ethnicity of patients and the odds ratio, and 95% confidence intervals were quantified. There were 16,168 non-Hispanic patients and 2,341 Hispanic patients that underwent radial fracture surgery. Of the non-Hispanic and Hispanic patients, 6,198 (38.3%) and 733 (31.3%) received a nerve block, respectively ($P<0.001$). Through using a multivariable logistic regression analysis that will control for various confounders, it is expected that Hispanic patients would have decreased odds of receive receiving nerve blocks as part of their treatment for the surgical pain. Non-Hispanic patients are more likely to receive nerve blocks as part of their treatment. This study suggests potential health disparity in pain management for Hispanic patients for this orthopedic surgery.

Shannon Cao

Biology, UC San Diego
Yang Lab
Mentored by Professor Jing Yang

Proteomic Analysis of Epithelial Cell Polarity Complexes

A majority of human carcinomas show loss of epithelial apical-basal polarity during the progression from benign to invasive carcinoma. Apical-basal polarity is shown to inhibit cell invasion and suppress tumor metastasis. However, how the apical-basal complex regulates tumor cell invasion is not fully understood. In this research, TurboID-based proximity labeling technology was used to identify proteins associated with the aPKC-PAR6B epithelial polarity complex. Caco2 cell lines expressing NES-TurboID, PAR6B-TurboID and aPKC-TurboID were constructed for proximity labeling. NES-TurboID was used as the background control. Immunostaining and immunoblotting were performed to verify location and biotinylation labeling efficiency by PAR6B-TurboID and aPKC-TurboID. Mass spectrometry analysis was performed to identify the proteomes associated with the PAR6-aPKC complex.In comparison to the negative control TurboID-NES, 286 proteins were identified with a significant ≥ 2-fold enrichment associated with PAR6B-TurboID and 307 proteins were associated with PKCz-TurboID. These proteins revealed enrichment of known apical/basal polarity proteins, validating the labeling specificity of the TurboID approach. Gene Ontology (GO) analysis also showed that the enriched proteins are involved in multiple biological functions, including regulation of Hippo signaling, TGF receptor signaling, and Notch signaling pathway. Together, my research demonstrates the feasibility to use the TurboID approach to identify novel epithelial polarity-associated proteins and uncovered a number of potential proteins involved in apical-basal polarity signaling.

Ericsson Cao

General Biology, UC San Diego
Ahmadian Summer Fellowship
Mentored by Dr. Alan Saltiel

The Effect of Drug BQU57 On High Fat Diet (HFD) Induced Obesity On Mice

High Fat Diet (HFD) induced obesity has been one of the most prominent diseases in today's society, and it contributes to the cause of many diseases such as diabetes, fatty liver disease, and numerous cancers. Mitochondrial dysfunctions often correlate with many obesity-induced diseases due to their prominent role in energy metabolism, and it is believed that the protein RalA has an important role in regulating this organelle. The drug BQU57 is an inhibitor of RalA, through keeping RalA in its inactivated form, it is able to stop the downstream effectors of RalA from being activated, therefore alleviating mitochondrial fission and therefore reducing obesity due to enhanced metabolism. This in vivo study is to investigate the effect of BQU57 on the HFD-induced obesity of mice, potentially providing insight into treating human obesity-induced diseases.

Sonny Cao

Electrical Engineering, UC San Diego
ECE SRIP
Mentored by Professor Dinesh Bharadia

Developing a new antenna array architecture to increase 5G access

5G technology currently utilizes frequencies known as sub-6 (1GHz to 6GHz) for its long range and practical applications. 5G's higher frequency ranges known as mmWave (24 GHz to 100 GHz) have higher throughput and speed but a lack of range and directional flexibility, making it less practical for users on the move. To solve this issue, a new antenna architecture was proposed for 6G mmWave networks called Delay Phased Array (DPA). DPA is a new theory for creating multiple beams concurrently to serve multiple users. The goal of my project is to build a DPA prototype in the sub-6 range with two fundamental components: a True Time Delay (TTD) module and a Phase Shifter. The first goal is to use Fast Serial Peripheral Interface (SPI) and program the modules in real time. The second goal is to construct multiple components together in an 8x1 array so multiple TTDs and Phase Shifters can operate together. The last goal is to perform experiments in various environments to ensure strong performance in a multi user setting.

With this implementation, we push the boundaries of current 5G systems and open the path beyond 5G networks.

Josue Castellanos

Biology, Palomar College
STEMULATE
Mentored by Dr. Daniela Valdez-Jasso

Investigating Pulmonary Arterial Hypertension in rats while accounting for sex difference

Pulmonary Arterial Hypertension (PAH) is a progressive cardiovascular disorder characterized by sustained elevated pulmonary arterial pressure, leading to impaired oxygenation, vascular remodeling, and right heart failure. PAH currently has no cure, and females are three times more susceptible to PAH, but males are at greater risk of dying from this disease. This study focuses on specific differences between male, female, and ovariectomized (OVX) female rat models. Male, female, and OVX rats were subjected to a well-established experimental model of PAH. Hemodynamic parameters were measured, including the right ventricular systolic pressure (RVSP) and mean arterial pressure. Vaginal swabs were taken from the female and ovariectomized female rats to assess their estrous cycle. These findings emphasize the importance of considering sex differences when researching PAH, as they may influence disease progression, treatment responses, and disease severity. Further research of the molecular and cellular mechanisms underlying sex-specific differences in PAH is warranted to develop targeted solutions for preventing and managing this lethal disease and hopefully finding a cure.

Nadia Celaya Carrillo

Public Health with a Concentration in Community Health Sciences, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Chadwick Campbell

The health implication of labor-intensive work for Latinx immigrant workers within the San Gabriel Valley

Occupational health ensures successful retention rates that certify that all Latinx immigrant workers have proper working conditions and have the resources to implement different ways of prioritizing their health and well-being. There is an issue regarding the successful retention rates for healthcare resources and proper advocacy of their overall health in a long-term spectrum. Latinx immigrant labor-intensive workers are at a higher risk of developing chronic diseases and long-lasting health problems. Public health research over the years has explored the troubling concerns that may deteriorate a person's well-being whether it's through their everyday job, illness, life experiences, or even how their upbringing left them more vulnerable to poor health conditions. Many workers are left with no options but to pursue these jobs as they're one of the few that

will allow them to provide for themselves and their families continuously. I will review public health research through a literature review with oral history interviews. Through interviews, the main focus is to observe the history of occupational health of Latinx immigrants living in the San Gabriel Valley and how their health is affected by labor-intensive jobs in their everyday lives. With the literature review, my main goal is to review past publications regarding labor-intensive work and its impact on the Latinx community. By doing this project, we will learn more about the connection between longevity and quality of life and how it's interconnected with the well-being progression of occupational workers in different labor-intensive fields (e.g., factory workers, and construction work).

Gabriela Ceron

Biological Sciences, UC Merced
UC LEADS
Mentored by Dr. Nicolas Thiault

Role and Regulation of CD4-CTL in Chronic Inflammatory Diseases

The ability of CD4 T cells to differentiate into T helper fates is crucial for effective protective immunity against pathogens and cancers. The generation and maintenance of CD4 T Cell effector functions is controlled by the master transcription factor ThPOK. However, under steady-state conditions, repeated non-immunogenic stimulation of the T cell receptor (TCR) can lead to the loss of ThPOK expression, resulting in the reprogramming of CD4 T helper cells into CD4 cytotoxic T lymphocytes (CD4-CTLs). These reprogrammed cells acquire features characteristic of CD8 T killer cells, including the expression of molecules such as Runx3 and granzyme B. Given these previous findings, we aimed to investigate whether CD4-CTL reprogramming occurs in chronic inflammatory settings characterized by continuous antigen exposure in a poorly immunogenic micro-environment. Additionally, we aimed to identify molecular actors involved in this process. Furthermore, using newly engineered mouse models, we intended to determine if reprogrammed CD4-CTLs are beneficial in viral chronic infections, focusing on Lymphocytic Choriomeningitis Virus (LCMV) infections. The data obtained from this study will not only allow a better understanding of the CD4-CTL reprogramming but also, provide evidence supporting the critical roles played by these cells in protective immunity against chronic inflammatory diseases.

Oscar Cerpa Avina

Clinical Psychology, UC San Diego
McNair Scholars Program
Mentored by Professor Michael E. McCullough

Literature Review on Social Evaluation Manipulations

Fear of negative social evaluation is a well-known cause of prosociality. Although researchers have developed many scientific methods designed to cause people to believe that they're under evaluation, few attempts have been made to pinpoint the mechanisms that underlie negative evaluation's effect upon prosociality. In this paper, I explore prominent social evaluation manipulations including exposure to a depiction of eyes, the threat that someone will report the individual's behavior to others, the amount of information revealed to others about the individual, and the use of a camera to connect individuals. This literature review aims to identify the effectiveness and commonalities among these methods, with the goal of achieving greater understanding of how and why social evaluations increase prosociality. This work will help researchers to better understand the core mechanisms behind judgment and lead to development of methods to use in future research on social evaluation.

Shreya Chandrasekhar

Cell and Molecular Biology, UC San Diego
STARS
Mentored by Dr.Sonya Neal

Investigation of sphingolipid interaction with yeast rhomboid protein Dfm1 and its implication on misfolded protein degradation

Eukaryotic proteins are imported into the endoplasmic reticulum where they are subsequently folded. However, the failure to fold correctly leads to their elimination through ER-associated degradation (ERAD). The accumulation of faulty proteins leads to life-threatening diseases like cancer and neurodegeneration. Rhomboids are a class of membrane-bound serine proteases which are involved in numerous physiological functions. Dfm1 is a rhomboid pseudo-protease that removes misfolded membrane proteins in yeast through ERAD. Recent studies from the Neal Lab have revealed an ERAD-independent role of Dfm1 in negatively regulating sphingolipid metabolism. Preliminary studies have demonstrated that the dysregulation of sphingolipid levels within cells impacts the eradication process of misfolded membrane proteins from the ER. Furthermore, bioinformatic investigations have identified potential sphingolipid binding sites in Dfm1. The objective of my project was to examine the interactions of sphingolipids with Dfm1 and study their consequences on Dfm1's functions. Initially, we performed a molecular docking study using softwares Autodock and Discovery Studios, to confirm the previously identified sphingolipid binding sites of Dfm1. To corroborate the results experimentally, we performed crosslinking of Dfm1 with a photoactivatable and clickable sphingolipid precursor fatty acid, pacFACer (N-(9-(3-pent-4-ynyl-3-H-diazirin-3-yl)-nonanoyl)-D-erythro-sphingosine) tagged with a fluorescent tag, TAMRA (tetramethylrhodamine azide). Successful crosslinking of TAMRA-tagged pacFACer to GFP-tagged wild-type Dfm1 and Dfm1 with mutated sphingolipid binding motifs was tested by co-immunoprecipitation and Western blots. These experiments shed light on the physical interaction of sphingolipids with Dfm1, paving the way for studying the consequences of such interactions on Dfm1's function in sphingolipid regulation.

Hojin Chang

Computer Engineering, UC San Diego
ECE SRIP
Mentored by Dr. Bill Lin

Selective Client Pruning in Federated Learning

Federated Learning (FL) has emerged as a promising machine learning paradigm, wherein distributed clients collaboratively train a shared global model under the supervision of a central server. Despite its success, FL faces various challenges, prominently including communication cost, which can hinder its scalability and efficiency. Here, we introduce the new concept of "client pruning" in the context of FL. Client pruning involves the identification and removal of clients that do not significantly contribute to the learning of the shared global model. These clients can be regarded as outliers or possess adversarial examples, thereby adversely affecting the overall performance of the global model. We begin by providing insights into the necessity of client pruning in FL across diverse scenarios. By empirically demonstrating the potential limitations posed by certain clients, we establish the rationale for employing a client pruning strategy to enhance the overall FL system. Subsequently, we present a novel FL client pruning algorithm that effectively detects and excludes such non-contributing clients. Our proposed algorithm is designed to selectively retain only the most informative and valuable clients, thereby reducing the communication rounds significantly while concurrently improving the global model's performance. To validate the efficacy of our approach, we conduct experiments on various datasets and under diverse FL configurations. The results demonstrate substantial gains in communication efficiency, with a notable reduction in communication rounds achieved through the strategic removal of redundant clients. Furthermore, the pruned FL model exhibits enhanced performance, surpassing that of the conventional FL model with all clients included.

Rosa Chavez

Molecular and Cell Biology, UC San Diego
Summer TRELS
Mentored by Dr. Sonya Neal

The Study of Rhomboid Proteases using CRISPR and Fluorescent Proteins in a Zebrafish Model

RHBDL1/2/3/4 are genes that encode for rhomboid-like proteins, which belong to the family of serine proteases that are generally in charge of degrading proteins. These rhomboid-like proteins are involved in many pathways including those of wound healing, and in mechanisms regarding the development and diseases of mammals, such as cancer. However, the molecular mechanism by which they carry out their function is poorly understood and questions regarding the tissues that express this protein in living organisms remain unanswered to this day. For this reason, the project I am conducting aims to develop a fluorescent reporter line in zebrafish to monitor the expression of RHBDL2 using Gateway cloning. This method combines different vectors in order to create one final expression plasmid with GFP tagging our protein. Fluorescent labeling of these proteins have been used for many discoveries in the proteostasis field, and zebrafish are an ideal model for this research due to their high fertility and quick generation time. In addition, they carry the autonomous transposon Tol2, which will be used to create the expression plasmid containing our gene of interest via Tol2's transposon-mediated system. This will then be injected into our zebrafish at the one cell stage. Levels of GFP will be tracked on an hourly and daily basis to see at what stage they peak in order to get insight on RHBDL2's function. Once I have stabilized my GFP transgenic line within RHBDL2, I will apply my method to other less understood genes such as RHBDL3.

Hector Chavez

Molecular and Cell Biology, UC San Diego
Summer CAMP
Mentored by Dr. Kathleen Fisch

Molecular Mechanisms of Placental Dysfunction in Preeclampsia

Preeclampsia is characterized by hypertension, proteinuria and multi-organ damage during pregnancy. We hypothesize that increased mutagenesis, as seen in the phenomenon widespread placental mosaicism, may cause dysregulation of placental function and a be a contributing factor in the development of preeclampsia. To address this question, we performed variant calling and differential expression analysis of RNA-seq data of 152 human placental samples. We identified a network of 62 genes with rare somatic variants in human placentas in EO PE and LO PE that are significantly interconnected in network space using String DB (PPI enrichment p-value 6.05e-8). These genes are enriched in REACTOME IL-4 and IL-13 signaling, REACTOME growth hormone receptor signaling, anti-apoptosis genes and placenta-specific genes (FDR B&H <0.05). Rare somatic damaging mutations were identified in 465 genes enriched for vasculature development, cell adhesion molecule binding, angiogenesis, and epithelial cell migration and differentiation (FDR B&H <0.05). StringDB network analysis (v12-0) revealed a PPI enrichment p-value of 1.75e-12. At the transcript level, we identified 1083 isoforms enriched in the early-onset preeclamptic (<34 weeks gestation) condition relative to early-onset normal (< 34 weeks gestation) placentas. We explored genome-wide transcript expression between early-onset preeclampsia and early-onset normal and identified differential expressed transcripts enriched for vasculature development (p-value = 0.041135), cell adhesion molecule binding (p-value = 0.001769), and angiogenesis (p-value = 0.044953) pathways as dysregulated. We are continuing to explore the extent to which rare, damaging and somatic single nucleotide variants and alternative splicing contributes to placental dysfunction.

Sarah Chavez

Cellular and Molecular Biology, CSU, Northridge
STARS
Mentored by Dr. Heidi Cook-Anderson

Chemical Reprogramming of Primed Pluripotent Stem Cells to Naive Pluripotent Stem Cells

Due to proprietary information this abstract has been redacted.

Bianca Chen

Human Biology, UC San Diego
Multidisciplinary Approach to Addressing Cancer Disparities
Mentored by Dr. Georgia Sadler, Dr. Miguel Lopez-Ramirez

Resources to Help Cancer Patients are at Our Fingertips

Language barriers can lead to life-threatening errors in the healthcare setting. Human translators are the best solution. In emergency situations, can AI substitute for human translation services? ChatGPT and Google Translate were used to pilot test translations from English to Chinese, English to Spanish, and vise versa to evaluate the accuracy of the translations. Articles from PubMed and Google Scholar and other sources were found using keywords such as: language barrier, ChatGPT, AI, natural language processing, Chinese, and Spanish. Eligible articles were full-text accessible, written in English, and published between 2014 to 2023. Various applications, such as Google Translate and ChatGPT, offer translation capabilities in both text and speech forms. When considering English to Chinese and English to Spanish translation, or vice-versa, results illustrated that at times Google Translate performed better and, at other times, ChatGPT was better. Google Translate was sufficient for simple communication. ChatGPT was more accurate when specific context was applied. For both options, thinking and practicing before recording clarified and improved the translation. Both improved with the use of shorter, simpler sentences. However, ChatGPT offers the unique option of providing audience specific context to improve translations. While AI translations are not authorized in healthcare settings, there is no alternative in emergency situations. Thus, collaborating to improve the quality of AI services can drastically improve patient outcomes in emergency situations.

Cathy Chen

Cognitive and Behavioral Neuroscience, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Weg Ongkeko

Characterization of the intratumoral archaea microbiome with subtypes of Papillary Thyroid Carcinoma

Previous studies have demonstrated the important role of microbiota in cancer, most prominently, the gut microbiome's influence on oncogenesis and tumor progression. While most studies of the cancer microbiome have investigated bacterial species, the role of archaea species in oncogenesis and tumor progression remains largely unstudied. Moreover, the focus of most contemporary studies has been on the gut microbiome, thus there is a lack of intratumor microbiome studies. Understanding the association between the intratumoral microbiome and Papillary Thyroid Carcinoma may become a valuable means for assessing prognoses and diagnoses. The three subtypes of PTC, which are conventional, follicular variant and tall cell variant, differ in aggressiveness, probability of spread to lymph nodes and, therefore, prognosis, and profiling the intratumor microenvironment of PTC can have considerable clinical applications, as it could be used as a less invasive method for diagnosis. After extracting the microbe reads from 452 tumor tissue samples and 54 adjacent normal tissues, we found 1 archaeal species enriched in the tall cell variant, 2 species enriched in the follicular variant and 2 species down-regulated in the classical variant. This study aims to compare differentially abundant archaea species in the three subtypes and associate these microbes with pertinent clinical staging variables and hallmark oncogenic signature pathways. In this project, we hope to propose potential mechanisms for these archaea species' influence on oncogenesis, by studying how their respective abundance is correlated to specific immune pathways and oncogenic pathways pertinent to PTC.

Jingyi Chen

Political Science - Public Law, UC San Diego
UC Scholars
Mentored by Professor Fonna Forman

The Interplay of Social Norms and Legal Systems: Unraveling the Complexity of Domestic Violence in China and Paving the Path for Change

Despite the implementation of China's Anti-domestic Violence Law in 2015, its effectiveness has been subject to scrutiny among researchers. This research explores the multifaceted factors that contribute to the perpetuation of domestic violence in China, employing a social norms approach to understand the interplay between social norms and legal systems. It seeks to uncover the intricacies associated with researching this issue and ultimately propose potential strategies for change through the transformation of social norms. Drawing on social norms theories and building upon prior political and sociological research on China, this study examines specific instances of domestic violence in China to identify the factors that impede access to justice and perpetuate harmful practices. The primary objective of this study is to shed light on the complex nature of domestic violence in China and emphasize the significance of adopting a social norms approach to effectively address this problem. This type of research may contribute to a systematic study of domestic violence in China that can influence public discourse and empower people to work toward positive change.

Weston Chester

Physics with a specialization in astrophysics, UC San Diego
Volunteer
Mentored by Professor Adam Burgasser

Red Giants in Disguise: Differences in the Near-Infrared Spectra of Obscured Red Giants and Low Mass Brown Dwarfs

Stars can appear red either because they have low-temperature atmospheres or are obscured by gas and dust in the intergalactic medium. These confounding factors make it difficult to distinguish low-temperature brown dwarfs from distant and obscured red giants based on photometry alone, since both types of objects can appear red and dim. However, the spectrum of a star can inform observers about its temperature, surface gravity, and elemental make-up, allowing us to distinguish these classes. In this presentation, I examine the near-infrared spectra of cool brown dwarfs and red giants with similar photometric properties to determine how these sources can be distinguished. The spectral data were obtained from the IRTF IRSA Data Archive and IRTF Legacy Archive, which include 20 years of observations made with the SpeX instrument at NASA's InfraRed Telescope Facility (IRTF). I reduced the archival data using a new python-based reduction code called pyspextool, and analyzed the reduced data using the SPLAT package. I present spectral diagnostics that allow us to distinguish brown dwarf and red giant spectra, and the underlying physical properties that explain these differences. These diagnostics will prove useful for analysis of the full SpeX IRTF archive, deep infrared spectral surveys conducted with the James Webb Space Telescope, and future wide-area spectral surveys such as SPHEREx.

Vita Chou

Molecular and Cell Biology, UC San Diego
UC Scholars
Mentored by Dr. Colleen McHugh

GRAS1 non-coding RNA controls cancer cell growth

Ferroptosis is a recently discovered iron-dependent cell death pathway. Ferroptosis can play a crucial role in suppressing the growth of cancer cells. In this research project, we investigated the function of genes involved in protecting cells against ferroptosis. We found that a non-coding RNA transcript, the Growth Regulator Antisense 1 RNA (GRAS1), protects lung cancer cells from ferroptosis and DNA damage, and that decreased expression of GRAS1 triggers cell death. We employed techniques including Western Blot and cell viability assay to test the effects of GRAS1 perturbation on cell growth. To serve as controls in this project, we used an empty vector as the negative control which had no effect on the cells. Ferrostatin was used as a positive control, as it has been shown to protect cells from ferroptosis. We cloned different isoforms of the GRAS1 gene and evaluated the effects of their expression in complementing cell death and DNA damage in GRAS1 knockdown cells.

Jonathan Choy

Neurobiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Chih-Ying Su

Morphometric and morphological characterization of CO2-sensing neurons

Insects rely on olfactory cues to forage, seek mates, and avoid predators. Among behaviorally relevant odorants, carbon dioxide (CO2) holds special ethological significance for all insects, such as eliciting attraction in mosquitoes and aversion in fruit flies. Despite extensive studies on the functional significance of CO2-sensing neurons, the morphological and morphometric features of these neurons remain poorly characterized. Here, we employ volume electron microscopy (EM) to characterize the morphology of CO2-sensing neurons at nanoscale resolution. By analyzing serial block-face electron microscopy images of cryofixed antennal tissue, we compiled an extensive morphometric and morphological dataset, reconstructing 3D models of 25 CO2-sensing neurons which represents approximately 50% of the CO2-sensing neurons housed on a single antenna. Our analysis uncovers unique dendritic morphological features in the CO2-sensing neurons—instead of the cylindrical and tapered dendritic branches commonly found in odor-sensing neurons, we observe a unique flattened, sheet-like morphology in the majority of analyzed neurons. Unexpectedly, a small minority of the neurons exhibits ring-shaped dendritic morphologies, as if the dendritic sheet curved in and fused together. Our findings will lay the foundation for future investigations into how the size and shape of these CO2-sensing neurons influence their responses and sensitivity.

Peyton Cleaver

Biological Anthropology, UC San Diego
Summer TRELS
Mentored by Dr. Amy Non

Changes in the Sex at Birth Ratio Following the Onset of the Covid-19 Pandemic

The Trivers-Willard evolutionary hypothesis predicts that parents in poor environmental conditions will favor the offspring sex with more reliable chance of reproductive success, which in humans is female offspring. For example, red deer mothers in bad condition show a reduction in the male: female sex ratio of offspring, due to increased loss of male fetuses. The sex ratio in humans at birth (male births/total live births), typically rests at 0.510 globally. In line with this hypothesis, the sex ratio at birth has been observed to briefly decrease within a few months after large-scale, unexpected stressful events, such as 9/11 attacks and, in the case of the Covid-19 pandemic, the sex ratio at birth decreased to 0.499 ~3 months following the declaration of emergency and the start of quarantine in South Africa, and a smaller decrease was observed in England, and Wales. We hypothesize that a similar trend in the sex at birth ratio will occur in the United States, though preliminary results do not indicate a nationwide shift. We will also examine how social factors such as race, education, maternal age, marital status, and insurance status, impacted the observed sex ratio trends during COVID. If a dip in the sex ratio following the start of the pandemic in the US is also observed, it may support the Trivers-Willard hypothesis in demonstrating COVID as a driver of population-level stress. A nationwide shift in sex ratio may also indicate mental health implications of COVID that have impacts across generations.

Jacobo Cortes

Political Science, UC San Diego
McNair Scholars Program
Mentored by Daphne Taylor-Garcia

Investigating the Effects that Machismo Ideologies that come from Mexico Play on Children and how it Psychologically Motivates or Kills their Will Power to Succeed.

The machismo ideology in Mexico can be rooted back to the Spanish colonization that brought in gender violence and the masculine pride idea that is still present to this day. Universally, there are millions of individuals that suffer through this idea that a boy is made to be macho and superior over women with the traditional and old fashioned ways of "what it takes to be a man." There are multiple components to this ideology and throughout this research project, the study of how these different components; through the lens of sexism, racism, and sexual orientation, we ask how does machismo ideologies affect secondary generations to either overcome this generational trauma and succeed or how often do people let this ideology continue through fear of harm. It is evident that when seeing the social structure that this world was built off of there was this machismo structure but the effects that this has on children continue to fuel this way of living that leave many homeless, traumatized, beaten, and even killed. Throughout the study, I will additionally run interviews and get first hand experiences that support the idea of people's experiences getting affected by the machismo ideology and acknowledging that this ideology is real and creates trauma for kids around the world.

Christian Cortes

Clinical Psychology, UC San Diego
STARTNeuro
Mentored by Dr. Victoria Risbrough

Investigating changes in neuronal activity of fat-innervating sensory neurons

Due to the high prevalence of obesity and type 2 diabetes, research in improving our understanding of adipose (fat) tissue has been highlighted. Adipose tissue has a major role in metabolic control of our body via bidirectional communication with the central nervous system (CNS). Conventionally, the brain-fat crosstalk involves sympathetic

fibers of the CNS sending efferent signals and adipose tissue communicating its metabolic state to the brain by secreting hormones. The afferent pathway of brain-fat communication, which involves somatosensory neurons originating from the dorsal root ganglia (DRGs), has remained understudied. A recent study shed light on the functional importance of these fat-innervating sensory neurons. We aim to further investigate this afferent pathway and demonstrate how downstream neuronal activity is affected by changing the animal’s diet and whether this change is dependent on a particular receptor. This will be accomplished by utilizing molecular techniques to cause a loss-of-function mutation for a specific receptor in DRG neurons of one side of the animal’s body, leaving the contralateral side as a control. Then, we will compare the neuronal activity of second-order neurons in the left and right sides of the animal's spinal cord. We expect higher basal neuronal activity in animals fed with high-fat diet compared to normal chow diet. Furthermore, we hypothesize that, given our receptor of interest is involved in afferent signaling from adipose tissue, we may observe less neuronal activity when the receptor’s function has been impaired compared to control conditions where the receptor is intact.

Jenille Cruz

Physical Chemistry, UC San Diego
STARS
Mentored by Dr. Vicki Grassian

Utilizing Surface Sensitive Techniques to Understand Properties of Surface-Active Species in Sea Spray Aerosols and the Sea Surface Microlayer

Atmospheric aerosols are small solid or liquid particles present in the air that affect Earth’s climate through their interactions from scattering or absorbing solar radiation and from cloud condensation nuclei activity. Atmospheric aerosols are nanometers to micrometers size range and originate from natural sources, such as sea spray and windblown dust as well as anthropogenic sources, like burning of fossil fuels and biomass. Sea spray aerosols (SSA) are the largest natural source of environmental particles and are produced from wave breaking, wind shear, and bubble bursting at the ocean surface. The topmost layer of the ocean surface, known as the sea surface microlayer (SSML), contains a variety of surface-active molecular species with different compositions and exhibit different properties, which can play a significant role in influencing the lifetime, chemical, and physical properties of SSA. In this study, stability and structure properties of the surface-active species will be analyzed using surface sensitive techniques such as a Langmuir trough system with surface tension measurements, infrared reflection-absorption spectroscopy, and Brewster angle microscopy. These techniques will provide information on stability, structure, and orientation of the species at the air/water interface. It is crucial to understand the properties of these surface-active species at the air/water interface as it impacts the climate relevant properties of SSA and SSML.

Saloni Dangre

Molecular and Cell Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Douglas Bartlett

Isolating Anaerobic, Extremophilic Microbes from Western Australia Transient Lakes

The Western Australia Transient Lakes (WATL) represent some of the most extreme environments on Earth. Some of these lakes contain the pH and salinity limits of life and yet are home to a diverse range of largely unexplored microbial life. They are also some of the best modern terrestrial analogs to past environments on Mars. This project aims to gain a deeper understanding of microbial life in the WATL through (1) isolating, (2) culturing, and (3) characterizing novel strains of anaerobic extremophiles. Studying novel microbes in WATL can give us insight into the genes and molecular mechanisms for survival in low pH and saline environments that may allow life outside Earth's current habitability window. Anaerobic pore water from target lakes of high salinity and low pH was collected and inoculated into four types of growth media. The enrichments were then assessed for growth, diluted, and sequenced. Notably, eight samples came back with high-quality 16S sequences, suggesting that these cultures have become axenic. The genera from the top BLAST hits for these samples include Anaeromonas, Anaerovorax, Caldisalinibacter, Clostridiisalibacter, Halanaerobium, and Paraliobacillus. Additionally, the BLAST percent identities of the eight samples range from 92.88% to 99.71%. The lower percent identities in this range indicate the presence of novel genera. Moving forward, all samples that have reached a pure culture state will be characterized through WGS. One to two samples with low percent identities and high-quality sequences will be further characterized using a combined genotypic, chemotaxonomic and phenotypic approach.

Taújay Davis

Biology, Howard University
STARS
Mentored by Dr. Vu Nguyen

The Functional Dynamics of Histone Modifiers in Living Cells

Eukaryotic DNA is packaged around histones proteins which may suppress gene activity within the study of epigenetics. How do epigenetic factors modify these histone proteins? Here we sought to visualize the functional dynamics of these epigenetic machineries that are involved in histone modifications such as methyltransferases, ubiquitin-conjugation enzymes, structural maintenance and deacetylases. We used the experimental practices of PCR, Gel Electrophoresis, and Transformation in order to image live yeast cells at single-molecule resolution. The expected results of the experiment include being able to fluorescently label the factors in order to track their activities. Our findings about epigenetic factors in yeast cells will inform further experiments concerning complex organisms.

Micah De la Pena

Physics, UC San Diego
Summer CAMP
Mentored by Professor Javier Duarte

Self-Supervised Machine Learning for LHC Jet Physics

Machine learning (ML) is the use of computer systems and algorithms to learn a specific task or group of tasks without explicit programming. Self-supervised ML refers to the training of these algorithms without the need for labeled data. This approach has been used to great effect in training large language models like GPT-4. Our research is aimed at using these methods to analyze jets at the Large Hadron Collider (LHC). A jet is the signature of a quark and gluon produced in a high energy collision such as those that we see at the LHC. My studies focus on studying the effectiveness of different data augmentations in a self-supervised learning method called variance-invariance-covariance regularization (VICReg). By changing different aspects/augmentations of the VICReg model, we can assess the gain, loss, or maintenance of performance. The lessons learned can be used to further improve self-supervised ML algorithms in particle physics.

Pranati Denduluri

Human Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Elsa Sanchez Lopez

Analysis of Human Synovial and Mice DMM Model Tissue

Osteoarthritis (OA) is the most prevalent form of arthritis, especially in the older population. Mostly occurring in the joint, this disease causes a degradation in the cartilage that protects the end of the bones. Symptoms include joint pain, stiffness, and inflammation and can complicate the lives of many patients. Synovial inflammation is partly mediated by the infiltration of macrophages. In this project we will examine the presence of macrophages, and their features, using surgical excess of synovial tissue from individuals with osteoarthritis that undergo total knee replacement. To compare human and mouse synovial tissue we will also analyze the presence of macrophages, in mice suffering with osteoarthritis, by the destabilization of the medial meniscus (DMM) model. The DMM protocol consists of artificially destabilizing the medial meniscus of the subject, resulting in the gradual degradation of the cartilage. Pictures of tissues from mice treated with the DMM protocol are prepared, through staining methods. The patterns of macrophage production are noted and analyzed, in order to manipulate the instance of macrophage growth in the presence of osteoarthritis in future experiments.

Dhruvi Desai

Bioengineering, UC San Diego

URS - Undergraduate Research Scholarships
Mentored by Dr. Frank Talke

Development of a Murine-Sized Inflatable Vaginal Dilator for the Measurement of Vaginal Tissue Properties

Vaginal tissue properties are a significantly understudied topic in women's health. Tissue properties are crucial for understanding vaginal tears during pregnancy and effects of dilation therapy for the treatment of vaginal stenosis. To prepare for future vaginal tissue studies in murine (mouse), a soft-material inflatable vaginal dilator system with pressure-sensing capabilities was developed. The design functions as follows; the dilator will be inserted into the murine vaginal canal and inflated with saline, and a graphical user interface will provide data regarding the effect of dilation on the surrounding tissue walls. This study was performed in two parts: first, an elastomeric dilator balloon was developed, and then a saline delivery system with pressure-volume tracking was implemented. The balloon was manufactured by curing latex on a 3D-printed mold. A leak-proof clamp was designed to connect the balloon to the saline infusion tubing. After initial testing of the device prototype, it was observed that the addition of a balloon inner rod increased dilator stability during inflation and added procedural convenience for dilation in a constrained gynecological environment. The saline pump system was designed by connecting a syringe with a linear actuator and pressure sensor, and a microcontroller was utilized to track inflation at various volumes of expansion. By comparing measurements of dilator pressure and volume during inflation inside the murine vaginal canal, the device will be used to investigate dilation effects in murine and determine the stress-strain relationship for murine vaginal tissue. The results will be used to characterize human vaginal tissue.

Yair Diaz

Computer Science, Cypress College
STARS
Mentored by Dr. Matteo D'Antonio

GWAS/PRS & The Road to Inclusion

Genome-wide association studies (GWAS) aim at identifying genetic variants across the entire genome that are associated with particular traits or diseases. By combining the effect sizes of variants genome-wide, polygenic risk scores (PRS) are calculated to stratify individuals based on their genetic risk. While thousands of variants have been associated with complex traits and diseases, GWAS have been mostly performed on individuals of European descent. This lack of diversity has resulted in PRS not being transferable between populations, giving unfair advantages to certain groups of individuals. Therefore it is important to develop models to make GWAS and PRS calculations inclusive for all populations. We will develop simulations of genotypes and phenotypes using haptools, and then perform GWAS and PRS to understand the effects of genetic variation on disease in admixed and diverse populations. By using these simulations, we expect to understand the differences and similarities in genetic associations between populations and we will determine how PRS can be transferred between populations. Our results will suggest that studies on single populations are limited and study designs that include individuals from multiple populations, as well as admixed individuals, are required. Therefore, it can be implied that more diverse studies are necessary to get the proper distinctions to find what variants can affect the population at large. This is the first step towards working with diverse and admixed populations in GWAS and PRS.

Jerilyn Dickens

Developmental Psychology, UC San Diego
McNair Scholars Program
Mentored by Dr. Lauren Brookman-Frazee

Behavioral Sex Differences in Autism

Due to proprietary information this abstract has been redacted.

Brandi Dickens

Developmental Psychology, UC San Diego
McNair Scholars Program
Mentored by Professor Karen Dobkins

Positive Personality Traits, Connection to Nature, and Wellbeing

Some researchers believe that our society is becoming more disconnected from nature, which is thought to be leading to negative impacts on our mental wellbeing. However, there is mixed evidence that being in nature is enough to improve wellbeing and there may be other factors. The study utilized a survey-style correlational design using Qualtrics. The independent variables are positive personality traits and connection to nature (CTN), while the dependent variable is wellbeing. The Big Five Inventory (BFI) is used to measure agreeableness, conscientiousness, and openness. Adventurousness is measured using the Thrill and Adventure seeking subscale of the Sensation-Seeking Scale (SSS). Easygoing is measured using a simple measure that asks participants to rate how accurately an adjective (easygoing, calm, and happy) describes them. CTN is measured using the Deep CTN scale, which was developed by the HEALab at UCSD. Wellbeing is measured using the Ryff Wellbeing Scale. Based on previous research, predicted results show positive correlations between CTN and wellbeing, CTN and personality traits, and wellbeing and personality traits. The results showed that agreeableness, conscientiousness, openness, and easygoing have moderate to strong correlations with wellbeing. We also found that the personality traits that have moderate correlations with CTN are openness, easygoing, and adventurousness. We also found that CTN and wellbeing have a weak correlation, which is surprising. We need to further

analyze whether positive personality traits mediate the relationship between CTN and wellbeing, and these findings may have significant implications for how individuals are influenced by their personality traits.

Tyler Diep

Human Biology, UC San Diego
Genentech Scholars Program
Mentored by Dr. Binhai Zheng

The Role of DLK and LZK in the Survival of Injured Corticospinal Neurons

Due to proprietary information this abstract has been redacted.

Saathvik Dirisala

Data Science, UC San Diego
STARS
Mentored by Dr. Tsung-Ting Kuo

Decentralized Dynamic Patient Consent Management System for Hierarchical Data Elements

Due to proprietary information this abstract has been redacted.

Ethan Doan

NanoEngineering, UC San Diego
Triton Underground Scholars
Mentored by Professor Kesong Yang

First-Principles Investigation of Size Effect on Cohesive Energies of Transition-Metal Nanoparticles

Transition metal nanoparticles have been essential in the development of new technologies in various fields such as catalysis, electronics, and biomolecule detection. Cohesive energy is a fundamental property in understanding the thermodynamic stability of nanoparticles particularly for catalyst applications where reactions take place at high temperatures and pressures. In this study, the cohesive energies were systematically calculated for nanoparticles formed in 12 different geometries for 30 different transition metals using first-principles density functional theory calculations. So far, we have found that cohesive energies decrease with decreasing size with logarithmic relationships. These calculations provide valuable insight on the size effect of transition metals along with understanding periodic cohesive energy trends.

Coby Dodson

Public Health, UC San Diego
UC Scholars
Mentored by Dr. Cheryl Anderson

Sodium regulation in individuals on known dietary sodium intake

Studies conducted in the past have shown that an increase in dietary sodium can be linked to an increased risk for hypertension and other blood-related diseases. Reducing amounts of sodium through changes in diet can result in reduced blood pressure. This suggests that the effects of dietary sodium intake on blood pressure are influenced by sodium retention. The Sodium Regulation in Individuals on Known Dietary Sodium Intake or MEASURE Study aims to report the effects of a high and low sodium diet. Through a process of controlled feeding, the study is able to monitor patients' diets and manage their sodium intake. This helps to examine the effects of high and low dietary sodium intake by taking blood and urine samples. The study also aims to compare differences in sodium intake and sodium retention between racial groups.

Matt Dulansky

Structural Engineering, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Hyonny Kim

Optimizing Sandwich Composite Structures for Resilient Surfboard Design: A Study on Buckling Resistance and Material Properties

This research aims to develop a more resilient and durable surfboard design capable of withstanding the forces produced by waves, thereby reducing waste and promoting the use of sustainable materials. To achieve this goal, a new sandwich composite structure will be developed with enhanced torsional strain and greater flexibility in bending, while compensating for the reduced strength of the outer skin with a high-strength carbon fiber stringer. The optimal design of this composite structure will be determined through a series of analytical and numerical simulations, considering the influence of key design parameters such as material properties and geometric configurations. The findings of this research will contribute to the larger body of knowledge on composite materials and structural engineering, with potential applications beyond the surfboard industry.

Camille Dunning

Data Science, UC San Diego
STARS
Mentored by Adam Burgasser

Deep Learning-Based Decomposition of Unresolved Ultracool Dwarf Binary Systems

Ultracool dwarfs (UCDs), spanning late-M, L, T, and Y spectral classes, are the most abundant stars in our Milky Way galaxy. They comprise low-mass stars and brown dwarfs with masses ≤ 0.1 solar masses. Despite their prevalence, the detailed properties of UCDs, particularly unresolved binary pairs, have remained challenging to discern due to observational limits. In this study, I present a deep learning approach to decompose the combined-light near-infrared spectra (0.9-2.4 micron) of unresolved UCD binary systems to infer their primary and secondary spectral classifications. Using a curation of synthetic binary templates composed of M7 to L7 primary stars and T1 to T8 secondary stars as the training set, I developed a classification model using a multi-output simple recurrent neural network (RNN). I evaluated training with both the templates and difference spectra, the difference between a star's spectrum and its best-match system type standard. Using a feed-forward neural network on source spectrum, system type, and difference spectrum, I demonstrate the importance of dimensionality reduction for producing a precise model. I also evaluated the impact of telluric (Earth-based) absorption on spectral decomposition. I summarize the accuracy of this model for various spectral type combinations, and compare component types inferred from this model to those of previously identified resolved and unresolved UCD binary systems.

Tanya Dwivedi

Aerospace Engineering, UC San Diego
HEDP Lab at UCSD
Mentored by Dr. Farhat Beg

Stability Analysis for Gas Puff Z-Pinches

In the High Energy Density Physics (HEDP) laboratory, a significant portion of our investigations is centered around the realm of fusion instigated by gas puff z-pinches. This particular phenomenon occurs when a gas is introduced into a chamber containing two electrodes—an anode and a cathode—with an electric current traversing between them. An induced magnetic field emerges, orienting itself in an azimuthal direction, thereby compressing the gas into a narrow, high-density region, a process colloquially referred to as a ‘pinch’, which is unstable to Magneto Rayleigh Taylor Instability. This instability can be mitigated by an external magnetic field. In this analysis, we will show the instability analysis of the pinch in the presence of the magnetic field.

Samantha Dyer

General Biology, UC San Diego
UC Scholars
Mentored by Dr. Alexandra Jazz Dickinson

Itaconate Treatment in Native Plants of California to Mitigate Effects of Climate Change

Prolonged periods of environmental stress caused by climate change endanger native plant species in San Diego. In conjunction with the San Diego Botanical Garden, Dickinson lab will investigate the effect of itaconate treatment for stress resistance in *Phacelia distans*, *Phacelia grandiflora*, *Eschscholzia californica*, and *Camissoniopsis cheiranthifolia*. Itaconate is a metabolite commonly associated with growth and regeneration in mammalian species. Itaconate treatment in plants has been identified as a "chemical-free" and non-GMO method for increasing stress resistance across subsequent generations of plants. The effects of itaconate treatment have been previously identified in *Arabidopsis thaliana*, where initial specimens were treated and produced subsequent progeny with more robust qualities than previous generations. The project's overarching objective is to develop itaconate treatment as a potentially critical tool for conservation. To do this, the cross-generational effect of itaconate during stress will be measured and optimized in California native plants and *Arabidopsis thaliana* seeds collected from different regions of the world. This work will reveal more information about how itaconate works, with significant implications for protecting native ecosystems from climate change.

Paris Eberwein

Chemical Engineering, Palomar College
STEMULATE
Mentored by Matthew Miyada

Exploring Carrier Protein-Dependent Biosynthesis with Solvatochromic Fluorescent Probes

The purpose of the research is to determine how carrier proteins understand where to shuttle substrates to the proper pathways. Carrier proteins are essential in the biosynthesis of vital metabolites including fatty acids. Discovering the means by which carrier proteins shuttle substrates to create these important metabolites can lead to advances in medicine and bioengineering through the biosynthesis of niche polyketides and non-ribosomal peptides. Our fluorescent probes covalently modify target carrier proteins by mimicking the substrate. The solvatochromism of our fluorescent probes indicate the location of the substrate as it proceeds throughout biosynthetic pathways.

Kristin Ebuengan

Computer Science, UC San Diego
Early Research Scholars Program (ERSP)
Mentored by Dr. Pat Pannuto

Dirt Cheap: Timekeeping with Soil and Friends

Embedded systems (small computer systems designed for a specific task) that are intermittently-powered have a timekeeping problem. Since they lack batteries, these systems typically collect and use energy from the environment. Common energy sources such as solar or wind are inconsistent. Due to their unstable energy income, intermittently-powered devices cannot harvest enough instantaneous power to continuously run, so they shut down when out of energy and lose track of time completely. This greatly limits what intermittently-powered devices can accomplish since accurate timekeeping is required to keep precise timestamps on data collection, carry out certain security protocols, and schedule tasks beyond the device's wake time. Current timekeeping solutions require external synchronization or can only keep time for short periods (i.e. seconds) without power. We solve these issues by creating an external method of keeping track of time for intermittently-powered devices using constant low-power energy sources. We build a prototype of our system and power it with energy harvested from inexpensive soil microbial fuel cells (sMFCs). sMFCs utilize the waste products of naturally occurring soil bacteria to produce low but constant power of about 20 microwatts, around 1,000,000 times less power than a charging smartphone draws. We find this is still sufficient to sustain a real-time clock indefinitely while concurrently charging a supercapacitor for intermittent computing. We also implement a task scheduler that schedules when to gather sensor data based on time and show that our solution succeeds at executing applications previously inaccessible to intermittent computing systems.

Pansée ElGhayati

Cognitive and behavioral neuroscience, UC San Diego
STARTNeuro
Mentored by Sourish Mukhopadhyay

Investigating Scent Marking Behavior in Female Mice: Potential for Female Pheromonal Communication

Social communication is an important aspect of group living. One way animals communicate with each other is through depositing chemical cues in the environment. Scent marking behavior is one such communication behavior that has been extensively studied in male mice, as it plays a crucial role in olfactory communication for territory establishment, and reproductive signaling. However, the extent to which this behavior is unique to males remains unclear. In this study, we aim to determine if female mice engage in scent marking behavior (SMUF), and explore the factors that may influence this behavior. We find that unlike adult males, females do not scent mark in response to the presence female urine odor in their environment. However, surprisingly, we find that social isolation during adolescence uncovers a robust scent marking response in female mice. This is highly unexpected because the prevalent view of scent marking until now has been that this is a sexually dimorphic behavior that only males perform. Our results indicate that female mice also utilize this form of communication but do so under specific contexts. Scent marking plays a vital role in olfactory communication, influencing social interactions, both cooperative and competitive, within and between species. Understanding the potential existence and modulating factors of SMUF in female mice would contribute to our knowledge of intersexual communication and expand our

comprehension of the broader ecological and evolutionary implications of scent marking behavior.

Julia Epshtein

Computer Science, University of Massachusetts Amherst
ERSP - Early Research Scholars Program
Mentored by Dr. Michael Coblenz

The Kale Project: A Study of Spreadsheet Usability

With more than 750 million users of Microsoft Excel alone, spreadsheets play a crucial role in various fields such as finance, business, science, research, and data analysis. Despite their popularity and widespread use, spreadsheets are prone to errors, especially when dealing with large datasets and complex calculations. A 2015 study alone found that more than 95% of spreadsheets contain at least one error. The Kale Project explores how spreadsheets can be made safer for all kinds of users, avoiding large classes of spreadsheet bugs. One challenge with existing spreadsheet tools is their limited ability to detect errors when the structure of the spreadsheet changes. This can cause inconsistencies or inaccuracies in data, leading to serious consequences. Our initiative focuses on addressing the most pressing issues of spreadsheets. We hope our tools will help spreadsheet users identify and fix errors, and make data analysis more accurate and reliable.

Anabell Espinosa

Marine Biology, CSU, Fullerton
STARS
Mentored by Dr. Octavio Aburto

Collaborative Management of Artisanal Fisheries in Mexico: Punta Abreojos case study

Historically, global fisheries have relied on top-down strategies for managing stocks and implementing regulations. However, this centralized and non-participatory approach often falls short of desired outcomes and creates conflicts between managers and fishing communities. Artisanal fisheries are adversely affected by these top-down strategies, as they are multi-species and require localized considerations for its management. A major challenge faced by artisanal fisheries worldwide is the lack of sufficient data to manage their unique characteristics. To address these issues, there is a growing recognition of the need for bottom-up management strategies that empower fishing communities and encourage their participation in policy creation. Such an ecosystem-based approach not only promotes sustainable fisheries but also safeguards the economic well-being of fishers and their communities. Since 2009, the Punta Abreojos community on the Pacific coast of Baja California has collaborated with the Collaborative Fisheries Monitoring Program. This program integrates the knowledge of fishers and scientists to study the relationship between fisheries and natural resources. Fishers generate local landing data, operational costs, and market prices, which are used to co-manage these resources. This study was conducted to analyze the different stocks comprising the fishery of Punta Abreojos, utilizing data obtained from the PCC program. The goal of the study of Punta Abreojos is to provide valuable insights into the dynamics of the fishery, encompassing its various stocks. This collaborative effort enables a more comprehensive understanding of the unique challenges faced by artisanal fisheries, facilitating the development of effective and sustainable co-management strategies.

Kenya Espinoza

Biology with a concentration in Biotechnology, CSU, Bakersfield
STARS
Mentored by Dr. Matteo D'Antonio

Using fine-mapping to understand the differences between different populations on GAWS loci.

Genome-wide association studies (GWAS) investigate genetic variation across the entire genome of a large group of individuals to identify genetic factors that may be associated with a disease or trait. Technology advancements and the accessibility of larger and more diverse datasets have made GWAS more potent and effective over time. The identification of genetic variants in disease has been aided by computational tools and statistical techniques. GWAS aids in understanding the genetic basis of complex diseases, including the development of new treatments and medications that specifically target individuals that share similar genetic backgrounds. The purpose of our study is to analyze breast cancer GWAS data between four populations (African Americans, Europeans, Central/South Asians, and East Asians) in the UK BioBank. To examine the GWAS data and identify the genetic variants related to breast cancer, we will create Manhattan plots, which will help identify genome-wide significant associations. On a genetic level, Manhattan plots show the P values of each tested variant in the GWAS. On the x-axis, the variants are displayed in genomic order by chromosome and position, while the y-axis shows the P value's -log10 value of the association with breast cancer. We will analyze summary statistics of breast cancer GWAS and perform fine mapping. Fine mapping is a technique used to identify the specific causal variants at a certain locus. In different populations, we expect to discover the causal variants for breast cancer.

Yulianna Estrada

Biomedical Engineering, Boston University
MRSEC REU or RIMSE
Mentored by Professor Jon Pokorski

Conducting Polymer Based Biohybrid Systems for Bioelectronic Plants

Plants are vital to the human population yet they face direct and indirect challenges caused by climate change, reducing crop yield and health in certain regions. To address these challenges, plant bioelectronics is an emerging field focused on monitoring plant health using wearable sensors. The problem with this technology is its impact on the plant leaf over a prolonged period, causing it to weaken or die because of the sensor's lack of adaptability to plant growth. To bypass this issue, conductive polymers are being used as an alternative because of their flexibility and potential to adapt to plant growth. However, leaf structures pose a significant challenge to polymers, causing a reduction in performance and durability when applied on the leaf surface. To address this limitation, we propose modifying the conductive polymer poly(3,4-ethylenedioxythiophene)-poly(styrenesulfonate)(PEDOT:PSS) adding a polymer block of poly(vinyltrimethoxysilane) (PEDOT:[PSS-b-PVMTS]). This final product will be formulated into a bioink that can be extruded creating circuits in the surface of the leaf. We hypothesize that the presence of silane in the composition will create the covalent bonding needed to strengthen polymer adhesion to the plant surface. Subsequently, this modified ink will be used to print on living systems and various patterning methods will be explored for stretchability as the plant matures. The longevity of the system will then be assessed through plant surveillance and conductivity measurements. We envision this study will lead to an improvement in plant survival and long-lasting biocompatibility of bioelectronics.

Joshua Evans

Physics with Specialization in Material Science, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Professor Alex Frano

Characterization of strongly correlated materials using synchrotron-based techniques and computational modeling

This research project is based on using different X-ray spectroscopy and scattering techniques to characterize materials from various families of strongly correlated transition metal oxides (TMOs), such as cuprates and nickelates. TMOs host a wide range of novel quantum phases, such as superconductivity and spin- and charge-density waves, and have numerous applications, from cell phones to magnetic recording. These phases are set under the specific environment the system is in, which can reveal the application the sample can be used for. Therefore, this research project will examine and characterize those phase properties to better understand the electron structure of the system.

Colby Fagan

Biology, UC Santa Barbara
UC LEADS
Mentored by Dr. Rusty Gage

The Role of LINE-1 Retrotransposons in Neuroinflammation and Alzheimer's Disease

Alzheimer's disease affects more than six million people nationwide and, despite decades of efforts to identify pharmacological treatments, clinical trials have shown little success. A deeper understanding of the mechanism of AD onset is necessary. Neuroinflammation is known to be associated with AD in both humans and animal models but it is unclear if it is an upstream or downstream effect of the disease. Therefore, elucidating the molecular basis of neuroinflammation in the context of AD is vital. Recent evidence suggests the involvement of LINE-1 retrotransposable elements in neurodegenerative disorders, including AD, through their influence on epigenetic modifications and the associated inflammatory responses. To test LINE-1's involvement in neuroinflammation, we will treat AD patient-derived directly induced neurons (iNs) in culture with nucleotide reverse transcriptase inhibitors (NRTIs), lowering LINE-1's activity. We will then compare the secretory profile of the NRTI-treated AD iNs to a control group of AD iNs treated with an empty vehicle. If inhibition of LINE-1 activity in AD iNs results in an inflammatory profile more similar to healthy neurons, this could indicate a potential avenue for AD treatment.

Joana Fang

Computer Science, UC Los Angeles
VERSA
Mentored by Dr. Mia Minnes

Moving Toward a More Supportive Field: A Community-Building Program in a Large Undergraduate Computer Science and Engineering Department

UC San Diego's CSE-PACE (Computer Science and Engineering-Peer-led Academic Cohort Experiences) organized incoming undergraduate students into cohorts, each led by an experienced CSE undergraduate mentor. These cohorts met weekly serving to build community in computing and connect students to other activities. We are motivated to see the effects of this community-building program on students' class grades, as well as how CSE-PACE relates to student connections. From there, we ask to what extent do CSE-PACE students have social support, through the number of people they can reach out to, compared to non-CSE-PACE students? To what extent does this relate to CSE-PACE students' CSE-PACE attendance? How do these relate to the students' grades? Further, we explore the impacts of CSE-PACE on students. From here, we get to see how to refine CSE-PACE for the future, and ultimately, we get to see how we can help students find community in what is sometimes regarded as an isolating field.

Samira Feili

Bioengineering: Biotechnology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Kellie Breen Church

Mapping Neural Pathways Whereby Stress Impairs Fertility

This study investigates the effects of stress on fertility in female mice, focusing on the role of norepinephrine neurons, and their impact on the neural pathway involved in reproductive function. Approximately 1 in 8 couples struggle with infertility issues, and it is to be thought that stress is a major contributor in many cases. This project will evaluate this concept by setting up a model of chronic psychosocial stressors, combined with a high fat diet to assess the role of norepinephrine neurons in disrupting pathways required for reproduction. I hypothesize that norepinephrine neurons signal to the reproductive axis and disrupt it, via kisspeptin neurons. Fertility will be evaluated by ovarian cyclicity via vaginal lavages, studying the reproductive cycles that occur rhythmically in rodents and are similar to the rhythmic control in women. I expect to see suppression in kisspeptin and luteinizing hormone in the stressed animal when norepinephrine neurons are activated, and no suppression in the healthy control animal. Using immunohistochemistry, kisspeptin expression will be analyzed. LH levels between healthy control animals and animals that will be exposed to the developed psychosocial stress model will be analyzed. This technique will determine whether the norepinephrine neuron population is activated during the stressors. This work is relevant to women's health as estrogen controls more than fertility, but has a vital role in keeping the female heart, brain, and bones healthy, protecting women from developing cardiovascular disease, dementia, and osteoporosis. Exhibiting stress not only impacts reproductive health, but the overall wellbeing of women.

Garrett Feng

Human Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Amir Zarrinpar

Evaluating Engineered Native E. coli's Tumor-Homing Ability for Colorectal Cancer Therapy

Due to proprietary information this abstract has been redacted.

Brian Ferrante

Environmental Systems: Earth Sciences, UC San Diego
UC Scholars
Mentored by Dr. Sarah Purkey

Ocean Circulation: Temperature and Oxygen Levels Changing Over Time

Due to its importance in heat absorption, taking in 90% of anthropogenic heat produced, our project investigates changes in ocean ventilation and circulation and what it means for the ocean as a whole. Temperature and oxygen levels around the Antarctic, overall and at different depths, were the main focus of our study. Our data was taken from GO-SHIP, an organization doing top to bottom hydrographic surveys measuring CTD-O (Conductivity, Temperature, Depth, Oxygen) every ten years since the 1990's.

Approximately 50 zonal and meridional transects are measured every 50 km before being quality controlled and added to the EasyOcean database. To explore the Easy Ocean data, we developed a MATLAB notebook to visualize key aspects of the data. Differences over time for temperature, salinity, and oxygen, as well as differences in depth and latitude for the same metrics were the main focus. Multiple plots were created to assess temporal and spatial variability. The MATLAB notebook, as well as the plots created for assessment, will be presented to show any changes in ocean temperature or oxygen levels around Antarctica.

Steven Flemig

Oceanic and Atmospheric Sciences, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Andreas Andersson

Analyzing Ocean Alkalinity Enhancement and Marine Carbon Dioxide Removal through Calcium Carbonate Sediment Dissolution

Ocean alkalinity enhancement has been proposed as a method of marine based carbon dioxide removal. Ocean alkalinity enhancement is done by adding carbonate based minerals to the ocean. This was done using the passing of a cruise ship over the Bermuda carbonate platform as an analog for Ocean alkalinity enhancement. Seawater samples collected inside and outside of the plume created by the passing cruise ship were tested for their total alkalinity. The total alkalinity values seemed to show no signals of either mineral precipitation or dissolution, fitting a slightly elevated pattern of previously determined gradients across the platform. Due to this uncertainty, additional testing of calcium carbonate sediments from Bermuda will be needed to make further conclusions. Calcium carbonate sediment samples collected from Bermuda will now be tested on a free-drift reactor while being exposed to different pCO2 levels. Determining which levels of pCO2 will lead to mineral dissolution (i.e. ocean alkalinity enhancement) and at what rate this will occur.

Sarah Flores

Bioengineering: Bioinformatics, UC San Diego
Colors of the Brain
Mentored by Dr. Kay Tye

Influence of Competitive Competence in Rearranging Social Hierarchies

Across social species, animals naturally form social dominance hierarchies that facilitate group survival and promote social stability. Prior work from the Tye lab has shown that dominance status can dictate competitive success for food rewards. However, it is unknown whether competence in competitive tasks can rearrange position within social dominance hierarchies. To investigate this, we will first use the tube test assay to determine the ranks of male mouse cage mates. We will then use an ethologically-

relevant social competition assay to measure the relationship between dominance status and competitive success. In this assay, mice will be trained differently according to their social dominance status to explore whether higher levels of training can increase competitive success and social status in subsequent tube tests. Future work will investigate how brain regions like the orbitofrontal cortex can represent not only competitive success, but also the relative rank of competitors in our competition assay. Overall, our findings will inform studies looking at the brain basis for social behaviors and their disruption in mental health disorders.

Cristian Fuentes Hernandez

Political Science, UC San Diego
McNair Scholars Program
Mentored by Dr. Gerardo Arellano

Undergraduate Latinx Research Barriers at UC San Diego

In the last years, there has been an increase in diversity efforts in higher education, from more representation in Academia, to better conditions for students for marginalized groups. For the past 5 years, UC San Diego has been working on becoming a Hispanic Serving Institution. Here, I hope to utilize my experiences as a Raza Resource Centro Learning Specialist in order to explain the barriers that many Latinx students have faced postpandemic with regards to their academics. This is done through a mix of quantitive data based on qualitative data by interviews to people that had different levels of engagement with research I separated the levels of engagement in “Students who have no research experience, and “students who have research experience”. I will do a comparative analysis of challenges that they had to overcome and techniques that helped succeed in their academic engagement. This data is important because it can help people involved in higher education build bridges for marginalized groups to inspire people to go into Academia.

Beneen Fune

NanoEngineering and Mathematics-Computer Science, UC San Diego
MRSEC REU or RIMSE
Mentored by Professor Tod Pascal

DMAx: a high-throughput workflow for dynamic mechanical analysis simulations with LAMMPS

Dynamic Mechanical Analysis (DMA) is an important experimental characterization technique for the mechanical properties of polymers. Our group has developed a tool (DMAx) to simulate this technique with molecular dynamics and output properties such as the frequency-dependent storage and loss modulus. In this work, we transform this software in a high-throughput, user-friendly workflow that is able to intake multiple polymer structures and suggest the ones with the user’s desired mechanical and dielectric properties. We integrated our workflow to the python package atomate2 and we are populating the Polymer Database with the observed mechanical properties.

Samvel Gaboyan

Molecular and Cell Biology, UC San Diego
199 or other independent study for credit
Mentored by Dr. Laura Crotty Alexander

Fourth Generation E-cigarettes Present Immunosuppressive Properties in Mouse Models of Allergic Asthma

Fourth generation e-cigarettes (i.e. JUUL) continue to be marketed as an attraction towards adolescent users. Asthma is characterized by airway inflammation, mucus secretion, and bronchoconstriction. We used a murine model of asthma in which ovalbumin (OVA) is used to induce an allergic Th2-high inflammatory airways disease (AIAD). By exposing mice to e-cigarette aerosols, we aim to determine the role of these inhalants on the recruitment of inflammatory cells into the lungs during AIAD pathogenesis. Eight-week-old female BALB/c mice underwent whole-body exposure (inExpose by SciReq) to e-cigarette aerosols (JUUL Virginia Tobacco) or air control for either 120 minutes/day, 5 days/week, for one month or 60 minutes/day, 5 days/week, for two months. Fifty-percent of air control mice and all e-cigarette exposed mice underwent AIAD induction. Lung physiology was measured via flexiVent (SciReq). Airway hyperreactivity was assessed via methacholine challenge. Total cell counts were obtained using a hemocytometer. Flow cytometry was used to identify cell types. Inhalation of e-cigarette aerosols diminished recruitment of Eosinophils ($p < 0.01$), T cells ($p < 0.01$), and B cells ($p < 0.05$) to lungs by 40% in AIAD mice. No significant differences were observed in the recruitment of immune cells into the airways, nor airway resistance. Virginia Tobacco flavored JUUL e-cigarette suppress leukocytes (eosinophils) and lymphocytes (CD4+ T cells and B cells) in lung parenchyma of AIAD mice. Future experiments will examine whether this difference is due to the flavor or nicotine content of the JUUL device, or the sex of the mice.

Pranava Gande

Bioengineering: Bioinformatics, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Weg Ongkeko

Characterization of extracellular vesicle microRNA dysregulation and immune response in the HPV and smoking etiologies of Head and Neck Squamous Cell Carcinoma

MicroRNAs (miRNAs), non-coding RNA responsible for regulating mRNA expression, are functional molecules within extracellular vesicles implicated in cancer metastasis and progression. This project will elucidate the role of EV miRNAs in immune dysregulation in Head and Neck Squamous Cell Carcinoma (HNSCC). Though several studies have

shown that particular miRNAs are significantly differentially expressed in the EVs of HNSCC patients versus non-cancer patients, the specific function of these miRNAs in immune dysregulation is not well-characterized. This project addresses this by comparing miRNA expression profiles in the two primary etiologies of HNSCC, HPV and smoking, each of whose tumor microenvironments displays different forms of immune dysregulation in immunosuppression and inflammation respectively. We will perform Kruskal-Wallis tests and Geneset Enrichment Analysis with data from The Cancer Genome Atlas to computationally analyze miRNA dysregulation and the immune genes associated with this dysregulation. Next, we will validate the computationally observed EV miRNA dysregulation in cigarette-smoke exposed HNSCC cells by an in-vitro experiment. In this experiment, we will expose Tumor-Infiltrating Lymphocyte cell cultures to varying levels of cigarette smoke and measure the cultures' EV miRNA expression with a custom PCR test. Lastly, we will conduct an in-vitro invasion assay to assess the functional consequences of EV miRNA dysregulation for the invasive capacity of HNSCC cells.

Esaul Garcia

Chemical Engineering, UC San Diego
Summer TRELS
Mentored by Eugene Yeo

Investigating the effects of RNA binding proteins on neuronal RNA transport

The transport of RNA to axons is a critical process in the development and function of the nervous system. RNA binding proteins (RBPs) play a crucial role in this process by facilitating the localization and transport of specific mRNAs to axons. Neuron function requires the trafficking of these RNAs and transport requires these transcripts to be more locally stabilized than the average RNA. Only some of the proteins responsible for this transport have been discovered, such as ANAX11 and ZBP1. Others, suspected to be involved in transport, such as FUS and FMRP, have been implicated in neurodegenerative disease. However, the identity of many RBPs that are involved in axonal transport of RNAs remains unknown. Therefore, there is a need to identify these RBPs and their function to better understand the mechanisms underlying axonal RNA transport. To identify RBPs involved in axonal transport we are developing a high-throughput screening approach which will involve using a reporter system in differentiated neuronal cells. This reporter system will include 2 hairpin systems, PP7 with PCP-GFP to track RNAs and MS2 with MCP-GFP to bind our RBP of interest to the reporter RNA. We expect to identify several RBPs that are involved in axonal RNA transport and gain a deeper understanding of the underlying mechanisms. Furthermore, the identification of these RBPs will provide insights into the molecular mechanisms underlying axonal RNA transport and will open new avenues for studying the regulation of gene expression in the nervous system.

Alexandra Garcia

Psychology, UC San Diego
McNair Scholars Program
Mentored by Dr. Kay Tye

Acute and chronic social isolation promote diverse behavior repertoires and differentially modify mPFC responses to social contact

The social environment around us influences our behavior. For example, divergent social behaviors emerge from different durations of social isolation (Lee et al., 2021). Acute social isolation produces prosocial behaviors, and chronic social isolation results in antisocial behaviors following re-introduction to a social group. Many studies point toward the medial prefrontal cortex (mPFC) as a potential region for processing and representing features in our social environment. However, the exact time course of social isolation, its impact on social behavior, and the neural circuitry underlying social homeostasis remain unknown. To explore how the mPFC encodes social information and undergoes a state change following social isolation, we used in vivo cellular resolution calcium imaging coupled with computer vision and machine learning tools to measure behavioral responses and mPFC neural activity as animals engaged in a juvenile intruder task. As part of this experimental design, adult male mice are presented with a novel juvenile male mouse in acute versus chronic isolation conditions (2hr, 6hr, 24hr, 7d, 14d, and 28d) to determine how different durations of isolation impact social behavior. We recorded the mice's social interaction time and used machine learning tools to discover differences in behavioral motifs following isolation. Additionally, to observe changes in neuronal activity we conducted calcium imaging in the mPFC of mice engaged in social behavior after group-housing and isolation. Overall, our findings may uncover the neural mechanisms relevant to our processing of social information to dictate our interactions with the environment.

Jenna Garcia

Human Biology, Cognitive and Behavoiral Neuroscience, UC San Diego
Multidisciplinary Approach to Addressing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler

First Do No Harm: Discussing Cancer Screening With People Coping with Advancing Dementia

Communications among health care providers, patients, and caregivers are challenging, especially when issues are complicated, emotionally-laden, and cross-disciplinary. The Wong-Baker FACES® Pain Rating Scale facilitates such essential communications. This narrative review of the scientific literature searched for communication facilitators about cancer screening options when other life-threatening conditions are already present. Databases such as CINAHL, PubMed, Google Scholar, and Ethnic NewsWatch were used to identify eligible peer-reviewed, full-text accessible articles published in English between 1950 and 2023. Keywords used for these searches included: dementia, cancer, communication, early detection, colorectal, colonoscopy, mammography, skin, screening, protocols, prevention, and guidelines. Eligible articles' references were also considered for inclusion. Of 167 articles reviewed, 18 were relevant. The review identified tools that provide extensive information about life-limiting illnesses, but no resources were found that facilitate the delicate communication between providers and patients/caregivers regarding what cancer screening could be discontinued versus continued. Cancer screening guidelines can change in importance as another life-limiting disease progresses. It can be distressing for patients and their loved ones to figure out what cancer screenings will benefit the patient. Easily interpreted tools comparable to the Wong-Baker FACES® Pain Rating Scale may help providers to reduce the families' decision-making burden. A comparable communication facilitator has been drafted. It can be easily understood by patients/caregivers and thereby facilitate communications by outlining the cancer screening options against the timeline of the life-limiting disease. Pilot testing the tool is recommended.

Melody Gill

Computer Science, UC San Diego
Early Research Scholars' Program (ERSP)
Mentored by Dr. Pat Pannuto

Dirt Cheap: Timekeeping with Soil and Friends

Embedded systems (small computer systems designed for a specific task) that are intermittently-powered have a timekeeping problem. Since they lack batteries, these systems typically collect and use energy from the environment. Common energy sources such as solar or wind are inconsistent. Due to their unstable energy income, intermittently-powered devices cannot harvest enough instantaneous power to continuously run, so they shut down when out of energy and lose track of time completely. This greatly limits what intermittently-powered devices can accomplish since accurate timekeeping is required to keep precise timestamps on data collection, carry out certain security protocols, and schedule tasks beyond the device's wake time. Current timekeeping solutions require external synchronization or can only keep time for short periods (i.e. seconds) without power. We solve these issues by creating an external method of keeping track of time for intermittently-powered devices using constant low-power energy sources. We build a prototype of our system and power it with energy harvested from inexpensive soil microbial fuel cells (sMFCs). sMFCs utilize the waste products of naturally occurring soil bacteria to produce low but constant power of about 20 microwatts, around 1,000,000 times less power than a charging smartphone draws. We find this is still sufficient to sustain a real-time clock indefinitely while concurrently charging a supercapacitor for intermittent computing. We also implement a task scheduler that schedules when to gather sensor data based on time and show that our solution succeeds at executing applications previously inaccessible to intermittent computing systems.

Alfonso Godínez Aguilar

Chemical & Physical Biology, Harvard University
VERSA
Mentored by Dr. Melinda Owens

Investigating the Extent of Existing Opportunity Gaps and the Effectiveness of a Chemistry Intervention in Lower-Division Biology Courses

An understanding of chemistry within biology plays an important role in shaping students' science identity and influencing their trajectory in the life sciences. Our research aims to address the historical underrepresentation and exclusion of minoritized identities in science. This study, conducted at a large R1 institution, examines the presence of initial opportunity gaps within various minoritized groups in lower-division biology courses, focusing on their prior exposure to chemistry, comfort level with chemistry, and performance on a chemistry pre-quiz. Additionally, we investigate the effectiveness of a chemistry intervention in mitigating equity gaps within these groups, considering their overall course performance and attitudes toward biology. To measure student performance, we utilized a pre- and post-chemistry quiz, the first midterm exam (which focused primarily on chemistry topics within biology), and the final course grades. Students also reported their prior experience and comfort level with chemistry. A qualitative analysis of post-course survey responses was performed to gain insight into the impact of chemistry topics and of a chemistry intervention on students' biology experience. Anticipated findings include the identification of opportunity gaps among different minoritized groups, highlighting the existing disparities. Moreover, we expect that the intervention will enhance students' chemistry knowledge and, to some extent, mitigate equity gaps in student performance. By shedding light on the challenges faced by minority groups in these courses and evaluating the effectiveness of a targeted intervention, this research contributes to the promotion of inclusivity and equal opportunities within undergraduate biology education.

Preston Gomersall

Aerospace Engineering, UC San Diego
Summer TRELS
Mentored by Professor Oliver Schmidt

Robust Design and Optimization of Turbomachinery Compressors

Dedicated to advancing technology for a greener and more cost-effective future in air transportation, this research project focuses on enhancing the performance of gas turbine engines, which play a vital role in the operation of commercial aircrafts. The specific area of interest lies in optimizing the compressor component of the turbine engine. This component compresses air prior to entering the combustion chamber, where it undergoes fuel combustion to generate thrust for the aircraft. Factors affecting compressor performance, such as blade twist angle, blade geometry, and inlet and outlet mass flow rate, are analyzed and optimized to improve efficiency and overall performance. The

utilization of Ansys software, employing computational fluid dynamics (CFD) for intricate calculations, allows for the development of a comprehensive model and offers a range of optimization tools effectively utilized throughout the research process.

Briana Gomez

Anthropology Biological Concentration, UC San Diego
Triton Underground Scholars
Mentored by Aftab Jassal

Transcending the Cycle: Exploring Karma, Yoga and the Healing of Generational Trauma

This research explores the role of embodied experience in spiritual practices in the modern world, addressing a gap in knowledge and understanding. Previous studies have touched on the connection between the body and spirituality, but further investigation is needed to integrate contemporary perspectives, cross-cultural and interdisciplinary approaches, quantitative and experimental designs, as well as experiential and phenomenological research methods. This study examines how individuals perceive and engage with their bodies during spiritual practices and how these experiences impact their biological well-being and connection to the divine or absolute. The research involves a comprehensive literature review, encompassing diverse religious and spiritual traditions and psychological frameworks. Qualitative methods, such as interviews and observations, are employed to explore subjective experiences of embodied spirituality. Quantitative studies investigate the relationship between specific aspects of embodied experience and spiritual well-being. Longitudinal and experimental designs are utilized to explore causal relationships and long-term effects. The main argument is that the body is indispensable for connecting with the absolute, and the world and the human body can serve as channels to salvation. The research also explores potential outcomes related to generational healing and karma, as well as tangible biological markers of the body. These outcomes shed light on the impact of embodied spiritual practices in fostering personal growth, spiritual development, and healing. The findings have implications for individuals seeking a deeper understanding of their physical health, spiritual journeys, and for practitioners and researchers in psychology, anthropology, theology, the medical field and spirituality.

Rubi Gomez

Public Health, UC San Diego
McNair Scholars Program
Mentored by Dr. Britta Larsen

Social Support and Physical Activity Attitudes

Childhood obesity is a prevalent issue in the US, affecting 14.7 million children. Latino teenagers are particularly vulnerable to this problem due to insufficient levels of physical

activity (PA). Moreover, social relationships can play a significant role in shaping attitudes toward exercise. The relationship between parental or peer support and PA has not been comprehensively explored on a global scale or within the Latina community. This is a crucial gap that needs to be filled. The objective of this study is to investigate whether social support from parents or peers is linked to the PA attitudes of teenage Latinas. Data were taken from Chicas Fuertes, a randomized trial of a mobile technology-based physical activity program for Latina teens. The cross-sectional analysis used baseline data from a whole data set of 174 adolescent participants aged 13 to 18, collected from August 2020 to June 2023. Multiple regression analysis was used to compare the strength of the links between the predictor variables (parental social support and friend social support) and the outcome (attitudes towards PA). Attitudes towards PA were measured using the PACES survey which is derived from a validated survey asking participants to rate their enjoyment of PA on a scale from 1-7. The predictor variables were measured by averaging the survey responses into single scores for parental social support and friend social support. Understanding which social relationships have a greater association can help improve physical activity levels among Latina adolescents in the U.S.

Michelle Gomez

Cognitive and Behavioral Neuroscience, UC San Diego
STARS
Mentored by Dr. Christine Smith

Hippocampal Subregions and their relationship to news event memory in older adults with normal cognition or mild cognitive impairment

Individuals with Mild Cognitive Impairment (MCI) are at risk for developing Alzheimer's disease (AD). According to existing tests, MCI patients exhibit extensive impairment in remembering the past (retrograde memory, RM) concurrent with only mild impairment in new learning. This finding suggests that more sensitive RM tests could identify MCI closer to when subtle neural and cognitive changes begin, therefore improving earlier diagnosis and access to interventions. In older adults with either MCI (N=36) or normal cognition (NC) (N=34), we examined if a novel RM news events test (RM-NET) can significantly predict brain volumes of hippocampal subregions known to decline in AD (i.e., CA1 and subiculum). RM-NET scores significantly predicted the volumes of the whole hippocampus, subiculum, CA1, and dentate gyrus in the MCI group. No significant relationships were identified in the NC group for the RM-NET scores. The RM-NET holds promise for tapping into the brain structures that are known to decline early in AD.

Mynel Gomez Alvarez

Metallurgical & Materials Engineering, University of Texas at El Paso
MRSEC REU or RIMSE
Mentored by Krista Balto / Professor Joshua Figueroa

Investigating Solvent Impact of Selective Nanocrystal Surface Ligation Using Sterically-Encumbered Metal-Coordinating Ligands

The impact of organic ligands on nanoparticles is a critical factor influencing their behavior and physiochemical properties. Ligands like citrate or polyvinylpyrrolidone (PVP) play a crucial role in stabilizing nanoparticles and controlling their surface properties. Meanwhile, previous research on sterically encumbered m-terphenyl isocyanide ligands has yielded important findings, showcasing selective binding and leading to principles that can now be expanded to a vast library of ligands that have already been studied for molecular metal coordination complexes (ACS Nano, 2022). One crucial aspect is the significant influence of solvents on the rate of ligand exchange regarding the solvents' varying polarity, density, and dielectric constants affecting the ligand dynamics. Our research employs several techniques, such as transmission electron microscopy (TEM), UV-Vis spectroscopy, surface-enhanced Raman spectroscopy (SERS), and dynamic light scattering (DLS) to investigate the dynamics of ligand diffusion, molecular desorption, and solvent extraction after ligand exchange has occurred of different solvents.

Amanda Gonzalez

Cognitive and Behavioral Neuroscience, Psychology, UC San Diego
McNair Scholars Program
Mentored by Dr. Katherine Bangen

Objectively-Defined Subtle Cognitive Decline and its Association with CSF GAP-43

Objectively-defined subtle cognitive decline (Obj-SCD) is an emerging classification that may identify individuals at risk for future neuropathologic changes prior to a diagnosis of mild cognitive impairment (MCI) or dementia. In this study, we focused on the presynaptic protein growth-associated protein 43 (GAP-43), which is a marker of synaptic dysfunction, and has been associated with cognitive decline and Alzheimer's disease (AD). To test associations between Obj-SCD and GAP-43, we examined the cerebrospinal fluid (CSF) GAP-43 measurements of participants from the Alzheimer's Disease Neuroimaging Initiative (ADNI) cohort. Participants were divided into 6 groups based on cognitive status (cognitively unimpaired (CU), SCD, or MCI) and whether they are AD biomarker negative or positive, based on amyloid beta imaging using positron emission tomography (PET). The CU- group showed lower baseline GAP-43 than all biomarker positive groups. When analyzing trajectories of functional abilities over time, higher GAP-43 at baseline predicted a steeper rate of decline for the MCI+ and SCD+ groups compared to other groups. Our findings suggest GAP-43 may be a useful predictor for further cognitive decline and support biological meaningfulness of the SCD classification.

Sara Gonzalez

Public health with concentration in medicine sciences, UC San Diego

YES program
Mentored by Dr. Georgia Sadler

How to Reduce Areca Nut Attributable Oral Cancers in Western Pacific/Southeast Asia Regions

The use of areca nut and betel quid increase the risk of oral cancers. This narrative review of the scientific literature tests the hypothesis that: "There are evidence-based primary and secondary prevention methods available to reduce the use of areca nut and betel quid (BQ)." Eligible articles were focused on oral cancers correlated with chewing areca nut or BQ. PubMed, CINAHL, EthnicNews, and Google Scholar databases were searched for eligible articles written in English, with full-text accessibility, and published between 2002 and 2023. Articles were also found in the citation lists of relevant articles. Search words used included areca, nut, oral cancer, betel, quid, prevention day, regulations, carcinogen, and policy. Carcinogenicity of areca nut has not been widely communicated or acknowledged in most areca nut-consuming countries and no global policy exists for its control. However, Taiwan reported using primary prevention through individual interventions and public policy mechanisms, and reported a significant impact on oral cancer knowledge and awareness, reduction of risk habits, and increased uptake of mouth self-examination. These prevention methods include an Areca Prevention Day, legally implemented areca nut/betel quid-free environments, spitting betel quid juice laws, education and awareness promotion, and the Betel Quid Plantation Program. These significantly showed reduced prevalence of areca nut chewing. Taiwan's cumulative preventative measures have proven highly effective and offer examples of interventions that could be implemented worldwide to reduce the prevalence of areca-nut and betel-quid usage and its attributable oral cancer.

Austin Gou

Molecular and Cell Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Matthew Daugherty

Unpacking PAK6

Positive-sense single-stranded RNA (+ssRNA) viruses consist of many highly pervasive human pathogens, including poliovirus, dengue virus, and SARS-CoV 2. As part of their life cycle, the genomes of these viruses are translated into large polyproteins that require processing from virus-encoded proteases to be cleaved into functional subunits. In addition to being a critical modulator of the viral life cycle, these proteases often cleave host proteins, including those involved in host antiviral defenses. The antagonistic interactions between viral proteases and host proteins serve as the basis for host-viral arms races, where viral proteases and host targets both rapidly evolve to maintain or evade this interaction. P21-activated kinase 6 (PAK6), is a host protein that I have demonstrated is consistently cleaved by proteases derived from viruses in the

Picornaviridae and Coronaviridae families. I have also shown that cleavage is virus and host-specific and have mapped the primary sites of cleavage within the PAK6 sequence for both families of viruses. PAK6 has previously been shown to be involved with cell signaling pathways that regulate cell death through apoptosis. My goal is to characterize how viral protease induced cleavage of PAK6 influences these apoptosis regulatory pathways. By characterizing the downstream effects of this interaction between host protein and viral protease, I seek to uncover the significance of PAK6 and its status as a viral protease target in the context of host innate immunity and viral pathogenesis.

John Greene

Pharmacological Chemistry, UC San Diego
Summer TRELS
Mentored by Dr. Emmanuel Theodorakis

Total Synthesis of Natural Products

Due to proprietary information this abstract has been redacted.

Andrea Guerra Chong

Neurobiology, UC San Diego
STARTNeuro
Mentored by Dr. Daniel Whittaker

Cellular Senescence in the Aging Brain

Due to proprietary information this abstract has been redacted.

Veronica Gutierrez

Psychology, CSU, Northridge
STARS
Mentored by Lindsey Powell

Joint Attention in Early Infancy

Due to proprietary information this abstract has been redacted.

Emmanuel Gutierrez

Cognitive Science with a Specialization in Machine Learning and Neural Computation, UC San Diego
McNair Scholars Program
Mentored by Dr. David Danks

Developing Fairness Criteria for Ethical Artificial Intelligence: Generalizing Harm Mitigation across Diverse Groups

As artificial intelligence (AI) becomes more common in everyday use, the problems it can cause become more evident. This research project addresses the ethical challenges posed by algorithm bias and errors in AI systems through the development of new fairness criteria. Traditional fairness approaches often focus on the probability of an algorithm making an error due to group membership, which may inadvertently neglect the disproportionate harms to certain groups. To promote a more equitable and inclusive AI landscape, this study proposes the creation of fairness criteria that prioritize generalizing harm mitigation across all groups, regardless of their membership. The research outline encompasses several key areas: firstly, an introduction highlighting the significance of fairness criteria in AI, recognizing the limitations of existing approaches to generalized harm mitigation; secondly, a comprehensive review of current fairness frameworks and their constraints; thirdly, the definition and formulation of novel fairness criteria to account for harm distribution across diverse groups; fourthly, an evaluation of these criteria on benchmark datasets and real-world AI applications; fifthly, an exploration of ethical considerations involved in implementing fairness criteria; and finally, recommendations for integrating the proposed fairness criteria into AI development practices. Through this project, we aim to contribute to a more ethical and socially responsible deployment of AI systems, ensuring fairness and inclusivity for all groups in modern society.

Leticia Guzman

Communication/Music, UC San Diego
McNair Scholars Program
Mentored by Professor Amy Cimini

undetonated borderlands: ancestral rage, healing and artistic practices against state violence in stolen and border-militarized Kumeyaay territory

At the end of 2022, the U.S./Mexico border hit record heights of asylum-seeking individuals and migrant deaths. I grew up within the borderlands of the stolen and border-militarized Kumeyaay territory, so crossing back and forth to visit family in Mexico was an integral part of my upbringing. In 2018, I jumped into border field work coordinating donation drives from Sherman Heights to Tijuana refugee shelters as an emergency response to arriving migrant caravans and the Trump Administration’s border closures; bearing witness to the atrocities of our immigration system and real-life implications of racist policy. I remember staying late at night at an encampment outside of El Chaparral and listening to a migrant child singing “One Love” by Bob Marley while people came out of their tents to share a collective moment of peace despite the odds stacked against them. Inhabiting artistic practices, like music and theater, serves as a means for survival. This has pushed me to re-imagine how anger can be used for political and artistic liberation. Audre Lorde's speech, "The Uses of Anger" plays on the strings that anger from injustice is not only mine because it is collectively and ancestrally shared. This potent, unbreakable sense of hope coupled with a fine balance of desperation has been carried through generations of state violence and oppression seemingly undetonated. This project will illuminate the basis that art is political and that we are all artists. I will combine my experience of the border while building a bridge between geographical history, analysis, and interviews.

Farah Haleem

Human Biology, UC San Diego
McNair Scholars Program
Mentored by Dr. Shyamanga Borooah

Using Base-Editing as a Treatment Approach for Autosomal Dominant Inherited Retinal Degenerations

Retinitis Pigmentosa (RP) is a common early-onset autosomal dominant disease categorized under Inherited Retinal Degenerations (IRDs). It significantly impairs patients' quality of life, starting with peripheral vision loss in childhood and progressing to central vision loss and complete blindness. Current treatment options for PRPH2-associated disease are limited due to its dominant inheritance and potential haploinsufficiency, resulting in both gain and loss of function effects. Gene editing, specifically base editing, offers a potential approach to correct pathogenic mutations without the drawbacks of double-stranded breaks associated with traditional CRISPR-based editing. This process involves CRISPR-based targeting and a DNA base editor. PRPH2 mutations, such as the G208D mutation, cause RP by rendering the peripherin-2 protein nonfunctional, leading to photoreceptor loss. Peripherin-2 is essential for the development of photoreceptor outer segments crucial for vision. PRPH2 mutations are associated with various forms of autosomal dominant IRD, including macular and peripheral diseases, and can result in different diseases among individuals due to modifying factors. The study will utilize RP cells extracted from blood samples of patients with the PRPH2 mutation as the disease model system. The methods involve designing guide RNAs, optimizing PAM location, cloning gRNA expression using the Golden Gate Cloning Method, transfecting cells with sgRNA and Base-Editor plasmids, and subsequently sequencing and analyzing the transfected cells for base-pair substitution efficiency and indel levels. The next step would be cell transfection and sequencing.The project aims to develop a CRISPR base editor that can correct the specific point mutation in RP, restoring protein function and curing the disease by precisely replacing the faulty amino acid with a healthy one.

Justin Han

Environmental Systems - Ecology, Behavior, Evolution, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Sarah Aarons

Tracing Zirconium Stable Isotopes: River to Sea

Due to proprietary information this abstract has been redacted.

Joshua Hartman

Human Biology, UC San Diego
Multidisciplinary Approach to Addressing Cancer Disparities
Mentored by Dr. Georgia Sadler

Facilitating Hybrid Learning in Support Groups for Patients with Multiple Myeloma

Multiple Myeloma (MM) patient support groups, like most support structures, were not immune to the immediate shift to remote learning and ensuing confusion during the onset of the pandemic. A narrative literature review was conducted to gather the most current information regarding effective methods in promoting hybrid learning for cancer patient support groups, with a specific focus on MM. Articles reviewed were found using PubMed, Google Scholar, and Web-of-Science via the keywords Support groups, Hybrid Learning, and Multiple Myeloma. Publications in the last 5 years, in English, and with full-text availability were included in this review. As the world begins to recover from the pandemic, everything has begun to shift to a hybrid functionality which involves remote and in-person learning components. Unfortunately, a large majority of patients with MM are of increased age meaning that poor computer/internet literacy is common. Furthermore, immunodeficiencies as a result of MM itself and MM treatments raise risks in settings where outside exposure increases. Despite these obstacles, hybrid learning has tremendous potential. The incorporation of digital tools provides accessible resources and adaptable learning avenues, thereby nurturing engagement and knowledge retention. Complementing this, strategic in-person sessions foster emotional support and shared experiences, both of which are essential to the health of MM patients. This review seeks to improve comprehension of hybrid learning and the most beneficial ways to address related challenges, thereby facilitating the development of MM-specific education interventions and support infrastructures.

JD Heidenrich

Computer Engineering, UC San Diego
ECE SRIP
Mentored by Dr. Nicholas Antipa

Miniscope

Microscopes are valuable tools in the world of science, but their models tend to be bulky and difficult to maneuver. A smaller design of a microscope, that still produces a quality image, would allow for a vast number of experiments that were not possible before. The idea of an ultra-miniature microscope has been researched for several years now at UCLA and their research aims to monitor the brain activity of mice, while they are

unrestrained. This has revolutionized neuroscience research because it allows researchers to observe the brains of the mice, while they are free to roam around and act normally. The research I am conducting aims to build upon this miniscope by investigating the possibility of swapping out specific parts. At the top of the list of changes is to connect a sensor that is capable of recording the firing of neurons, which is not possible with the current sensor in the miniscope.

Vincent Hernandez

Molecular and Cellular Biology, UC Merced
STARS
Mentored by Dr. Vivian Hook

Development of Cathepsin B Assay Over a Broad pH Range in Human Brain Disorders

Cathepsin B biologically functions within the acidic pH of the lysosome but has displayed pathological substrate cleavage properties at the neutral pH of the cytosol, nuclei, and extracellular locations. This range of activity presented the need to develop substrates that measure cathepsin B activity across pH levels which can provide insight into the mechanisms of its broad enzymatic activity. The Z-Nle-Lys-Arg-AMC substrate has been proven to have activity between pH 4.6 and pH 7.2 and was specifically cleaved by cathepsin B over other cysteine cathepsins. It successfully monitored cathepsin B activity in neuronal and glial cells which are relevant to human brain disorders such as traumatic brain injury and Alzheimer's disease. Assay development utilizing this substrate will provide valuable insight into understanding the mechanisms that cathepsin B has in mouse models of human disease conditions that are associated with neurodegeneration. The results of this development will help advance the discovery of therapeutic targets for cathepsin B.

Veronica Hernandez

Psychology with a Specialization in Clinical Psychology, UC San Diego
HHMI Janelia-Meyerhoff Undergraduate Summer Program
Mentored by Dr. Boaz Mohar, Dr. Gabriela Michel, Dr. Nelson Spruston

Protein Turnover Measures Location of Synaptic Plasticity in Mice Learning a Task

Throughout our lives, we use our prior knowledge and experiences to determine appropriate responses to new situations; this ability in both humans and animals involves learning and memory, and is crucial for survival. Neural recording methods such as calcium imaging and electrophysiology found that there are many brain regions with activity correlated to tasks involving learning and memory. These learning and memory processes are thought to be implemented by synaptic plasticity. However, despite finding changes in activity in specific brain regions, these correlates of neural activity do not guarantee that the change in synapses are in these regions and that this activity is responsible for learning and memory. To address this knowledge gap, we recently described a method to measure protein turnover in mice to study learning. In these experiments, water restricted mice are placed on a virtual reality rig, and are trained to associate a cue with a reward before analyzing protein turnover post-mortem. Results will help identify where in the brain synapses change during learning by highlighting the brain region with the most proteins turned over after mice learned a task. These results will provide valuable insight into locating where in the brain synapses change during learning and memory, which will help better understand functions of different brain regions and guide future experiments to determine mechanisms of synaptic plasticity.

Saba Heydari Seradj

Neurobiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Li Ye

Investigating changes in neuronal activity of fat-innervating sensory neurons

Due to proprietary information this abstract has been redacted.

Camilla Hong

Biotechnology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Professor Prashant Mali

In-Situ Circularized RNA Optimization To Tackle Gene Dysregulation

Due to proprietary information this abstract has been redacted.

Duncan Hong

biology, UC San Diego
Multidisciplinary Approach to Addressing Cancer Disparities
Mentored by Georgia Sadler

Multiple Myeloma's Prevalence in China

Multiple myeloma is a plasma cell malignancy that is marked by a deficiency in red blood cells, bone lesions, and excess blood calcium levels. Patients diagnosed with multiple myeloma have a 5-year survival rate of around 55%. This malignancy is typically observed in older patients, and has no known environmental risk factors. While overall understanding of myeloma prevalence in developing countries is limited, recent studies surrounding myeloma burden in China have identified that people in developing countries may be at risk for getting the disease at a younger age than people in developed countries, and that Asian males may be more susceptible than Asian females to

hematological cancers such as myeloma. This literature review will explore the dynamics of the age and gender disparities within myeloma in China, and suggest actions that can be taken in light of these disparities. Included in this study are scholarly articles from 2018 onward, taken from PubMed, Google Scholar, and the UC Library Search; the following keywords were used to find articles: multiple myeloma, disparities, blood cancer, Asian-American, China. This review contains statistics on myeloma incidence in China, stratified by age group, gender, and geography, risk factors that Chinese people face, and an overall discussion on the implications of these findings and suggestions for future action.

Megan Hosfield

Sociology, CSU, San Marcos
STARS
Mentored by David Fortunato

How does the administrative burden of prior authorization of health insurance policies impact the quality of care in the United States for marginalized communities?

This research presents the challenges Americans must face with prior authorization policies from health insurance agencies. It introduces the challenges marginalized communities face in addition to receiving authorization through the frustrating period of uncertain approval odds.

Sophia Hsu

Chemistry, UC San Diego
MRSEC REU or RIMSE
Mentored by Professor Michael Sailor

Optimization of Lipid Coating on Porous Silicon Nanoparticles Using a Microfluidic Solvent Mixing System

Porous silicon nanoparticles can act as effective nanocarriers for therapeutics in biomedicine, however the nanoparticles can lack biostability. One way to improve the biostability of nanoparticles is with surface coatings. Lipids have emerged as versatile nanoparticle coatings that impart enhanced biocompatibility and stability. This work explores use of lipid-coated porous silicon nanoparticles (pSiNPs) as a method of gene delivery with potential for a variety of infectious disease and cancer treatments. Current lipid-coating processes for pSiNPs are unreliable as they yield polydispersed nanoparticles. Our work aims to optimize the lipid-coating process for pSiNPs through use of a microfluidic solvent mixing system. Mixing an organic solution of lipid and an aqueous solution of pSiNPs in a staggered herringbone mixer, we aim to produce lipid coated nanoparticles. In order to optimize the lipid-coating processes the total flow rate, flow rate ratio (ratio of flow rate of lipid solution to flow rate of aqueous solution), and molar ratios are adjusted to assess which parameters will yield the most uniform particles.

These nanoparticles will be characterized by Dynamic Light Scattering (DLS), Zeta Potential, Transmission Electron Microscopy (TEM) and Nanoparticle Tracking Analysis (NTA). If successful, this work will provide a standard optimized procedure for the coating of porous silicon with lipids.

Daisy Hu

NanoEngineering, UC San Diego
Haddad Lab
Mentored by Hang Yao

Exploring the Effect of Basic Fibroblast Growth Factor on Methadone-Impacted Early Brain Development Using Human Cortical Organoids

Methadone is a medication used to treat opioid use disorder during pregnancy. However, Methadone usage during pregnancy may cause birth defects, including neurological defects in infants' brains. Using human cortical organoids (hCOs) as a model for early infant brain development, previous studies have shown that methadone causes cellular death in hCOs. Basic fibroblast growth factor (bFGF) is a polypeptide involved in cell differentiation and proliferation in various cell types. In this research, we explore whether the presence of bFGF alleviates cellular death caused by methadone by treating hCOs with bFGF and Methadone concurrently.

Evan Huang

Chemistry, UC San Diego
MRSEC REU or RIMSE
Mentored by Dr. Shaowei Li

Dosing and Study of O-BODIPY Dye in Scanning Tunneling Microscope

The high-performance chiral response of the O-BODIPY dye molecule has been previously developed and covered in the visible spectrum. However, there is currently a lack of clear experimental maps that correlate local electronic structures with chiral properties in such structures. Here, we combine scanning tunneling microscope (STM) and circular dichroism (CD) to detect the electronic orbit and optical properties of chiral O-BODIPY dye. A low-cost, easy-to-build, and compact Knudsen cell is fabricated for the dosing of the O-BODIPY molecules in STM.

Christopher Huerta

Neurobiology, UC San Diego
PATHS Scholars
Mentored by Dr. Ardem Patapoutian

Expression of Mechanosensative Ion Channels in the Gastrointestinal Tract

The Enteric Nervous System is composed of the neurons that regulate our gastrointestinal function, including digestion, for which mechanical and chemical processes are essential. However, the mechanisms and the identity of the molecule detecting mechanical distention at the cellular level remain unknown. Piezo proteins are recently discovered mechanosensitive ion channels that play a crucial role in mechanotransduction—the cell's ability to convert physical stimuli into biochemical signals—throughout the body. However, their expression in enteric neurons and their role in the initiation of peristalsis are poorly understood. This research aims to reveal the presence of Piezo1 and Piezo2 channels in gut neurons at the transcript and protein levels. In situ hybridization will be used to reveal any Piezo transcript expression. For protein localization, transgenic mouse models with fluorescent proteins fused to Piezo1 and to Piezo2 will be used. Mouse gastrointestinal samples will be analyzed using neuronal markers to distinguish the presence of neuron-specific Piezo channels. It is expected that Piezo expression on both the transcript and protein levels will be shown, however, likely not in a 1:1 ratio. It is also expected that previous transcriptomic data showing a lack of co-expression between Piezo1 and Piezo2 will be validated. The identification of the specific molecules at play in mechanical digestion opens the door to understanding how impaired mechanotransduction affects gut-related disorders.

Matisohn Huynh

Electrical Engineering, Palomar College
STEMULATE
Mentored by Abdullah Albatta / Professor Truong Nguyen

Effect of CT Scan Image Enhancement on The Ability of Deep Learning Models to Segment Lesions in the Liver.

Image enhancement techniques significantly impact the performance of deep learning models, often enhancing model generalization and overall accuracy. However, not all image enhancements yield improved results; some can degrade model performance by introducing unrealistic representations of the underlying data. This research investigates the effect of various image enhancement techniques on the performance of deep learning models designed for liver lesion segmentation. We particularly focus on image denoising techniques and intensity transformations, including BM3D, Non-Local Means, spatial filtering, contrast stretching, and image sharpening. These techniques were chosen due to the challenging nature of liver lesions in CT scans, which are frequently difficult to distinguish and separate from surrounding healthy tissues due to noise, blurred boundaries, and similar intensity values and histogram distribution. The findings from this study will potentially provide guidance for suitable pre-processing of CT scans to improve deep learning models performance for accurate segmentation of liver lesions.

Jaden Huynh

Cognitive and Behavioral Neuroscience, UC San Diego
McNair Scholars Program
Mentored by Dr. Greg Appelbaum

Exploring EEG Biomarkers for Treatment Prediction in Obsessive-Compulsive Disorder: A Comprehensive Review

This review explores the use of EEG biomarkers, specifically EEG complexity and gamma oscillations, in predicting treatment outcomes for patients with obsessive-compulsive disorder (OCD). A comprehensive search of electronic databases was conducted to identify relevant studies published in peer-reviewed journals between 2005 and 2023. Inclusion criteria involved studies that focused on patients diagnosed with OCD, and investigated EEG biomarkers predictive value for treatment response. The reviewed studies suggest that EEG complexity and gamma oscillations hold promise as biomarkers for predicting treatment response in OCD patients. One study indicated that EEG complexity could serve as a biomarker for predicting treatment resistance in OCD, while another study highlighted the potential of gamma oscillations as a predictor of treatment response to paroxetine. Furthermore, neurophysiological markers, including EEG and transcranial magnetic stimulation (TMS), have been recognized as valuable tools in the treatment of OCD, as indicated by consensus statements and previous research. Digital interventions and emerging technologies have also shown potential in enhancing prediction, assessment, and intervention for OCD. Despite supporting evidence for the use of EEG complexity and gamma oscillations as biomarkers, further research is necessary to establish their reliability and validity. Additionally, future investigations should explore additional biomarkers and innovative interventions to advance the prediction, assessment, and treatment of OCD. Such advancements hold the potential to improve patient outcomes and deepen our understanding of the underlying mechanisms of OCD.

Emily Infante

Biochemistry, UC San Diego
MRSEC REU or RIMSE
Mentored by Professor Andrea Tao

A general method for the fabrication of binary nanoparticle assemblies

Due to proprietary information this abstract has been redacted.

Lucy Ishkhanian

Psychology, CSU, Northridge
STARS
Mentored by Dr. Gail Heyman

"It's like an all-knowing oracle!": Beliefs about how ChatGPT works and how its use will impact education

Since ChatGPT became widely available in November 2022, many individuals who previously knew nothing about Generative A.I. began discussing and using it. Undoubtedly, it will have a huge impact on the future of education, but because the technology is so new, we know little about what its impact will be. Now it is critical to examine how lay people with no expertise in engineering and machine learning understand what ChatGPT is and what it can do. Anecdotally, many people have incorrect beliefs about it, with some overestimating its limitations (e.g., can only be used as a calculator) and others overestimating its capabilities (e.g., it is a sentient being). Our project will investigate college students' and educators' beliefs about the capabilities of ChatGPT and the consequences of using it for education. In online surveys and follow-up interviews, we will ask participants to evaluate statements such as "ChatGPT can produce accurate responses all the time" and predict whether common uses of ChatGPT will benefit or hinder students' learning. We expect participants to have misconceptions that ChatGPT can solve any problem and detect its own previously generated outputs. We also believe that students will think using ChatGPT will help with learning, while educators see it as a hindrance. The findings will inform decision making for the integration of Generative A.I. in college coursework by revealing misguided beliefs that need to be corrected and identifying points of risk that threaten learners' abilities to think critically and generate original ideas.

Clarissa Jacobo Hernandez

Bioengineering, UC Berkeley
STARS
Mentored by Dr. Karen Christman

Exploring the Regenerative Process of Injured Pelvic Floor Muscles in Pregnant Rat Model

Pelvic floor disorders (PFDs) affect one in three women causing challenges such as bladder control problems, bowel control problems, and pelvic organ prolapse. These disorders arise from weakened pelvic floor muscles(PFMs) predominantly observed in women who have experienced injury from vaginal delivery. During vaginal delivery, the pelvic floor muscles stretch about three times the length of their relaxed state, resulting in long-lasting damage. Research conducted on non-pregnant rat models has demonstrated that simulated birth injury(SBI) can disrupt the repair process of PFMs and hinder their functionality. In our project, we plan to conduct SBI on pregnant rat models to comprehend the primary risk factors for PFDs. By assessing the strained PFM regeneration process in lactating and non-lactating postpartum rats, we aim to elucidate the impact postpartum hormones have on muscle repair mechanisms. We expect to quantify the long term regeneration process by performing immunohistochemistry analyses of PFMs with collagen-1, laminin, alpha-smooth muscle actin(α-SMA), and isolectin. Collagen-1 staining will measure the scarred tissue around muscle fibers, an indicator of fibrosis that causes muscle stiffness and prevents muscle regeneration. Laminin and DAPI will be used to localize the centralized nuclei in fibers to quantify active regenerating fibers and calculate muscle fiber size. α-SMA and isolectin will indicate the vasculature, lining the walls of blood vessels and accentuating the endothelial cells in capillaries. Through this study, we aspire to contribute to the broader knowledge of PFMs, ultimately facilitating the development of more effective preventive measures and treatment options.

Devanshi Jain

Mathematics-Computer Science, UC San Diego
Summer TRELS
Mentored by Professor Oliver Schmidt

Robust Design and Optimization of Turbomachinery Compressors

Dedicated to advancing technology for a greener and more cost-effective future in air transportation, this research project focuses on enhancing the performance of gas turbine engines, which play a vital role in the operation of commercial aircrafts. The specific area of interest lies in optimizing the compressor component of the turbine engine. This component compresses air prior to entering the combustion chamber, where it undergoes fuel combustion to generate thrust for the aircraft. Factors affecting compressor performance, such as blade twist angle, blade geometry, and inlet and outlet mass flow rate, are analyzed and optimized to improve efficiency and overall performance. The utilization of Ansys software, employing computational fluid dynamics (CFD) for intricate calculations, allows for the development of a comprehensive model and offers a range of optimization tools effectively utilized throughout the research process.

Dominic Jauregui Haynes

Psychology with a specialization in Cognitive and Behavioral Neuroscience, UC San Diego
McNair Scholars Program
Mentored by Gedeon Deak

Responsiveness of Caregivers affecting play

Previous research has shown that sensitive development within infants can be denoted in the first year. In this research we will be looking at how responsiveness is. A view of 5 infant-mother dyads will be analyzed through a case study from 4,6,9, and 12 months. This study hopes to investigate how the affective responsiveness of a caregivers' interactions within play affect how the degree of play is followed. Analysis of this data is still being revised.

Ian Jayachandran

Computer Engineering, UC San Diego
ECE SRIP
Mentored by Professor Saharnaz Baghdadchi

Optical Voice Recorder Using Digital Holography

In this project, we will use interference to reconstruct audio signals using light. This process will first involve understanding how the phase of light can be modified with sound waves. Then, using an interferometer, the phase shifted light will be used to create an interference pattern. Spatial filtering and Fourier transform will be used to extract the phase information from the interference pattern and reproduce the original audio signal. By the end of this project, we expect to be able to record a voice signal from light and play it.

Katrina Jensen

Biochemistry, CSU, Long Beach
STARS
Mentored by Chengbiao Wu

Investigating the Differences in Mice With and Without Alzheimer's Disease Genotype

Due to proprietary information this abstract has been redacted.

Monica Jensen

Neurobiology, UC San Diego
Genentech Scholars Program
Mentored by Dr. Nicola Allen

MoleculeX overexpression in astrocytes as an approach to rescue astrocyte reactivity and synaptic loss in Alzheimer's Disease

During development astrocytes play a crucial role in regulating neuronal synapse formation and maturation. In neurodegenerative diseases such as Alzheimer's Disease (AD), there is a loss of neuronal synapses. Recent work has demonstrated that astrocytes in AD down-regulate expression of pro-synaptogenic proteins that support synaptic health. In parallel, a subpopulation of astrocytes transition to a reactive proinflammatory state called astrogliosis, which involves morphological rearrangement of the intermediate filament protein Gfap in astrocyte processes. These hyper-reactive astrocytes are often located in close proximity to the characteristic amyloid plaques that define AD. Our preliminary data shows that astrocytes in the APP/PSEN1 mouse model of AD have decreased mRNA expression levels of an astrocyte-enriched secreted protein, MoleculeX. During development MoleculeX regulates synapse and spine density. Thus, we hypothesize that targeting astrocytes with MoleculeX overexpression in APP/PSEN1 mice may be a promising approach to rescue astrogliosis and the loss of synapses. We developed a Cre-dependent viral-mediated approach to overexpress either MoleculeX or the control spaghetti monster fluorescent protein (smFP) in astrocytes. To assess the pathological outcomes,we will utilize immunohistochemical labeling to measure Gfap and 6E10 immunoreactivity in the hippocampus and frontal cortex. We can compare the area of Gfap labeling between wildtype mice and mutant mice expressing either smFP or MoleculeX. The 6E10 antibody labels amyloid plaques and we can measure the density of plaques between conditions. The data collected will provide insight into whether MoleculeX can be used to ameliorate astrocyte reactivity and repair synaptic loss in AD.

Ariel Jeon

Electrical Engineering, UC San Diego
ECE SRIP
Mentored by Professor Tina Ng

Visualizing Pressure Maps for Hypertonicity Assessment

Hypertonicity is a condition characterized by unusual muscle stiffness, and is commonly a result of neurological disorders. Evaluating its severity is crucial in selecting appropriate treatment, but current clinical evaluations rely on subjective scales that may either be too time-consuming or imprecise. To address this lack of a precise evaluation tool, my mentor has engineered a sensor glove to facilitate an accurate assessment model using pressure sensors. For my summer research, I’ve focused on developing a user interface for our collaborating clinicians at Rady Children’s Hospital to visualize the pressure maps of the sensor glove. This task will be accomplished using MATLAB and LabVIEW. The interface is expected to ensure consistency and differentiation when being used during clinical evaluations. The goal is to provide real-time feedback to the clinicians, so that they can check if the measurements are sufficiently consistent among different trials, and the visualized pressure maps would aid their analysis of movement limitations of different body areas in patients with hypertonicity.

Runpeng Jian

Computer Science, UC San Diego
UC LEADS
Mentored by Dr. Xiaolong Wang

Denoising Diffusion Model: Exploration of Methods in Inverse Problem

Denoising diffusion models are known for their ability to generate diverse types of data according to users' input. These models can handle various forms of data such as images, videos, and figures. The denoising process involves removing the predicted noise, obtained from a trained noise predictor, from a noisy image to align it with the user's desired outcome. In addition to advancements in diffusion models, significant progress has been made in solving inverse problems. These problems involve deducing or restoring missing or damaged parts of visual input data based on available observations. This research aims to investigate the potential of denoising diffusion models in addressing inverse problems, following two proposed methods presented at CVPR 2023: the replacement-based method and the reconstruction-based method. By exploring these approaches, we aim to uncover new possibilities for the application of denoising diffusion models in the field of inverse problems.

Yaya Jiang

Computer Science, UC San Diego
ERSP summer
Mentored by Professor Christine Alvarado

Understanding the Landscape of California Computer Science Transfer Pathways: A study of Transfer Agreements between California Public Universities and Community Colleges

Computer Science transfer students can face multiple challenges, as research has found that the pathways designed to prepare students to transfer into a 4-year university are not very straightforward. Additionally, while the ideal transfer pathway allows students to transfer courses so that all lower division graduation requirements are covered, this is not always the case as articulation agreements in computer science between a 4-year university and a community college are nonexistent or incomplete as they don’t have equivalent community college coursework that transfers to lower division requirements of the 4-year university. To assess how good a curriculum agreement is between a 4-year university and a community college, different characteristics of the agreements were calculated. These include the percentage of 4-year university requirements that did not have articulating courses, the greatest and average number of community college course credits that transferred to a single 4-year university requirement, and the greatest and average number of options of community college courses for a single 4-year university requirement. These metrics are used to determine which community colleges and 4-year universities are more or less well-positioned to support transfer. Additionally, whether the proximity of community college to a 4-year university is significant to how well courses articulate is also explored. This allows for a better understanding of the landscape of articulation agreements and whether proximity influences the quality of a transfer agreement.

Grace Jin

Computer Engineering & Cognitive Science, UC San Diego
ECE SRIP
Mentored by Professor Edward Wang

Revolutionizing Medical Activity Tracking: A Novel Wearable Hardware and Software Ecosystem for Irritable Bowel Syndrome Patients

Due to proprietary information this abstract has been redacted.

Irisa Jin

Data Science; Cognitive Science with a Specialization in Machine Learning and Neural Computation, UC San Diego
Multidisciplinary Approach to Addressing Cancer Disparities
Mentored by Dr. Georgia Sadler, Dr. Miguel Lopez-Ramirez

The Silent Influence of Mental Health Disorders on Cancer Care

One in five U.S. adults lives with mental illness, but its impact on cancer care is often overlooked. This narrative review of scientific literature explores what is known about the impact of mental illness on optimal cancer management, testing the hypothesis that mental illness compromises cancer care. Relevant full-text, peer-reviewed, English-language articles published between 2013 to 2023 were found via PubMed, EBSCO, Google Scholar, Ethnic NewsWatch, and CINAHL databases. Search terms included the ten most common mental illnesses, plus: mental health, cancer, disparities, early detection, treatment, mortality, and morbidity. A total of 20 articles were reviewed; five were relevant to the topic. Additional articles were identified through the reference lists of eligible articles. The identified studies included data from cancer patients with mental illness and interviews/questionnaires with healthcare professionals. Most studies suggested an inferior quality of cancer care for patients with mental illness with causes at both the patient and provider level. At the patient level, the delayed diagnosis, limited access to screening, and concerns about receiving appropriate treatment contributed to the disparity. At the provider level, the lack of coordination among different specialties and between healthcare professionals and patients, along with insufficient physical and mental health education, further widened the gap. Future research can use AI to develop unbiased, standardized mental health assessment algorithms to monitor the interaction between mental health and oncology care. This will help to ensure that seemingly inconsequential mental health changes are properly evaluated.

Daniel John

Bioengineering: Biotechnology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Weg Ongkeko

Integrative Liquid Biopsy Diagnosis of Head and Neck Squamous Cell Carcinoma

The development of liquid biopsy technology is vital for inexpensive, non-invasive diagnosis of cancer. Thus, the goal of this study is to train a deep-learning model that can diagnose HNSCC with high accuracy in blood samples, using integrated microbial and genomic signatures.

Anais Johnson

Biochemistry, CSU, Long Beach
MRSEC REU or RIMSE
Mentored by Ji-Ho Park / Gabriella Stark

Optimization of Zwitterionic Polymer Stealth Coating on Silicon Nanoparticles to Extend Nanoparticle Residence Time

Non-specific protein absorption on nanoparticles can cause rapid clearance of nanoparticles from the body via the mononuclear phagocyte system. Polyethylene glycol (PEG) is the most commonly used stealth polymer known to increase stability and decrease protein absorption. One drawback of PEG is continued treatment with PEGylated nanoparticles can lead to an accelerated blood clearance phenomenon due to the formation of antibodies. Zwitterionic polymer stealth coatings have emerged as an alternative to PEG and have been shown to offer numerous biochemical advantages in terms of reducing nonspecific protein adsorption and extending in vivo lifespan. Studies suggest that surface density of the zwitterionic polymers on nanoparticles is proportional to the biofouling ability of the nanoparticles. Our work aims to parametrically investigate factors affecting the density of zwitterionic polymers on the surface of porous silicon nanoparticles (pSiNP), as well as determine the optimal polymer chain length to maximize nanoparticle lifespans in vivo. Zwitterionic polymers will be grafted onto the surface of porous Si nanoparticles, and characterized by thermogravimetric analysis, Fourier transform infrared spectroscopy (FTIR), dynamic light scattering, and Zeta potential analysis to quantify the relative surface density between samples. We will utilize Bicinchoninic acid assays to examine the effect of the surface density and chain length of zwitterionic polymers in relation to the rate of non-specific protein adsorption on pSiNPs.

Ryan Jones

Chemical Engineering, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Nisarg Shah

Immunoregulatory Nanoparticles for Modulating Inflammatory Arthritis

The purpose of the proposed project is to contribute to our understanding of regulating autoimmune disorders. Autoimmune diseases arise when the body cannot regulate and maintain its own cells properly. Currently, the scientific community's knowledge surrounding these diseases are incomplete, and thus, the treatment options for those with autoimmune disorders are limited. My contribution to this topic will consist in the formulation and administration of small, drug-loaded particles. The size of my particles present a unique functional advantage in that they can interact with target cells in much different (and possibly more effective) ways than other drug therapies can. The particles in this study would utilize PLGA, a safe polymer already used in therapies today, loaded with ATRA, a drug used currently to stimulate the immune system in cancer therapy. The goal of the project is to understand the interaction of ATRA loaded nanoparticles in an inflammatory arthritis model. My approach would utilize Sakaguchi mice which have been bred to express inflammatory arthritis under specific conditions in order to model the associated condition in human arthritis conditions. The project will support my goal of developing a nanoparticle-based immunomodulatory treatment for inflammatory arthritis and other such autoimmune models in the future.

Mollie Jordan

Computer Science, North Carolina State University
Summer ERSP
Mentored by Adalbert Gerald Soosai Raj

Need a Programming Exercise Generated? ChatGPT's Got Your Back: Automatic Generation of Non-English Programming Problems Using OpenAI GPT 3.5

Large language models (LLMs) like ChatGPT are changing computing education and may create additional barriers to those already faced by non-native English speakers (NNES) learning computing. We investigate an opportunity for positive impact of LLMs on NNES through multilingual programming exercise generation. Following previous work with LLM example generation in English, we prompt OpenAI GPT-3.5 in different natural languages such as Tamil, Spanish, and Vietnamese, to create introductory programming exercises, sample solutions, and test cases. We evaluate these exercises on their sensibility, readability, topicality, cultural relevance, and readiness for use. Our results will provide a template for teachers and students to generate programming exercises in their own natural language and context, helping to overcome the challenges of exercise generation for professors and lack of resources in non-English languages.

Richa Kafle

Computer Science B.S., UC San Diego
CSE ERSP
Mentored by Professor Christine Alvarado

Understanding the Landscape of California Computer Science Transfer Pathways: A study of Transfer Agreements between California Public Universities and Community Colleges

Computer Science transfer students can face multiple challenges, as research has found that the pathways designed to prepare students to transfer into a 4-year university are not very straightforward. Additionally, while the ideal transfer pathway allows students to transfer courses so that all lower division graduation requirements are covered, this is not always the case as articulation agreements in computer science between a 4-year university and a community college are nonexistent or incomplete as they don't have equivalent community college coursework that transfers to lower division requirements of the 4-year university. To assess how good a curriculum agreement is between a 4-year university and a community college, different characteristics of the agreements were calculated. These include the percentage of 4-year university requirements that did not have articulating courses, the greatest and average number of community college course credits that transferred to a single 4-year university requirement, and the greatest and average number of options of community college courses for a single 4-year university requirement. These metrics are used to determine which community colleges and 4-year universities are more or less well-positioned to support transfer. Additionally, whether the proximity of community college to a 4-year university is significant to how well courses articulate is also explored. This allows for a better understanding of the landscape of articulation agreements and whether proximity influences the quality of a transfer agreement.

Samuel Kahn

General Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Associate Professor Nicola Allen

Validation of an Astrocyte Specific Smad4 cKO in Fragile X Syndrome Mice

The gene Fmr1 encodes for the protein translational regulator FMRP (Fragile X Messenger Ribonucleoprotein). The loss or mutation of this gene causes the genetic disorder Fragile X Syndrome (FXS), a common inherited form of intellectual disability and autism spectrum disorder. Previous research in the Allen lab has shown that factors secreted by astrocytes, glial brain cells, help encourage neuron growth. This secretion is called ACM, or astrocyte conditioned media. ACM obtained from FXS astrocytes has been shown to lead to abnormal neuronal outgrowth. Specifically, FXS astrocytes increase secretion of the protein Bone Morphogenetic Protein 6 (BMP6), which changes astrocyte properties, inhibiting neuronal outgrowth. My graduate mentor and I are investigating if suppressing BMP signaling in astrocytes specifically can rescue FXS deficits. He has created a mouse line that has an astrocyte-specific knockout of BMP signaling via Cre-Lox recombination. This knockout targets the gene Smad4, which is at the end of the intracellular signaling pathway for BMP6. I will assess the efficiency and specificity of this knockout in different parts of the brain. I will do this by detecting astrocytes and Smad4 protein in brain tissue slices with immunofluorescence and confocal microscopy, and quantifying Smad4 intensity within astrocytes in the visual cortex, auditory cortex, superior/inferior colliculus, and thalamus with Imaris semi-automated image analysis. We hypothesize the knockout will be efficient and astrocyte-specific in all parts of the brain. Within neurodevelopmental disorder research, the role of astrocytes is understudied. These findings will contribute to future research aimed at rescuing FXS pathology.

Ishita Kakkar

Computer Science, Mathematics, University of Massachusetts
ERSP
Mentored by Dr. Mai ElSherief

Examining Mental Burnout Discourse Across Reddit Online Communities

This research aims to identify indicators of mental burnout in online conversations and explore the support needs of individuals when sharing their burnout experiences on social media platforms like Reddit. Mental burnout, induced by chronic stress, significantly impacts individuals' well-being across various domains, including occupational settings and personal hobbies, with wider societal implications. While previous research has extensively explored depression, and stress, a dearth of studies focuses on burnout within online social media communities. Understanding the language of mental burnout in these contexts is vital for evaluating the support individuals seek, whether emotional or informational, and determining the burnout stage (exhaustion, cynicism, or inefficacy) at which they turn to social media as coping mechanisms. This knowledge will inform the development of appropriate tools to assist those experiencing burnout. We employed a systematic annotation process to achieve this goal by prompting the GPT Model using a FewShot-CoT approach to label 500 randomly sampled social media posts (within a 500-word limit) related to burnout. Labels such as 'exhaustion,' 'cynicism,' 'inefficacy,' or 'none-of-the-above' were assigned to each post. Machine learning models trained on the labeled dataset will classify a dataset of 297,623 burnout-related posts containing the phrase 'burnout.' We aim to differentiate genuine burnout experiences from casual usage of the term, and identify the support needs expressed in the posts, distinguishing between informational and emotional requirements. This research contributes valuable insights into understanding and addressing burnout within online communities by examining the language used on social media. Ultimately, these findings will facilitate the development of effective tools and support systems to help individuals experiencing burnout.

Marina Kartono

Chemistry, Imperial Valley College
SDNI REU
Mentored by Prof. Alina Schimpf

The Role of Countercations on the Assembly of the Preyssler-type Polyoxometalate

Due to proprietary information this abstract has been redacted.

Joe Kesler

Ecology, Behavior, and Evolution, UC San Diego
LAEP Scholars
Mentored by Professor Elsa Cleland

Quantifying California Poppy Abundance Across Latitudes

Understanding species abundance across varying latitudes is crucial for predicting their response to environmental change. This research aimed to quantify the abundance of the California Poppy (Eschscholzia californica) across latitudes in California. Previous research suggested that variation in poppy phenology was influenced by latitude, where poppies from more northern latitudes exhibited delayed germination compared to their counterparts from southern latitudes. However research on how abundance is affected by latitude has not been studied. To investigate poppy demography, 20 long-term monitoring plots at ten UC reserves spanning from Bodega Bay (northmost site) to Eliot Chaparral (southernmost site) were established. Each plot measured 1 meter by half a meter and was spaced 2.5 meters apart along a transect. Within each plot, the number of poppies were recorded and from this, average abundance within half a meter squared per site was calculated. The results indicated that there was no linear relationship between the average number of poppies in each plot, and latitude. While this does suggest that more factors than solely latitude affect this trait, long-term monitoring of these plots are necessary to gain a comprehensive understanding of these annual/perennial plants. Ultimately, this knowledge will enhance our ability to anticipate and manage potential shifts in plant populations in response to environmental change and inform conservation efforts aimed at preserving this iconic species

Aren Khachatryan

Molecular and cell biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Gene Yeo

Stress Granules interaction with CAG repeats RNA in Huntington's Disease

Studies of neurodegenerative diseases is the disruption of RNA metabolism through RNA binding protein (RBP) loss of function. RBPs are critical for many cellular processes including proper gene expression, splicing, RNA transport, and translation. In neurodegenerative diseases, RBPs decrease in expression, become mislocalized, and are prone to aggregation. In CAG repeat expansion diseases, such as Huntington's disease (HD), CAG repeats RNA from nuclear RNA foci which can sequester RBPs, leading to RNA metabolism dysregulation. This chain of events is increasingly thought to be a main contributor to neurodegeneration. Our approach was to utilize the novel RNA targeting Cas protein dCas13d fused with the proximity labeling protein APEX2 in a HEK293T model of HD. This technology allows for the identification of protein-RNA interactions of an RNA of interest by using a sgRNA. In our hands, our cellular model recapitulates disease phenotypes such as containing nuclear RNA foci and protein aggregation, suggesting that our model is highly relevant. Our APEX experiment results show that mutant HTT exon 1 mRNA preferentially binds proteins involved in translation and stress granules. Additionally, this data may give us insights into the mechanism underlying the toxic translation of short polyQ proteins in HD. This unbiased genome-wide approach to comprehensively profile proteins interacting with mutant HTT mRNA will help us understand the RNA-based mechanisms that underlie neuronal dysfunction and may facilitate the development of effective therapies for CAG repeat expansion disorders.

Latanya Khissy Beyniouah

Computer Science, Howard University
STARS
Mentored by Dr. Imani Munyaka

User Privacy in Android Apps

This abstract introduces two key topics: diversity, emphasizing its importance in fostering inclusive environments, and android app security, highlighting the critical need for safeguarding user data in the context of widespread app usage. Studying the security of money loan Android apps in global south countries is crucial for ensuring user protection and fostering financial inclusion. This project seeks to investigate the security aspects of these apps by analyzing their privacy/security policies. By identifying potential vulnerabilities and proposing recommendations, the research aims to enhance the security and trustworthiness of these financial technologies. The findings of this study will contribute to the development of more secure digital lending ecosystems, ultimately safeguarding user data and transactions while promoting financial accessibility in global south countries. Collecting the statements released by large corporations released during the Black Lives Matter (BLM) movement aims to examine and analyze them with the objective of addressing inclusion and diversity within marketing and big corporations. By collecting and scrutinizing these statements, this study seeks to gain insights into the strategies and commitments made by corporations towards fostering a more inclusive and diverse environment. The findings of this research endeavor will contribute to understanding the role of corporations in promoting social change and provide valuable insights for enhancing diversity and inclusion efforts in the corporate world. Addressing diversity and ensuring robust android app security are essential components for creating a more inclusive and secure digital landscape.

Dina Kianiazar

Neurobiology, UC San Diego
Neurosciences Undergraduate Research Volunteer
Mentored by Dr. Kim Dore

APOE Post Translational Modification & its Potential Role in Alzheimer's Disease

The apolipoprotein E protein (APOE) plays important roles in the brain including lipid transport, and is associated with Alzheimer’s Disease (AD) risk.

There are three APOE isoforms that differ in the presence or absence of a cysteine amino acid at positions 112 and 158. Palmitoylation is a reversible post translational modification specifically happening on cysteine, which increases association with

membranes. APOE4 has no cysteine in the protein sequence, while also having the highest risk for AD. APOE3, the most common isoform, has one cysteine at codon 112, and is an intermediate risk factor, while APOE2 has two cysteine, and has been found to be protective against AD. APOE palmitoylation is predicted but has never been shown experimentally. In order to determine the impact of AD and APOE on palmitoylation, we have used the APEGS assay (a biotin-switch biochemical assay) in order to quantify the amount of palmitoylation in APOE3 and APOE4 samples treated with depalmitoylation enzyme inhibitors, while also looking at palmitoylation at the signal peptides for each isoform. We expected to see an increase in palmitoylation using drugs that inhibit depalmitoylating enzymes like ABHD17, APT1, and APT2. Our preliminary results indicate that there is an increase in palmitoylation for all APOE3 samples treated with depalmitoylating enzyme inhibitors. We have also found that palmitoylation does not occur at the signal peptide position for APOE3 and APOE4. We plan to pursue this research in order to analyze the regulation of APOE palmitoylation in vivo, and test whether synaptic and behavior deficits seen in AD can be rescued by focusing on APOE and palmitoylation

Angeline Kim

Chemistry, UC San Diego
MRSEC REU or RIMSE
Mentored by Professor Sailor

Stability of Styrenic Carbon Double-Grafted Porous Silicon Particles for Lithium-storage Anode Materials

Due to proprietary information this abstract has been redacted.

Matthew Kim

Computer Science, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Professor Sylvia Herbert

Safe Multi-Agent Guidance using Koopman-Hopf Control of Nonlinear and Stochastic Systems for Robotic Applications

The rapid growth of engineered autonomy in various domains highlights the need for reliable and safe planning algorithms. This paper addresses this challenge by proposing a Koopman-Hopf controller for optimal guidance in the presence of antagonistic or stochastic disturbance. This approach combines Koopman theory for linearization with the Hopf formula for linear reachability to mitigate the computational burden associated with traditional dynamic programming methods. Koopman theory triumphs over other linearization methods as it can globally approximate a system with a continuous model, while the Hopf formula enables real-time computation of time-varying linear systems. The primary goal of this study is to investigate the effectiveness of the Koopman-Hopf

controller in real-world scenarios, specifically for single and multi-agent robotic systems. This study builds upon the theoretical work of UCSD's Safe Autonomous Systems lab and extends it by conducting real-world experiments using spherical, rolling robots (Spheros). With actively recorded depth and odometry data of individual agents, it is feasible to compute the optimal control for overcoming any bounded disturbance. Furthermore, exploration of multi-agent settings allows for the evaluation of the controller's ability to safely compute around disturbances arising from multi-agency and its ability to solve pursuit-evasion games, where multiple robots herd or capture evasive, antagonistic agents. Ultimately, the proof of the effectiveness and reliability of the controller would yield a promising solution and direction for future developments in real-time autonomy with real-world applications.

Hannah Kim

Neurobiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Professor Takaki Komiyama

Exploring the contribution of motor cortex and thalamus on striatal activity during movement

This project aims to understand how different brain areas interact with each other in order to generate complex and highly skilled motor behaviors. More specifically, I would like to determine the functional role of neuronal pathways involving motor cortex and thalamus in driving specific subpopulations of the striatum — the input nucleus of the basal ganglia — during movement. For this, the activity of striatal neurons will be imaged as mice perform motor tasks, by using in vivo two-photon calcium imaging through GRIN lens. At the same time, inactivation of cortical or thalamic inputs will be performed and the effect of these manipulations on the striatal activity and on movement performance will be quantified. These experiments will help understand whether and how cortical and thalamic inputs contribute to the activity of striatal neurons and to motor behavior.

Shaun Konganda

Neurobiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Jacqueline Bonds

Mitochondrial dynamics of neural stem cells

As the world’s aging population continues to grow, the ability to maintain cognitive resilience and address the changes in affective functions is a crucial public health concern. Hippocampal neurogenesis declines with age and processes that support the activation of neural stem cells (NSC) that can improve memory, cognition, and affective functioning declines. While many studies have focused on the regulation of several signaling pathways, little has been done to describe the impact of mitochondrial activity on neurogenesis and neuron cell differentiation and fate. Caveolin-1 (Cav-1) is a membrane lipid raft scaffolding protein which has been shown to influence both neurogenesis and mitochondrial function. The central hypothesis of the proposed research for this Undergraduate Research Scholarship is decreased/altered mitochondrial activity in neural stem cells causes enhanced quiescence by altering mitochondrial function via caveolin-1. In the context of Alzheimer's Disease (AD), mitochondrial dysfunction compromises neuronal function which in turn can impact the NSC pool (quiescence versus activation) via feedback mechanisms that impact the fate of these newly generated cells. Mitochondrial dynamics (i.e., fission/fusion and intracellular transport), which are critical for cellular function, have been shown to determine the cell fate of NSCs. Given that cognitive decline in AD is largely influenced by deficits in neurogenesis, understanding the mechanisms that control mitochondrial function in NSCs may contribute to the future development of effective neuroprotective treatments.

Sneha Korat

Geoscience, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Jeff Gee

Weak, variable geomagnetic field from a Jurassic (182 Ma) intrusion in Antarctica

The long-term variations of Earth's geomagnetic field intensity and direction are some of the only sources of information on the formation and evolution of the planet. Previous research suggests that when the Earth formed a solid inner core, the magnetic field may have transitioned from a relatively weak state to a stronger state. Analysis of these fluctuations, which are recorded and identifiable in rocks of appropriate age, will potentially provide insight on when the solid inner core of the Earth was formed. A large igneous intrusion in Antarctica, which was emplaced around 182 million years ago, has been sampled. During this time period, the Earth's magnetic field was reversing more frequently and had a lower intensity than in any interval in the past 500 million years. It was observed that a significant portion of this sample collection appears to have extremely low intensities, which suggests that the Earth's magnetic field may have been as weak as the time period postulated for solid inner core nucleation (nearly 500 million years ago). This project will explore whether the sample collection from Antarctica records a younger ultra-weak phase of Earth's magnetic field that is similar to that ~500 million years ago and thus can provide insight to whether the intensity fluctuations of the Earth's magnetic field can be used reliably to inform our estimates of when the solid inner core formed.

Sanjana Korpal

Human Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Alexis C. Komor

Evaluating the Impact of Reversions of Individual Mutations on Wild-Type TadA Efficiency

Base editors are a class of genome editing tools that have the ability to make single base variations (SNVs) in DNA without introducing deleterious double stranded breaks (DSBs). My project is focused on evaluating an existing base editor, ABE7.10, and how the mutations on its corresponding enzyme, TadA—which have arisen through generations of directed evolution processes—impact the base editing activity. A number of different generations of the mutated enzyme exist, resulting in a total of 14 distinct mutations on the current wild-type TadA. By analyzing a comprehensive set of reversion mutant editors, where one or more mutations accumulated in the final ABE7.10 are reverted to their wild-type counterpart, we aim to test their individual impact on the activity of the base editor; evaluating mutations' structure/function relationships provides us with insight into the value of each mutation. By creating a library of plasmids of wild-type TadA7.10 that we've manipulated to have a single mutation reversed, we can transfect them into cells alongside a gRNA plasmid, responsible for guiding the enzyme, as well as a novel reporter plasmid, which we've designed to fluoresce in response to base editing activity. These manipulations allow us to measure the relationship between individual mutations and overall efficiency—information that is crucial to future research, since it spotlights both effective mutations and isolates mutations that decrease overall efficiency—ultimately yielding a more complete, comprehensive understanding of base editing activity.

Ryan Kosta

Computer Science, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Professor Yiying Zhang

Catena: A Scheduling System for Microsecond-Level Microservice DAGs

Modern web services such as Twitter and Netflix are composed of many small tasks, known as microservices. We propose Catena, a new RPC system that enables co-location of latency-critical microservices, whilst still achieving low tail latency and high server utilization. Catena uses a tiered approach to optimize explicitly for both high utilization and low latency when vertically autoscaling compute resources, in a manner that helps reduce resource contention and throughput instability. When resource contention does occur, Catena uses knowledge of the DAG to solve it by dynamically adjusting resource allocations for microservices across the entire service in a distributed manner.

Rita Kret

Chemical Engineering, Ohio State University
MRSEC REU or RIMSE
Mentored by Professor David Fenning

Optimizing Synthesis Conditions of Nickel Oxide Hole Transport Layers (HTLs) in Perovskite Solar Cell Devices

Metal halide perovskites (MHPs) are a promising solar absorber material due to their excellent optoelectronic properties, solution processability, and potential for low production cost. These attributes have attracted much attention in both academic and industrial environments, leading to solar cell performance rivaling that of state-of-the-art silicon cells. However, MHPs are highly susceptible to environmental and operational stressors, leading to degradation and early device failure. One aspect of MHP solar cells that needs to be addressed to curb this degradation is the transport layers: electron and hole selective materials on either side of the MHP layer that transport charge. In this project, I aim to implement nanoparticulate NiOx, a p-type metal oxide, as the hole-transport layer in MHP devices. After optimizing the synthesis conditions, device performance and stability will be assessed.

Brandon Krieg

Psychology, CSU, Bakersfield
STARS
Mentored by Dr. Abraham Palmer

Unraveling the Genetics of Substance Use Disorder: A Study on Heterogeneous Stock Rats

Due to proprietary information this abstract has been redacted.

Girish Krishnan

Electrical Engineering, UC San Diego
ECE SRIP
Mentored by Professor Yatish Turakhia

Large-scale Genomic Surveillance of SARS-CoV-2 via Wastewater-based Epidemiology

Wastewater-based epidemiology involves monitoring the genetic mutations occurring in a pathogen by analyzing genetic samples obtained from wastewater. This method is cost-effective, avoids clinical testing bias, and is capable of detecting emerging variants of a virus in both symptomatic and asymptomatic individuals. Our project aims to build a pipeline for wastewater-based epidemiology for the SARS-CoV-2 virus, by aligning and placing reads collected from wastewater samples onto a phylogenetic tree, refining the placement to recover lineages, and identifying the nodes to which each sample belongs. Our method demonstrates greater accuracy in lineage detection compared to previous surveillance methods. It can identify lineages that may not be detectable using the Freyja method and reduces the number of irrelevant lineages detected. Although our current pipeline has been tested on simulated reads, future work involves applying the pipeline to reads obtained and sequenced from real wastewater samples.

Megha Kumar

Data Science/ Math-CS, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Rob Knight

Investigating Microbial Associations with Anxiety and Depression Through Machine Learning

Anxiety (ANX) and depression (DEP) are debilitating mental disorders that have significant financial and social costs to society. Current therapeutics and treatments targeted towards ANX and DEP are insufficient; even with advanced technologies, biological understanding of these disorders is significantly lacking. Machine learning (ML) techniques can be utilized to identify microbial associations with ANX and DEP. These associations may inform the development of more effective, targeted therapeutics. The goal of this research is to analyze data from a large U.S.-based cohort to identify microbes that are significantly associated with anxiety or depression, and potentially partaking in the gut-brain axis. The gut microbiota-brain axis refers to the bidirectional network of communication between the gut microbiome and the brain, which substantiates the microbial contribution to neurological disorders. Studying ANX and DEP from the microbiome perspective comes with many unique benefits with respect to therapeutic potential. We chose to investigate the microbiome's association with ANX and DEP through a ML approach on a large cohort of Americans using the Tulsa-1000 dataset. We aim to apply Random Forest Classification (RF) and Logistic Regression on the microbial features to predict depression/anxiety. Our intention with using machine learning is to develop a generalized model which can perform well on unseen data, allowing us to identify microbes consistently implicated in ANX and DEP in the U.S. adult population. Feature importance will be examined to identify features particular to ANX or DEP. Compositionally aware statistical analysis will also be performed in the QIIME2 ecosystem.

Svetlana Kuznyetsova

Medical Technology, CSU, Northridge
STARS
Mentored by Adam J. Engler

Role of Breast Cancer Cells with Different Adhesive Phenotypes in Cancer Associated Fibroblast Activation

Breast cancer is a prevalent disease affecting women worldwide, yet the underlying biology remains poorly understood. There are several key players in the breast tumor microenvironment such as epithelial cells, fibroblasts, cancer associated fibroblasts, etc. however their role is unknown. This study aims to investigate the formation of cancer-associated fibroblasts (CAFs) and their contribution to the tumor microenvironment.

Prior research in the Engler Lab observed that within a breast cancer cell line, there are subpopulations of cancer cells with different adhesive abilities. Additionally, it was found that weakly adherent cells have a higher migratory capacity and contribute more to metastasis in an animal model compared to strongly adherent cells. We hypothesize that breast cancer cells with different adhesive abilities can contribute to varying degrees of CAF activation. To examine the formation of CAFs, a parallel plate flow chamber was employed to subject breast cancer cells to shear stress, allowing for the collection of cells with different adhesive phenotypes. Sorted cells were then used to condition media that was subsequently used to culture fibroblasts to observe CAF activation. Immunofluorescence was performed on fibroblast cells to assess the activation of specific biomarkers associated with CAFs. Furthermore, the study investigated the role of cytokines present in the conditioned media in inducing differences in CAF activation. Preliminary findings showed that conditioned media from sorted cells exhibited varying levels of several cytokines. Understanding the role of cytokines in CAF activation is important, and further investigations are needed to accomplish this.

Derrick Labidou

Biology, San Diego Miramar College
STEMULATE
Mentored by Prof. Michael D. Burkart

Exploring the critical processes in fatty acid biosynthesis of the enoyl reductase (ER)

Fatty acid biosynthesis, also known as FAB, is an essential pathway responsible for many different types of fatty acids such as lipids, biotin, and more. The metabolic enzymes involved in FAB form structured complexes that work in unison for cells to live. Most of the enzymes found in FAB are well studied to this point, but the only two that are not are the interactions between enoyl reductases (ERs) and acyl carrier proteins (ACPs). The ACPs transport the elongating chain of fatty acids through the different domains involved in FAS. The ER enzyme with the NADH reduces the fatty acid chain which creates a saturated fatty acid intermediate is essential in this process as the final step. By using these relationships a panel of tight-binding probes for the FABI (ER) was established. Through this selection of probes, the efficiency was explored and characterized.

Arya Lalezarzadeh

Human Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Zhimin Hu

The Role of INFAR1 in Breast Cancer Metastasis

Due to proprietary information this abstract has been redacted.

Gisel Larios

Biology, California Stare University, Bakersfield
STARS
Mentored by Dr. Rodney Gabriel

Identifying Independent Preoperative Risk Factors for Mortality and Morbidity Following Hysterectomy for Gynecological Cancer

Postoperative complications after a hysterectomy for gynecological cancer can be associated with preoperative conditions. The objective of this study was to identify independent risk factors for major postoperative complications including death, pulmonary embolism, myocardial infarction, and unplanned reintubation in this patient population. This study was a retrospective observational study using the National Surgical Quality Improvement Program database. All patients extracted underwent hysterectomy for gynecological cancer from 2014-2020. A multivariable logistic regression analysis was performed to assess for independent predictors. Odds ratios (OR) and 95% confidence interval (CI) were reported. The final study population consisted of 6,827 patients, in which 177 (2.60%) experienced a major postoperative complication. On multivariable logistic regression, geriatric age (OR 1.51, 95% CI 1.09– 2.08, P=0.01), dependent functional status (OR 2.29, 95% CI 1.21-4.32, P=0.01), elevated preoperative SGOT levels (OR 2.32, 95% CI 1.23-4.36, P=0.01), elevated white blood cell count (OR 1.80, 95% CI 1.13-2.85, P=0.01), elevated international normalized ratio (OR 2.84, 95% CI 1.15-7.04, P=0.02, American Society of Anesthesiologists Physical Status Score ≥3 (OR 2.4, 95% 1.60-3.65, P<0.001), ascites (OR 1.90, 95% CI 1.11-3.24, P=0.02), hypertension (OR 1.70, 95% CI 1.20-2.41, P=0.003), and disseminated cancer (OR 1.48, 95% CI 1.01-2.18, P= 0.04) were associated with increased odds for major postoperative complications. We identified independent risk factors for major postoperative complications following hysterectomy for gynecological cancer. All variables are information that can be elicited preoperatively and thus provides an opportunity for clinicians to risk-stratify patients and optimize modifiable risk factors prior to surgery.

Kaitlyn Lavarias

Mechanical Engineering, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Tania Morimoto

Haptic Grasper for Variable Force Rendering via Pneumatic Actuation

Haptics is a growing field of technology that implements kinesthetic and/or tactile feedback, typically through generating forces or vibrations. Haptic feedback can be used to improve user control of teleoperated robots, particularly in medical settings, where precise and careful control of instruments is critical for safe interactions between operators and patients. However, most commercially available haptic interfaces used for teleoperation do not provide grip force feedback, which limits users' ability to grasp objects with the appropriate amount of force and can lead to breaking or dropping the objects. This work proposes a novel grasper that can provide force feedback at the fingertips via pneumatic actuation. The grasper is designed to mimic the normal forces felt when grasping objects of varying sizes, ranging from thin structures such as tissue to wider structures such as bones. By mounting this lightweight grasper onto existing haptic devices, the rendered grip force feedback provided through the pneumatic actuation system will supplement the kinesthetic feedback provided by the commercially available haptic interfaces. The performance of the grasper, including its range of motion, range of forces, and speed of response will be characterized. It is expected that the grasper will help make user control of teleoperated robots safer and more precise in medical settings.

Amber Lawrence

Neurobiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Melinda Owens

Functional dissection of gut microbiota metabolites in the human-induced neuronal 2D model of Parkinson's Disease

Parkinson's disease is the second most prevalent neurodegenerative disease in the world. Dysbiosis of gut microbiota is implicated in Parkinson's disease patients, yet the causal bacteria/metabolites are still not identified. Here, we developed a system using human induced pluripotent stem cells (HIPSCs) as a tool to test specific bacterial metabolites on neuronal activity, neuro-immune interaction, and neuronal autophagy in the context of Parkinson's disease. Using antibody-based detection methods, we successfully differentiated and validated the corresponding neuronal cell types from CRISPR CAS9 edited cell lines with a familial Parkinson's disease background. Ongoing experiments involving analyzing brain immune-mediated response to bacterial metabolites and the detection of neural cell autophagy using HIPSC-derived neuronal-microglial coculture system under well-established familial PD background would enhance our knowledge on how gut-derived metabolites could affect normal or diseased brain functions.

Zaira Leal

Biological Anthropology, UC San Diego
Summer TRELS
Mentored by Carolina Marchetto

Studying Mood Disorders Using Stem Cells

Mood disorders are characterized by a variety of clinically diagnosed conditions that affect a person's persistent emotional state (mood). A national comorbidity survey estimated 21.4% of US Adults will experience a mood disorder at some point of their lives (Harvard Medical School, 2007). Treatment of mood disorders is significantly inefficient primarily due to inequitable medical treatment accessibility but also because of the poor predictivity of the preclinical models. Various treatment methods derived from animal model tests have been developed and prescribed to treat mood disorder in patients. However, the rodent brain is fundamentally different from the human brain in terms of size, structure, physiology, connectivity and function. For example, Lithium, commonly used to treat bipolar disorder, is ineffective for 30-40% of patients (Mishra et. al., 2021). The mechanisms, tendencies and behavior of rodent neurons differ drastically from human cells. Novel induced pluripotent stem cell (iPSC) research and technology has enabled the use of human-derived neurons as a new model to study human disease. These human neurons, created from skin or blood cells, have made possible new modes to treat mood disorders and virtually any human disease. This literature review examines the novel and fast-moving field of iPSC-based disease modeling in mood disorders, specifically major depressive and bipolar disorder since these are the most prevalent and commonly treated mood disorders in the United States.

Alex Lee

Bioengineering, biotechnology, UC San Diego
Summer TRELS
Mentored by Mark Fuster

Exploring the Effects of Pulsed Magnetic Fields on Tumor Cell Growth and Apoptosis

Mechanisms by which electromagnetic fields alter growth of tumor cells are poorly understood. Early studies using pulsed magnetic fields (PMFs) to induce electromagnetic forces (EMFs) on tumor monolayers suggest that the uniquely charged tumor glycocalyx may critically mediate plasma membrane leak and nanoscale membrane pore formation by PMFs. The sialic acid and glycosaminoglycan rich glycocalyx of brain tumor cells and lung cancer cells may make them especially susceptible to PMF-induced leak. Exposure of SH-S5SY neuroblastoma cells and A549 lung cancer cells to 10-min sequential 50- and 385-Hz low-energy PMFs once daily inhibited the growth of tumor cells in culture over a 3-day period. We initiated mechanistic studies using PMFs with a narrow pulse-width (higher dB/dt) system using a MagVenture coil source to explore effects on membrane-leak, viability, and apoptosis. In studies on SH-S5SY cells thus far, a 5-min exposure using 15 Hz pulse sequences (that results in significant membrane leak) demonstrates increased caspase-3 mediated apoptosis 3-hr following PMF exposure compared to sham (non-exposed) cells while there appeared to be no apoptotic effect at 24-hr post-exposure. Preliminary studies with T98G glioblastoma cells (with a distinct glycocalyx composition) do not show PMF-induced apoptosis 3-hr post-exposure. Possibly, PMF-induced apoptosis under such conditions may transiently affect tumor-cell growth by distinct tumor cells having unique glycocalyx compositions. More generally, low-frequency PMF exposure of tumor cells may affect distinct downstream growth and survival signaling pathways to mediate such biological effects in lung and brain tumor cells. Further studies are underway to explore such mechanisms.

Jenny Lee

Chemistry with a Global Health Concentration, Oberlin College
MRSEC REU or RIMSE
Mentored by Professor Julia Stauber

Utilizing a well-defined metallacage as a precursor for an extended network

Over the last several decades, the development of supramolecular structures has led to a wide variety of well-defined, molecular metal-organic cages with varying sizes and shapes. Chemists have leveraged the tunable and modular nature of subcomponent self-assembly to gain access to diverse supramolecular systems with applications relevant to host-guest chemistry, catalysis, and much more. Here, we are studying a supramolecular bimetallic, iron(II) complex supported by three iminopyridine ligands that are each functionalized as a peripheral amine group. The presence of three free amines on the periphery of the structure provides valuable synthetic handles for post-synthetic modification. Our work is focused on developing this bimetallic Fe(II) complex as a molecular, well-defined building block for the preparation of a new class of imine-linked crystalline porous materials through condensation with bifunctional aldehyde subcomponents. This synthetic methodology is reminiscent of the preparation covalent organic frameworks (COFs), which have been extensively studied for their use in gas separation, catalysis, and energy storage. We aim to utilize the tunable and modular nature of this molecular approach combined with the synthetic methods employed for the preparation of COFs to create a new class of metal-intercalated organic frameworks composed of well-defined, repeating subcomponents. These new systems will be evaluated through advanced materials characterization and computational models to demonstrate that the structure of these frameworks can be predicted.

George Lee

Geoscience, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Emily Chin

Translating what rocks say: learning the magmatic history of the Golden Trout Volcanic Field (CA, USA) from chemical analyses of lava-hosted olivine crystals.

The chemical composition of volcanic minerals can shed light on the origin of lavas erupted on Earth's surface. We use scanning electron microscope techniques to measure the chemistry of olivine crystals sampled from 2 basaltic cinder cones - South Fork and Tunnel Cones - located in the Golden Trout Volcanic Field ("GTVF"), a young (active perhaps as recently as 10,000 years ago) volcanic field in California's Sierra Nevada. Here, we report on the forsterite ("Fo" = 100 * Mg/(Mg+Fe)) contents of these crystals. Our preliminary data reveal that olivine crystals display normal zoning with higher Fo values in their centers compared to their rims. Specifically, olivines from South Fork Cone have an average composition of Fo88.60 in their cores and Fo87.17 in their rims. Tunnel Cone olivines have an average core composition of Fo86.65, and rims of Fo85.45.

This is consistent with continuous mineral growth in a single carrier magma, whereas other volcanic systems show more complicated compositional zoning representative of more complex histories (e.g., repeated recharge events of new magma). The compositions of the olivine centers resemble those of so-called primitive olivines that formed in mantle melt environments. We explore the timescale implications of primitive olivines erupting at Earth's surface in the context of deciphering the speeds with which (admittedly small) volcanoes in the Sierra Nevada might awaken and transition to an erupting state.

Christa Lehr

Computer Science Information Systems, Southern Connecticut State University
ERSP Summer Internship
Mentored by Professor Christine Alvarado

How Do I Get There From Here? A New Tool for Evaluating How Well Community College Articulations Match Computer Science Bachelor's Degree Requirements in California

A common theme in the literature for transfer student studies in Computer Science is that transfer students go into community college expecting a 4-year commitment, but the journey is rarely that short. Previous work has found that transfer students took 1213 distinct pathways to their resulting degree. Our work studies the landscape of transfer pathways in computer science in the state of California. We studied articulation agreements and graduation requirements for all the Universities of California, as well as the California State Universities for Computer Science. We scraped and checked the '22-'23 articulation agreements, and then collected and checked the graduation requirements for all CA public universities. Articulation courses were loaded into Curricular Analytics as admission requirements. How well a particular community college met articulation requirements was scraped into Google Sheets and verified by hand. Curricular Analytics was used to evaluate curriculum complexity and another tool was created for seeing how well a particular community college's courses matched a college's CS curriculum. We found the remaining complexity of a given CS B.S. degree (graduation requirement complexity - admission requirements complexity = remaining complexity of degree), and then used our tool to rank how prepared a student would be after completing a particular community college's articulation agreement. The results of the tool created for this study can assist students in choosing a college that will best meet their Computer Science transfer goals.

Verina Leung

Neurobiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Li Ye

Somatosensory remodeling in adipose tissues

Due to proprietary information this abstract has been redacted.

Harry Li

Biochemistry, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Professor Elizabeth Komives

Study of mechanisms and roles of INS domain

Due to proprietary information this abstract has been redacted.

Mica Li

Mathematics, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Professor Albert Chern

Harmonic Functions in Lie Sphere Geometry

Harmonic functions have been an area of study in analysis, stochastic processes, physics, engineering, complex analysis, and many other fields. Harmonic functions are defined to be twice continuously differentiable functions that satisfy the Laplace equation $\Delta f = 0$. Tristan Needham's 1994 paper The Geometry of Harmonic Functions brought attention to the lesser known geometric properties of harmonic functions, especially over circles. Needham's results reveal a deeper meaning of the Mean Value Property of harmonic functions. While the results are interesting, they are limited to only 2-dimensions as they are studied under complex analysis. We hope to generalize the results that Needham summarizes to more general dimensions and we expect to obtain results similar to that of the Kelvin transform – non-trivial symmetry of harmonic functions in general dimensions. Since harmonic functions seem to naturally work over spheres and circles, the general theory can also be formulated in terms of language such as Lie sphere geometry, which has greatly simplified problems involving circles and spheres in the past.

Angela Liu

Molecular and Cell Biology, UC San Diego
Ahmadian Summer Fellowship
Mentored by Dr. Amit Majithia

The Effect of UBE2G2 Knockout on VLDL Secretion

Steatosis, or fat accumulation, is a hallmark of nonalcoholic fatty liver disease (NAFLD), a condition that currently impacts 25% of the general population. We performed a high-

throughput imaging screen by knocking out 106 genes in Huh7 hepatocyte cells using CRISPR to identify mediators of steatosis. Among the 32 genes whose deletions increased lipid droplet size, we found that ubiquitin conjugating enzyme E2 G2 (UBE2G2) gene knockout leads to higher lipid droplet size and numbers in hepatocytes upon stimulation with oleate. Very-low-density lipoproteins (VLDL), a class of lipids associated with increased cardiovascular events, are synthesized in the endoplasmic reticulum to export triglycerides out of the cell. We investigated the effect of UBE2G2 knockout on VLDL secretion from hepatocytes and hypothesized that the UBE2G2 deletion in hepatocytes will result in lower levels of both intracellular and secreted ApoB100, a marker of VLDL. We treated WT and UBE2G2 knockout Huh7 cells with increasing concentrations of oleate for 6 hours and measured ApoB100 concentrations in culture media using an ELISA. We predict that our results will provide a better understanding of how UBE2G2 affects lipid droplet size.

Veronica Liu

Education Studies, UC San Diego
McNair Scholars Program
Mentored by Sherice Clarke, PhD

How is "Readiness" Met?: The Case of Oakland Unified School District in Oakland, CA

Readiness, often defined as the rate in which students meet literacy and critical skills, has long been a metric of the success of K-12 education in preparing students for college and careers. In Oakland, California, the Oakland Unified School District (OUSD) has highlighted their top priority as “All students graduate college, career, and community ready.”, implementing different programs and ideas throughout the years to achieve this goal. However, what does it mean to be ready for college, career, and community? How does the district measure readiness and support initiatives targeted at increasing student readiness? The aim of this study is to understand how school districts, focusing on OUSD, back up their goals of preparing students for the real world. Through a mixed-methods approach, this in-depth case study seeks to shed light on how metrics of readiness are understood and used by districts in supporting students. The implications of this study build upon contemporary definitions of readiness, while highlighting the ways school districts can improve standards and practices as it relates to college and career readiness.

Meihui Liu

Computer Engineering, UC San Diego
ECE SRIP
Mentored by Dr. Yang Zheng

Smoothing Mixed Traffic Flow via Data-driven Predictive Control of Autonomous Vehicles

Connected and autonomous vehicles (CAVs) are promising to smooth mixed traffic flows where human-driven vehicles coexist.; One of the biggest obstacles for most model-based control methods is to identify suitable car-following dynamics of human drivers. In this project, we focus on a data-driven non-parametric strategy called Data-EnablEd Predictive Leading Cruise Control (DeeP-LCC) in comparison with standard model predictive control (MPC) that requires accurate system models. We provide a Python implementation of the simulations of two major mixed traffic scenarios: emergency brake scenario and city highway scenario. Our numerical simulations illustrate the performance of DeeP-LCC in regard to its ability to smooth traffic perturbation, reduce fuel consumption, and improve safety. We also build up a website for easy reference on the code and simulation results. Finally, we set up a SUMO simulation environment to further investigate the impact of CAVs in large-scale mixed traffic systems.

Delbert Longino

Political Science, Morehouse College
STARS
Mentored by Dr. Lagina Gause

Which Party Lies more

Over the last few years, the threat of Misinformation has grown bigger and bigger. With phrases like “fake news” gaining popularity and increased fact-checking AI programming online, the problem of misinformation has become more widespread and mainstream. There is always a debate on which party “lies” more and through this project we can get a clearer picture of that conversation. I will be evaluating the amount and frequency of misinformation during the last 7 presidential elections and comparing the differences between parties. I theorize that Republicans will be found to have more unfactual statements than Democrats. I believe that due to Republican campaigns and messaging being more rooted in arbitrary feelings/beliefs rather than statistical or factually backed reasoning, they will be more likely to say something not fully reflective of actual reality.

Sarah Ruth Lopez

Chemistry, Mira Costa
STEMULATE
Mentored by Dr. Alina Schimpf

Cation Effects on the Assembly of Preyssler-type Polyoxometalates

Due to proprietary information this abstract has been redacted.

Alex Lopez

Electrical Engineering, UC San Diego
Summer CAMP

Mentored by Dr. Nicholas Boechler

Modifying Data Collection and Methods of a Split-Hopkinson Pressure Bar for High Strain Rate Testing

Powerful, quick impacts of materials can result in high-strain rates. Understanding these materials' responses allow for informed decisions in their applications, such as in the biomaterials, aerospace, and manufacturing industries. The Split-Hopkinson Pressure Bar (SHPB) is an experimental apparatus that measures the propagation of waves within a specimen as it undergoes a large strain rate. Typical measurement techniques use strain gauges on the incident and transmission bars to collect data from a striker bar's contact with the system. Additionally, striker bars have been propelled by numerous methods, mostly involving gas guns of varying designs. This presentation will report efforts to repair, upgrade, and modify a previously defunct SHPB, both in its data collection processes and gas gun system. Optical vibrometers will be used as a no-contact substitute for strain gauges. The current gas gun manifold will be redesigned to allow for remote operation and release of gas from the supply cylinder, ensuring safer and more accurate pressurization of the gun. Light gates will be used to measure the velocity of the striker bar system. Ideally, a remote-operated SHPB that utilizes optical strain measurement will result in an easier and safer to operate method of high-strain material testing.

Genesis Lopez Morales

Sociology - Law and Society, UC San Diego
Summer TRELS
Mentored by Professor Neil M. Gong

Root Causes of Central American Migration

In July of 2021, the Biden Administration announced the executive U.S. Strategy for Addressing the Root Causes of Migration in Central America. The report cites "corruption, violence, trafficking, and poverty" as the root causes of migration from the region, aggravated by "COVID 19, extreme weather, and severe economic decline.". As a solution, the administration has promised hundreds of millions of dollars from public and private sources to the region, as well as the establishment of many review committees, sporadic training for officers, and other initiatives. For years, administration after administration has resorted to commitments of funneling millions of dollars into the region to halt migration and build a more "democratic, prosperous, and safe Central America." However, the number of migrants from Central America has only increased over the past 40 years. Current migration patterns of Central America have a crucial historical dimension. Discovering and analyzing this historical dimension is critical for producing new knowledge that can restore the humanity of the U.S. immigration system and the individuals that engage it. Structuralism posits that "capitalist development, its penetration into peripheral areas, and the incorporation of these areas into the world economy" and is useful in discovering and examining this historical dimension.

Migration (in part) can be explained as an effect of the penetration of capitalism into states at a lower level of development. The 'penetration' of capitalist development often occurs concomitant to political 'penetration,'. including military intervention in state conflicts. Intervention by foreign states in these conflicts can intensify or prolong them, leading to direct or indirect displacement and/or emigration. In the case of Central America, we can observe structuralism in action, where the penetration of capitalist development directly and indirectly displaced hundreds of thousands of Central Americans domestically and internationally.

Alex Lu

Bioengineering, UC San Diego
Summer TRELS
Mentored by Tania K. Morimoto

Design and Fabrication of a Robust and Compact Actuation System for Concentric Tube Robots

Interest in robot-assisted minimally invasive surgery has grown significantly due to potential improvements in patient outcomes. A heavily examined robotic architecture in this field is the concentric tube robot (CTR), which consists of two or more pre-curved, superelastic tubes nested within one another, frequently with a surgical tool at the robot's tip. Each tube in a CTR can be translated and rotated to facilitate elastic and torsional interactions that enable snake-like motions. Indeed, the capabilities of CTR designs must be validated through physical experiments simulating surgical environments. For certain procedures where surgeon workspace is limited, it is important for the overall system to maintain a small footprint and remain portable. However, previously proposed CTR actuation systems are often large and heavy or small with reduced accuracy. Here we present a robust, modular, and compact CTR actuation system that ensures reliable translation and rotation of CTR tubes, grants access to the innermost tube, and offers flexibility to adjust the robot's base frame. The design employs vertical plate modules that consist of non-captive linear actuators for translation and a worm gear and wheel mechanism for rotation. This research encompasses the system design and prototype construction, and aims to conduct positioning and repeatability experiments to validate the accuracy and precision of the proposed prototype. Taking into consideration the limitations of existing CTR actuation systems, this research contributes to the advancement of robot-assisted minimally invasive surgery by providing a reliable actuation system that supports a wide array of future CTR surgical experimentations.

Jose Lucas

Biology, Palomar College
STEMULATE
Mentored by Dr. Valerie Schmidt

Towards the Synthesis of Bismuth Compounds at Multiple Oxidation States Using Redox-Active Ligands

Bismuth is an abundant element that is uniquely a non-toxic heavy metal. Despite its potential for applications in synthetic chemistry and photochemical processes, our general knowledge of the structure and reactivity of Bi-containing compounds is very limited. Due to these limits, it's important to design new Bi-containing compounds that would both expand the fundamental knowledge of this class of compound but also do this in a way that explores the impact of the Bi-oxidation state. We're interested in preparing and studying Bi-containing compounds that feature multi-dentate ligands that can participate in redox processes. This presentation will describe efforts towards the synthesis of neutral tridentate pyridine diimine, neutral bidentate alpha-diimine, and monoanionic bidentate acetylacetonate ligands and their subsequent metallation reactivity with various Bi(III)-salt precursors.

Ethan Lucsik

Biochemistry, CSU, Long Beach
MRSEC REU or RIMSE
Mentored by Dr. Micheal Sailor

Modification of Mesoporous Silicon Nanostructures by Trihydridosilanes for CLZ Drug Delivery

Worldwide, tuberculosis is the 13th leading cause of death and the second leading infectious killer (after COVID-19 and above both HIV & AIDS). Clofazimine (CLZ) is an effective antibiotic used against a wide spectrum of Gram-positive bacteria including tuberculosis and leprosy. One disadvantage of Clofazimine is its poor solubility in water and hydrophobic structure. Consequently, drug absorption is dissolution-limited causing high interpatient variability in effectivity. The focus of formulation development is solubility enhancement for drug delivery. Mesoporous Silicon based nanostructures are used as drug delivery carriers that can perform targeted delivery and controlled release. Here, organic trihydridosilanes are grafted to hydrogen-terminated porous Si nanostructures to increase CLZ adsorption for controlled dissolution in drug delivery.

Rohan Luthra

Materials science and engineering, Northwestern University
SDNI REU
Mentored by Jinhye Bae

Programmable stimuli-responsive shape morphing hydrogel actuators through 3D printing

Shape-morphing polymeric materials have garnered enduring attention across various research fields due to their significant potential in the realm of soft actuators, smart robotics and deployable devices. The crosslinked poly(N-isopropylacrylamide) (PNIPAM) is one of the most widely used stimuli-responsive hydrogels with temperature-dependent volumetric changes. Although immense studies have been reported using the crosslinked PNIPAM hydrogels, their isotropic volume changes limit their shape transformation and practical applications. In this work, 3D printed bilayer actuators comprising PNIPAM and polyacrylamide hydrogels are presented. Upon controlling the swelling and deswelling behaviors of PNIPAM by the crosslinking density and incorporation with functional additives, the actuators achieve programmable complex 3D shape transformations through temperature changes and light exposure. This approach could lead to advances in various research fields in hydrogel-based systems.

Kevin Ly

Computer Science and Engineering, UC San Diego
Summer ERSP
Mentored by Adalbert Gerald Soosai Raj

Need a Programming Exercise Generated? ChatGPT’s Got Your Back: Automatic Generation of Non-English Programming Problems Using OpenAI GPT 3.5

Large language models (LLMs) like ChatGPT are changing computing education and may create additional barriers to those already faced by non-native English speakers (NNES) learning computing. We investigate an opportunity for positive impact of LLMs on NNES through multilingual programming exercise generation. Following previous work with LLM example generation in English, we prompt OpenAI GPT-3.5 in different natural languages such as Tamil, Spanish, and Vietnamese, to create introductory programming exercises, sample solutions, and test cases. We evaluate these exercises on their sensibility, readability, topicality, cultural relevance, and readiness for use. Our results will provide a template for teachers and students to generate programming exercises in their own natural language and context, helping to overcome the challenges of exercise generation for professors and lack of resources in non-English languages.

Cecilia Ma Li

Animal Biology, UC Davis
STARS
Mentored by Dr. Shermin de Silva

The Funding Landscape of Conservation and Ecology - An Analysis of Peer-Reviewed Literature

Animal conservation research is important for protecting ecosystems, preserving endangered species, and ensuring long-term planetary sustainability. Government grants, non-profit organizations, charitable foundations, and public-private partnerships are common sources of research financing. All acknowledge the importance of maintaining natural heritage and the ecological balance it provides. Researching funding flows in

worldwide conservation and ecology journals can provide valuable insights into the financial support and priorities within the field. By analyzing funding sources, researchers can identify trends, potential biases, and areas of underinvestment, leading to more informed decision-making and resource allocation. This knowledge can help shape conservation strategies, foster collaboration among funding organizations, and promote transparency in funding practices, ultimately contributing to more effective and equitable conservation efforts globally. I hypothesize that the majority of funding for conservation and ecology research originates from federal sources. Analyzing global conservation and ecology journals for funding patterns and sources can reveal the extent of federal contributions, their implications for research outcomes and resource allocation, and shed light on the field's dependence on federal funding. Our research involves selecting articles from journals of interest over the past three years to examine the funding flow. We aim to analyze the sources and funding patterns to gain a deeper understanding of the financial support behind research. We will be analyzing the geographic relationship between various funders, researchers, and study locations. This approach will allow us to draw conclusions about distributions and allocations of conservation research funds to inform future generations of diverse and efficient funding efforts.

Fatima Maciel

Public Policy & Ethnic Studies, UC San Diego
McNair Scholars Program
Mentored by Dr. Simeon Man

Equitably in San Diego: An Analysis of Get It Done

Data is often understood to be “racially neutral” but in fact, it can actually exacerbate racial inequalities even more. This research project considers the ongoing conversations around whether San Diego’s infrastructure and services are equitable to all. In the process, I aim to uncover and examine the metrics that the city is using to measure “equity” and “servingness”. Ultimately bringing me to the question: How are these metrics being applied to the Get It Done service app to better address the disparities/inequities we are seeing between different districts? To answer this question, I will take data from Get-It-Done reports and feedback surveys submitted by San Diegans in 2021. While it is easy to blame the city for the unequal distribution of services across districts and communities, it is important to take a step back and look at the larger issue at hand: Who is not turning in these reports, and why? This research project is interested in examining both constituent experiences with the Get-It-Done Program and exploring methods that the city can implement to make Get-It-Done reports more accessible to our most vulnerable communities. This project moves beyond race in determining access, it is an in-depth analysis of how GID is being used across the intersections of race, age, class, language, and dis/ability.

Molly MacLaren

Computer Engineering, UC San Diego

CSE ERSP
Mentored by Michael Coblenz

Revisiting REVIS: Does visualizing errors help in learning Rust?

Concepts of ownership and lifetimes in the Rust programming language ensure safe memory management but introduce a learning curve for new adoptees. Rust Error Visualizer (REVIS) is a tool developed by UC San Diego students to overlay a diagram representing lifetime-related compiler errors where they occur in a user's code within the VSCode IDE. A preliminary study in CSE 131 allowed us to identify the most frequent and costly errors, but left us requiring more data to prove the efficacy of REVIS at improving the debugging process in other contexts. Therefore, I am implementing an error reporting feature built into the tool so that we can iteratively analyze whether seeing the visualizations reduces time spent debugging, and if it helps users become faster at fixing these errors over time.

Tulio Magana

Molecular and Cell Biology, UC San Diego
LAEP Scholars
Mentored by Dr. Julian Schroeder

Identification and Functional Analysis of Closely Homologous F-box Protein Genes in the CO2 Signal Transduction Pathway in Arabidopsis thaliana

Data recorded since the 1960s from the Keeling Curve shows a constant rise in CO2 concentrations in the atmosphere (Keeling, 2022). Our ecosystem, natural processes, and balance depend on carbon dioxide and atmospheric concentration. In addition, changes in atmospheric carbon dioxide concentration affect the internal CO2 concentration in plant leaves, and current research suggests that plants have CO2 sensing mechanisms in guard cells that regulate plant water loss by controlling stomatal opening and closure in leaves. Multiple genes involved in the CO2 signal transduction pathway have been identified in the biological model Arabidopsis thaliana. Even though many components have been previously identified, the mechanism still needs to be fully understood. For these reasons, CO2 signal transduction pathways in plants need to be investigated more deeply. Two types of genetic screens were used to identify novel components that play a role in this signaling mechanism: knock-down of closely related gene family members genome-wide using an artificial microRNA (amiRNA) library and gain-of-function using a Full-length cDNA over-expression ("FOX hunting" system) system that includes genomic scale over-expression of plant genes. Thermal images were taken to compare the phenotype to the "wildtype" control HsMyo and a positive control ht1-2 with warmer leaves due to a defect on guard cell CO2 signal transduction. The data was quantified using gas exchange analysis. This forward genetic screen identified closely homologous F-box protein genes as a candidate that could play a role in the CO2 signal transduction pathway.

Shruti Magesh

Human Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Weg Ongkeko

Characterization of tRNA derived fragments in Smoking Induced and Non-Smoking Induced Lung Squamous Cell Carcinoma

Lung squamous cell carcinoma (LUSC) is a very aggressive cancer, with an average five year survival rate of 24%. It is well established that LUSC onset and development is highly influenced by etiological agents, such as tobacco smoke. Accordingly, transfer RNA derived fragments (tRFs) are highly associated with cancer clinical outcomes and disease progression, and demonstrate significant potential to act as biomarkers for cancer treatments. As such, we aimed to characterize tRF expression in LUSC samples, as well as examine tRF correlations to patient survival outcomes and clinical variables. We also aimed to analyze the effect of tobacco smoke on tRF expression in LUSC. In order to do so, we obtained tRF read counts for 425 LUSC primary tumor samples and 36 adjacent normal samples from MINTbase v2.0. Specifically, we analyzed the samples in the following three cohorts: (1) all primary tumor samples (425 samples), (2) smoking induced LUSC primary tumor samples (134 samples), and (3) non-smoking induced LUSC primary tumor samples (18 samples). Differential expression analysis will be performed to identify significantly differentially expressed tRFs in primary tumor samples. tRF expression will also be correlated to patient survival outcomes and clinical variables. In addition, we will examine tRF correlations to protein abundance. Finally, in vitro validation will be used to confirm the role of tRFs in promoting carcinogenesis in smoking induced LUSC cell lines. We hope that our results can be used to identify more accurate biomarkers for novel LUSC diagnostic and therapeutic modalities.

Cameron Manard

Psychology Bachelor of Science with a Specialization in Social Psychology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Leslie Carver

Reward Anticipation to Social and Nonsocial Dynamic Stimuli in Preschool-Age Children With and Without Autism Spectrum Disorders

The social motivation hypothesis suggests that individuals with autism innately find social rewards less salient than neurotypical individuals and therefore are less motivated to participate in such activities. However, social things may be hard for people with autism because they have had a history of negative experiences with them, making social situations aversive over time. The stimulus preceding negativity (SPN) is an EEG component that measures the expectation of a stimulus. Prior research shows that

neurotypical children ages 6 to 8 have a larger SPN when expecting social versus nonsocial stimuli. For children ages 6 to 8 with autism, there is no difference in SPN when comparing social with nonsocial stimuli. Studying younger children allows us to understand whether this effect is innate or grows over time. In a previous study, neurotypical children ages 3 to 4 have results consistent with older neurotypical children. In this study, participants were shown a colored X or square for 500 ms, waited during a 2,000 ms inter-stimulus interval, and were then shown videos of female faces smiling (social) or of a toy car rolling down a ramp (nonsocial) for 1,000 ms. The SPN was recorded 200 ms before the onset of the video stimulus. In our study, we hope to replicate this study in children with autism. We plan to present the paradigm we are researching with the literature review and methods that motivate it. We also hope to present the pilot data we have collected at that point.

Jacob Mapa

Bioengineering, UC Riverside
SDNI REU
Mentored by Dr. Michael Sailor

Enzyme-loaded modified porous silicon nanoparticles in polymer scaffolds synthesized via spray nebulization for improved performance in nerve agent detoxification.

The nervous system is vital as the main control center for all functions of the human body and is responsible for maintaining the proper communication between each organ. The use of toxic nerve agents in chemical warfare has been a serious threat to life due to its nature of targeting the nervous system. This project aims to improve the recovery of exposure to nerve agents by enhancing the system of releasing nerve detoxifiers through the use of porous silicon nanoparticles. For this drug delivery system, we are investigating the loading of nerve detoxifiers into modified porous silicon nanoparticles (pSiNP). We are planning to trap the loaded pSiNPs in a matrix of polycaprolactone (PCL) polymer scaffolds to form a patch via spray nebulization. We are expecting that the nanofibrous scaffolds that make up the patch will provide additional protection to the enzyme-loaded particles, allowing for a slower payload release (which is desired, instead of having a burst release), and sufficient degradation of deadly nerve agents.

Britney Martinez

Psychology, CSU, Northridge
STARS
Mentored by Dr. Sarah Creel

How does perception relate to production: do speakers understand themselves?

Less-experienced speakers of a language sometimes sound different from more-experienced speakers. Is this because they have weaker perceptual representations, or do they instead have accurate representations but their productions have not "caught up"? In this study, we sought to test this by assessing speakers' comprehension of their own speech. If perception matches production, then subjects should understand themselves quite well. If perception is ahead of production, subjects may not understand themselves as well as a more-experienced speaker.

Shayne Mayo

Cognitive Science with a Specialization in Neuroscience, UC San Diego
STARTNeuro
Mentored by Dr. Kim Dore

Synaptic Long-term depression in aged AD mice

Long-term depression has been long established as a critical tool in neural plasticity. The degenerative effects of Alzheimer's Disease on LTD have been studied previously, with little consensus. Using comparative analysis of extracellular recordings of synaptic cells in the CA1 hippocampal region of both, wildtype and APP/PS1 line mice, this study hopes to address this lack of understanding and answer important questions regarding the potential steps that might lead to cognitive decline in those afflicted with the disease, as well as point to potential treatments to combat this decline.

Shawn McClure

Chemistry, UC San Diego
MRSEC REU or RIMSE
Mentored by Dr. Julia Stauber

Utilizing a well-defined metallacage as a precursor for an extended network

Over the last several decades, the development of supramolecular structures has led to a wide variety of well-defined, molecular metal organic cages with varying sizes and shapes. Chemists have leveraged the tunable and modular nature of subcomponent self-assembly to gain access to diverse supramolecular systems with applications relevant to host-guest chemistry, catalysis, and much more. Here, we are studying a supramolecular bimetallic, iron(II) complex supported by three iminopyridine ligands that are each functionalized a peripheral amine group. The presence of three free amines on the periphery of the structure provides valuable synthetic handles for post synthetic modification. Our work is focused on developing this bimetallic Fe(II) complex as a molecular, well-defined building block for the preparation of a new class of imine-linked crystalline porous materials through condensation with bifunctional aldehyde subcomponents. This synthetic methodology is reminiscent of the preparation covalent organic frameworks (COFs), which have been extensively studied for their use in gas separation, catalysis, and energy storage. We aim to utilize the tunable and modular nature of this molecular approach combined with the synthetic methods employed for the preparation of COFs to create a new class of metal-intercalated organic frameworks composed of well-defined, repeating subcomponents. These new systems will be evaluated through advanced materials characterization and computational models to demonstrate that the structure of these frameworks can be predicted.

Claire McNerney

Theatre & Linguistics, UC San Diego
Summer TRELS
Mentored by Professor Deborah Stein

Devised Theatre & Other Art Forms

Devised theatre is theatre that is created with an ensemble, rather than a director directing a pre-written play. Techniques for devising theatre often emphasize collaboration and collective decision-making. Because the process is so flexible, devised theatre often borrows from/builds upon other forms of art, such as performance art, visual art, and poetry. Using historical and contemporary devising techniques, my ensemble and I experimented with and tested various stimuli and processes in order to generate theatrical pieces. In both existing literature and our workshop experiences, adapting techniques from other art forms allows for the experimentation that shapes the creation process and contributes to the distinctly novel ideas that characterize devised theatre.

Jesús Medina Alcantar

Mathematics - Computer Science, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Gerardo Arellano

The Gender and Racial Gaps Among Educators and the Effects These Have on Students

Gender inequality in the workplace is an important issue being addressed by increasing women's representation in certain fields, such as STEM. Despite a noticeable lack of representation of women in STEM, we can observe the opposite in the field of Education. I have worked in a high school and an elementary school for the past two academic years and have noticed a notorious gap between men and women educators, there being more women than men. By examining my personal experience and observations on the National Center for Education Statistics, I will better understand how and why teachers choose their job and the connection that their racial and gender identities have on students. I hypothesize that young people consider teaching as a profession because of their current teachers who inspire them, thus a lack of racial and gender diversity discourages the underrepresented students to become educators. In a country whose need for teachers has grown over the past couple of years, it is important to acknowledge these gaps and work towards closing them while understanding the implications of a more diverse workforce in education. To gain sense-making insight into the topic especially as it relates to quantitative data on teacher representation, I will use qualitative methods to interview and gather information from at least three current teachers, three aspiring teachers, and three current students – all from San Diego, CA – in regards to their experiences in school and their present/future occupations. I will also build on already existing research regarding the gender and racial gaps in education.

Grace Medina Perez

Chemistry, UC San Diego
Summer TRELS
Mentored by Dr. Michael Burkart

Fluorescence labeling tubercular carrier protein

Mycobacterium tuberculosis (Mtb) is the causative agent of the disease, tuberculosis (TB), and a leading cause of death worldwide. The type II fatty acid synthesis pathway (FAS-II) in Mtb is a validated drug target as it is the target of the first line drug, isoniazid. However, in recent years, increased resistance to isoniazid has spurred the need for new drugs that inhibit this pathway. Acyl carrier proteins (ACPs) are highly conserved proteins that all contain 3-4 helical bundles with a conserved serine at the base of helix II. ACPs can exist in a variety of states, all of which are defined by the type of substrate, or lack of substrate, covalently tethered to this conserved serine. Mtb FAS-II is an iterative pathway that is dependent on a central ACP, AcpM. In this pathway, AcpM is responsible for shuttling the fatty acid substrate to the various partner proteins in the pathway. This research will focus on fluorescence labeling tubercular carrier protein.To date, no fluorescent substrates being successfully loaded onto AcpM have been reported. Once loaded, this fluorescent crypto-AcpM can be studied biochemically with various partner proteins to improve our understanding of protein-protein interactions. Here we show the successful fluorescent labeling of the Mtb AcpM and its interactions with partner proteins from the Mtb FAS-II pathway.

David Melendez-Perdomo

Biochemistry, UC San Diego
STARTNeuro
Mentored by Dr. Lisa Stowers

Internal Physiological State Adaptively Shapes Responses to Social Stimuli

An animal's internal physiological state influences how they respond to external stimuli. This is important in the context of social communication. In mice, major urinary proteins (MUPs) act as important social signals in urine scent marks that encode information regarding the sex, identity and condition of a given mouse. Prior work has revealed that female reproductive state shapes behavioral responses to these social stimuli. Crucially, the mouse reproductive cycle contains regular and repeating physiological states. This allows us to use a female mouse's response to MUPs as a model to study how changes in internal physiological state can alter responses to an external stimulus. In order to examine this question, we used a specific MUP that acts as a male sex pheromone called Darcin. Recombinant Darcin (rMUP 20) was synthesized and purified using a standard protein isolation procedure. Darcin is being used in this experiment because it acts as a strong social stimulus that shapes female spatial preferences and behavior. After protein purification, a preference assay was performed using a two chamber design to determine whether the female mice reproductive state affected preference towards Darcin. Preliminary results show pregnant mice avoided Darcin. Mice in estrus instead preferred Darcin. The implication of these results is that the physiological state of an animal may change the response to an external social stimulus in a manner that is adaptive to the given state of the animal.

Joaquin Menas

Ethnic Studies, UC San Diego
Triton Underground Scholars
Mentored by David Quijada

"Unlocking Potential: Overcoming Barriers to Higher Education for Formerly Incarcerated Chicanos."

This research project aims to examine the unique challenges that formerly incarcerated and system-impacted individuals within Chicano communities face in accessing higher education. It will employ a mixed-methods approach, incorporating Literature review, oral history, surveys, and case studies, to gain a comprehensive understanding of these barriers. Through this research, we will explore the intersection of ethnicity, incarceration history, and higher education, with a particular emphasis on understanding why there's a lack of emphasis on higher education within Chicano communities. The project will explore issues related to social stigma, systemic discrimination, financial constraints, and potentially inadequate educational support systems. The anticipated outcome is a set of policy recommendations and practical solutions aimed at enhancing educational opportunities for this marginalized group. These findings will shed light on an overlooked area and underscore the need for inclusive practices in higher education policy. By focusing on the Chicano community, this research contributes to the broader discussion on educational equity and justice for marginalized communities, while helping pave the way for more extensive research in this critical area.

Mayra Mendiola

Human Biology, UC San Diego
Janelia-Meyerhoff Undergraduate Summer Program
Mentored by Dr. Jennifer Lippincott-Schwartz & Dr. Ron Vale

Understanding the contribution of mitochondrial transport to neuronal mitostasis

Neurons are the building blocks of the brain. Their function of receiving, integrating, and delivering information is an energy-demanding process powered by mitochondrial respiration. Because neurons are large and arbored, local adenosine triphosphate (ATP) demand must be met by mitochondrial respiration locally. Thus, the maintenance of mitochondrial mass, positioning, and quality over time in each compartment (mitostasis) is the result of an ensemble of complex behaviors: retrograde and anterograde motility, anchoring, fission, fusion, and dynamic contacts with other organelles. To specifically understand the contribution of mitochondrial transport in neuronal mitostasis in dendrites and nerve terminals of cultured primary hippocampal neurons, we used a novel synthetic cargo [1]. The synthetic cargo is designed to mirror mitochondrial transport by displaying the mitochondrial transport adaptor Miro fused with green fluorescent protein (GFP) on the surface of a self-assembled 60-subunit dodecahedral particle in cells [2]. Furthermore, we use time-lapse fluorescence microscopy to compare the transport behavior of the mitochondria and the synthetic cargo across different neuronal compartments. By comparing it with mitochondrial motility, our synthetic cargo provides us with a tool to study Miro-facilitated-motility in pharmacologically perturbed neurons. Specifically, by manipulating neuronal activity, ATP availability and specific metabolic mechanisms, we can better understand the role mitochondrial transport plays in the maintenance of local neuronal energetic demand.

[1] Gladkova C and Vale R, 2022. Cell Bio 2022.

[2] Hsia Y et al, 2016, Design of a hyperstable 60-subunit protein icosahedron Nature, 535, 136–9

David Raymond Mendoza

Sociology Law & Society, UC San Diego
McNair Scholars Program
Mentored by Dr. José I. Fusté

Criminalization of Rap in the Twenty-First Century

In May of 2022, Atlanta-based rap label Young Stoner Life (YSL) was indicted on Georgia’s RICO Act which categorizes the label as a gang. In the days following the indictment, the Fulton County District Attorney claimed that gangs like YSL are committing conservatively 75% to 80% of violent crimes occurring in their community. However, emerging twenty-first century gang research contradicts the punitive approach and rhetoric used by Fulton County’s District Attorney in addressing gangs. There is no empirical evidence or data to back the DA’s claim regarding YSL and violent crimes in Atlanta. However, what is evident is that violent crimes are occurring more frequently in specific communities where rappers like rap label YSL grew up and have included in their rap songs. When conducting secondary data analysis, the data suggest that these neighborhoods are the highest in the city regarding poverty, unemployment, and drug use, among other factors. Furthermore this socio-cultural analysis argues that structural and economic factors such as deindustrialization, a federal war on drugs, and mass incarceration have significantly contributed to the violent crime rates in Atlanta today. To decrease the high rates of violent crime in Atlanta that Fulton County’s DA is

prioritizing, there needs to be a shift from the traditional punitive approach from law enforcement specifically when it comes to rappers and how gangs are interpreted. There needs to be a focus on the root causes of the issue, such as structural causes from the war on drugs and deindustrialization, rather than periphery factors. There needs to be a transition from punitive approaches to more community-centered policing approaches to gangs and crime particularly not only in the city of Atlanta but nationwide.

Mildred Meza

Biology, San Diego Miramar College
STEMULATE
Mentored by Dr. James Nieh

Omega-3 and 6 Fatty Acid Ratio's Impact on Honeybee Learning

Honey bees face several threats, including poor diet and high levels of pesticide exposure. We evaluated their olfactory memory to see if omega-3 and 6 fatty acid's ratio affects honeybees' resilience to pesticides. We isolated colonies in tents on a diet of balanced omega-3/6 fatty acid substitute pollen (1:1 ratio) or imbalanced (1:5 ratio) without access to other food, in order to determine what diet makes them more resistant to a neonicotinoid pesticide, Thiamethoxam. After the tented colonies were isolated on a specific diet (balanced or imbalanced), we captured a frame of brood comb with bees near emergence. Baby bees were captured, caged, and fed the same pollen diet that was provided in the tent for two weeks to enable them to grow into adult bees and exhibit foraging behavior. At the end of the two weeks, we switched their food solution with either a control or pesticide-laced solution. The next day, we tested their ability to learn and memorize by observing their reaction to two odors (one associated with punishment and one associated with reward) to determine which diet (balanced or imbalanced) makes the honey bees more resistant and increase their insect survival to pesticide exposure.

Brenda Meza

Psychology, CSU, Northridge
STARS
Mentored by Deanna Greene

Comparison of subcortical volumes between patients with Tourette Syndrome and a control group

Tourette Syndrome (TS) is a neurodevelopmental disorder of the nervous system characterized by involuntary sounds and movements called tics. The cause of Tourette Syndrome is still unknown, but it is assumed to be associated with abnormalities in the subcortical brain regions, specifically the basal ganglia and thalamus, which are involved in movement inhibition. This study aims to investigate differences in subcortical volumes in people with TS using modern analytic methods and a large study sample. Structural magnetic resonance imaging (sMRI) data from 101 participants with TS and 101 participants without tics (age 7-35 years old) will undergo automated volume segmentation in order to estimate volumes of several subcortical structures (thalamus, caudate nucleus, putamen, globus pallidus) in each participant. Volumes of each structure will be compared between the TS and control group. We will also test if there are any differences depending on the age group of the participants (e.g., children vs. adults). Our study findings may help advance our understanding of subcortical structure in people with Tourette Syndrome.

Jazlynn Meza

Cognitive Science specialization in neuroscience, UC San Diego
Colors of the Brain
Mentored by Nicola Allen

Characterization of astrocyte reactivity during aging in the Ts65Dn mouse model of Down Syndrome

Due to proprietary information this abstract has been redacted.

Maddie Mitchell

Human Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Sreekanth Chalasani

Understanding Autism Associated Changes to Gut Health in C. elegans

Autism is diagnosed in the clinic based on behavioral observations, however individuals with autism often suffer from chronic gut health issues. Little is understood how risk genes for autism play a role in these other comorbidities. In the Chalasani lab, we have found that changes to the expression of one such gene, neurexin, results in altered gut health in the small transparent roundworm Caenorhabditis elegans. C. elegans animals with loss of neurexin show deterioration to gut health, with increase gut leakiness as well as prolonged defecation timing. In this proposal, I aim to better understand how neurexin affects gut health by identifying important neurons in the animal's nervous system that influence the intestine. I will learn how to re-express neurexin in specific neurons in C. elegans and then monitor changes to intestinal leakiness and defecation. Furthermore, I will also help develop a more quantitative approach to studying gut leakiness by optimizing fluorescent dye filling of the intestine and observe its timecourse, in order to better understand how leakiness develops and what factors may impact it. These studies will help further our understanding of how an autism risk gene can impact other aspects of an animal's health and physiology, as well as further establish C. elegans as a model for studying the impact of the brain on the gut.

Elise Miyahara

Marine Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Professor Isabel Rivera-Collazo

The Examination of Ecosystem Health through XRF and Microfaunal Analysis

Due to proprietary information this abstract has been redacted.

Nicolas Morales

Kinesiology, CSU, San Marcos
STARS
Mentored by Dr. Eric Leas

Assessing compliance to in-person tobacco sales requirements in San Diego County

Due to proprietary information this abstract has been redacted.

Kevin Moreno

Neurobiology, UC San Diego
Genentech Scholars Program
Mentored by Dr. Stacey Glasgow

The Effect of the NF1A Gene on Motorneuron Development

Spinal motor neurons are important components of the body as they are key players in speech, movement, and breathing. Like most cells, motor neuron development relies on the spatial and temporal expression of different transcription factors. One of these transcription factors is NF1A, which Dr. Glasgow discovered to be controlled by higher order chromatin architecture in motor neurons. NFIA has previously been shown to be essential for the development of cells in the spinal cord, like glial cells. However, its effect on motor neuron development has not been identified yet. In order to fill this gap in our current knowledge, we are looking at how NF1A regulates the development and migration of motor neurons in embryonic mice. To examine this, immunohistochemistry will be used to compare presence and location of different motor neuron markers between control and NF1A conditional knockout mice (i.e. NFIA knocked out in the central nervous system). Specifically, motor neurons in the spinal cord will be counted and their spatial coordinates determined. This way, we will quantitatively identify the effect of the NF1A gene knockout on the identity and position of motor neurons. Overall, this research will further our fundamental understanding of motor neuron development and the migration of neurons within the central nervous system.

Leah Moylan

Biomedical Engineering, University of Kentucky
SDNI REU
Mentored by Dr. Daniela Valdez-Jasso

Predictors of Right-Ventricular Function in Pulmonary Arterial Hypertension Using Machine Learning

The objective of this research study is to employ supervised learning techniques to evaluate predictors of right-ventricular function in pulmonary arterial hypertension. Since right-ventricular function is used to determine disease severity and outcome, we would like to identify metrics, and relationships between those metrics, that are most informative of changes in right-ventricular function. This will be completed using data collected from rats induced with pulmonary arterial hypertension.

Dan Sun

Visual Arts, UC San Diego
Summer TRELS
Mentored by Lakshmi Chilukuri

Foundation: The Origin of Sixth College

Founded at the beginning of the new millennium, Sixth College recently celebrated twenty years as a storied college of UC San Diego. However, there still remains much of the college's history that has not been thoroughly documented and archived. Starting with the founding of Sixth College, the main objectives of this project have been to collect and organize a variety of sources, to analyze these sources, and to create the concept for a permanent yet organic visual display that will begin with the origin story of Sixth College. To travel back in time to the early days of Sixth College, materials have been gathered from Sixth College, UC San Diego's library, and alumni. It has been necessary to archive and analyze not only photographs but also founding documents, newspaper articles, videotapes, and more. By examining these sources more closely, both an important narrative has emerged and a better understanding of a key time in history has been gained. This era of Sixth College is also a glimpse into a unique and exciting time throughout the world as a whole—when the Internet and computers were rapidly becoming a major part of our lives. Not only through the archival process, but by creating a lasting visual display at Sixth College, students, professors, staff, alumni, and visitors alike will be able to learn from and take pride in Sixth College's history. Ultimately, this project is the foundation for what will continue to be a valuable resource for past, present, and future generations.

Rohan Nambimadom

Electrical Engineering, UC San Diego
ECE SRIP

Mentored by Professor Nicholas Antipa

Single-shot High Dynamic Range image via End to End Machine Learning model

Single-shot High Dynamic Range (HDR) imaging , is achievable integrating random fiber bundle and global start shutter function. However, due to the imperfect factors, such as the glare of the sensor and flare of the lens, recovering object in high dynamic range becomes a challenging non-linear reconstruction problem. In addition, these effects can easily result in noise that is highly correlated to the optical system. This means the general denoiser will have difficulty in cleaning them. This project is aiming to incorporate the forward optical model and ML idea to build up an end-to-end optimizer to find the best denoiser for single-shot HDR imaging system.

Sarah Naughten

Molecular and Cell Biology, UC San Diego
Winter TRELS
Mentored by Dr. Sydney Leibel

The Effects of A Multidisciplinary Severe Asthma Clinic on Asthma Medication Ratio Within the Pediatric Population

Within San Diego County, African American children are five times more likely to be hospitalized with asthma than their Caucasian counterparts and Hispanic children are twice as likely compared to Caucasian children. In 2015, the Severe Asthma Clinic (SAC) at Rady Children's Hospital in San Diego, was founded to address these aforementioned healthcare disparities. SAC is an interdepartmental collaboration between the Allergy/Immunology and Pulmonology departments. During SAC patient visits, physicians and the healthcare team use a variety of metrics to assess the severity of a patient's asthma and determine the best course of treatment; these metrics include the Asthma Medication Ratio (AMR). The AMR has been identified as a real-time risk assessment tool with previous researchers classifying patients with an AMR of ≥ 0.5 indicating low risk of having an asthma attack and an AMR of < 0.5 indicating high risk. We performed a retrospective chart analysis assessing the change in the AMR within the Severe Asthma Clinic patient population. We concluded that on average, participation in a multidisciplinary severe asthma clinic improved the patients' AMR. Within our observed patient population, the average AMR before involvement in the Severe Asthma Clinic was 0.47, and the average AMR after participation in the Severe Asthma Clinic was 0.51 thus decreasing the risk for asthma exacerbation in the cohort.

Nico Navarro

Psychology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Lindsey Powell

The Neural Foundations of Empathy

Even at an early age, humans have a tendency to want to help one another. Despite their limited physical and verbal abilities, 1-year-old infants will try to respond to a person in distress in order to ameliorate the situation. One open question is what motivates such helping behavior. Researchers cannot ask infants why they help, but measuring brain activation associated with helping may give insight into their motivations. One thought is that infant helping tendencies correspond to brain regions that contain "mentalizing" and reward networks. Conversely, evidence also points to activity in the sensory and motor regions, such as the pain matrix, of the brain suggesting that infants respond to others' distress as painful. The goal of this study is to use brain imaging technology to measure which areas of the brain respond to stimuli of a person failing versus succeeding at tasks, asking if those responses correspond to either or both the mentalizing or motor and sensory regions. Additionally, we will see how an infant's neural activity relates to an infants' helping behavior.

Kaitlyn Ng

Pharmacological Chemistry, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Professor Brian Zid

The role of mitochondrial mRNA localization on mRNA stabilization

With many neurodegenerative diseases being related to mitochondrial gene expression, a natural question is posed: how does the mitochondria regulate gene expression. Previously the Zid lab found that mRNA localization to the mitochondria can stabilize mRNAs, but with no known mechanism. The overall goal of my project proposal is to identify mechanisms in mitochondrial mRNA localization stabilization by using a genome-wide CRISPR inhibition screen. To do this I will create a plasmid that can direct the localization of mRNAs to the mitochondria using MS2 stem loops and a stem loop binding protein (MCP) bound to Tom70, an outer mitochondrial membrane protein. The lab has previously found this to strongly stabilize a reporter mRNA. I will first investigate the responses between two different lengths of stem loops 2x vs 12x. We will also verify that it is specifically the MCP bound to Tom70 that stabilizes mRNA, and not the MCP in general. Preliminarily I have found that adding MCP without Tom70 does not yield the same level of stabilization. I will also verify that the dCas9-MXi yeast strain, which is necessary for the CRISPR inhibition screen, is reducing transcription as expected when a target gRNA is expressed. To do this I will measure RNA levels of the target gene before and after induction of the gRNA of interest with qPCR. Mitochondrial gene expression continues to be a popular topic of interest among researchers in the quest to investigate the roots of many common diseases.

Kristin Nghiem

Molecular and Cell Biology, UC San Diego

IPATH Scholars
Mentored by Dr. David T Pride

Evaluating host ranges of jumbo vs. non-jumbo phages

Now that multiple bacterial pathogens have become antibiotic-resistant, phage therapy is being explored as an alternative to treating bacterial infections. Enterobacter is included with the ESKAPE pathogens, which are responsible for the preponderance of hospital-acquired infections across the world with a propensity to become antibiotic resistant. Because Enterobacter is one of the most common antibiotic-resistant pathogens, we have been developing a collection of phages found in the environment and wastewater that target and kill the Enterobacter isolates. In the process, we have used unique techniques to find jumbo phages that target Enterobacter and likely have nucleus-like structures to reduce Enterobacter resistance to them. We also have identified non-jumbo phages with significant activity against Enterobacter. We evaluated the host ranges of our jumbo and non-jumbo phages to determine whether they target the majority of the Enterobacter isolates we commonly encounter. To evaluate whether our phages can kill Enterobacter, we assessed whether the Enterobacter isolates have prophages embedded in their genomes that could kill the isolates, and have us incorrectly attribute the isolate killing to our phage collection. We identified 19 isolates with prophages and another 81 with no inducible prophages. We are testing our collection of 25 phages (5 of which are jumbo phages) against the remaining 81 Enterobacter isolates to decipher whether our phage collection has a broad range to kill many of these antibiotic-resistant isolates. With these findings, we can further develop bacteriophage therapy to create an effective treatment for Enterobacter infections that does not solely rely on antibiotics.

Kristopher Ngo

Electrical Engineering, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Hanh-Phuc Le

A Current-Mode Stimulation Circuit with Integrated SPI and DAC for Neural Stimulation

Due to proprietary information this abstract has been redacted.

Nam Nguyen

Human Biology, UC San Diego
Summer TRELS
Mentored by Professor JoAnn Trejo

Identifying Proteins that Interact with ARRDC3

Arrestin Domain-Containing Protein 3 (ARRDC3), an α-arrestin protein, has generated significant interest in cancer biology due to its potential role as a tumor suppressor. This is particularly relevant in triple-negative breast cancer (TNBC), a highly aggressive subtype lacking targeted therapies. Our laboratory is currently investigating ARRDC3 and its intriguing relationship with Protease-Activated Receptor 1 (PAR1), a G-protein-coupled receptor (GPCR). Notably, the ARRDC3-PAR1 interaction has been observed to have an inverse relationship with TNBC, hinting at a crucial role in mitigating cancer progression. Despite ARRDC3's structural similarity to β-arrestins, known regulators of GPCRs, its precise functions and protein-protein interactions remain to be fully elucidated. Therefore, our study uses a biotin ligase based proximity labeling approach (TurboID) to identify potential partners of ARRDC3, in order to enhance our understanding of its function and role in tumor suppression. Currently, we have constructed a fusion protein consisting of ARRDC3-TurboID. Before performing the ultimate experiment to identify proteins interacting with ARRDC3, we will have to characterize ARRDC3-TurboID to determine whether it retains the function and cellular location of a wild type ARRDC3. Our ultimate goal is to transfect the ARRDC3-TurboID construct into HEK-293 cells to identify new potential interaction partners for ARRDC3. These findings may elucidate ARRDC3's role in endosomal protein trafficking and its broader implications for cellular processes. By identifying and characterizing the interaction partners of ARRDC3, we anticipate significantly enriching our understanding of ARRDC3's tumor-suppressive role.

Tin Nguyen

Mechanical Engineering & Molecular and Cell Biology, UC San Diego
STARS
Mentored by Professor James Friend

Novel Omnidirectional Spiral Surface Acoustic Waves for Efficient Underwater Silent Propulsion

Underwater vehicles at small scales typically rely on electrical motors and propellers for propulsion. However, propellers are inefficient, especially at smaller scales, and they also generate detectable acoustic signals over long distances. Efficient and silent propulsion is crucial for autonomous underwater vehicles. As an alternative to propellers, surface acoustic wave (SAW) devices have been explored. SAW devices utilize piezoelectric materials to convert electrical energy into mechanical movement, generating fluid flow. Recent studies have shown that SAW devices exhibit higher efficiency compared to ultrasonic thrusters and are comparable to propeller-driven thrusters. Additionally, SAW devices are silent as they exploit sound attenuation to generate force. We aim to investigate the potential of using the novel omnidirectional spiral surface acoustic wave (OSSAW) devices as efficient and silent small-scale underwater propulsion. OSSAW devices employ a spiral interdigital electrode structure, enabling greater rotation speed at the same applied power as traditional SAW devices. Moreover, OSSAW devices produce a more axisymmetric streaming pattern than conventional devices. To analyze the OSSAW device as a propulsion generator, we will measure its propulsive force and model and visualize its propulsion mechanism using Particle Image Velocimetry. The propulsive force of the OSSAW device will be measured using a simple force balance model, where the device is set up as a submerged simple pendulum. It is hypothesized that OSSAW devices can generate greater force than traditional SAW devices while maintaining silence and efficiency. We hope that this finding could establish OSSAW as a superior method of propulsion for autonomous underwater vehicles.

Anna Nguyen

Mechanical Engineering, UC San Diego
STARS
Mentored by Professor Lisa Poulikakos

Giving "L"s to Mie Resonator Arrays Senses Circularly Polarized Light

Nano-optical arrays are two-dimensional, on-chip imaging platforms composed of periodically repeating nanoscale structures. It is hypothesized that the degree of asymmetry of the nanoscale structures is correlated with the sensitivity of the nano-optical array to the incident polarization of light. Chirality is one form of asymmetry in which an object cannot be superimposed on its mirror image regardless of the number of rotations or translations. Circularly polarized light is chiral: the electric and magnetic field components can travel in either a clockwise or counterclockwise rotation. To differentiate between clockwise and counterclockwise circularly polarized light, a chiral probe needs to be used. However, the ideal design of a chiral nanoscale structure has yet to be discovered. Here we report numerical investigations that correlate changing geometric parameters of L-shaped nanostructure arrays to their capability of distinguishing between counterclockwise and clockwise circularly polarized light. By constraining the problem to the visible light regime, our nano-optical arrays can be used as colorimetric sensors for circularly polarized light. Through appropriate geometric manipulations, it becomes possible to uniquely map a color to the rotation of circularly polarized light. This work provides insight into design guidelines for how L-shaped chiral nanostructures in nano-optical arrays can be engineered to detect the rotation of incident circularly polarized light. These sensors can enable high-precision imaging applications to detect chemicals, gases, or biomolecules and ultimately improve diagnostic technologies.

Laura Noronha

Human Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Nicola Allen

Altered Cholesterol Metabolism in Alzheimer's Disease Astrocytes

The brain is comprised of neurons and non-neuronal glial cells. Neurons use electrical signals to transmit information, but this communication is disrupted in Alzheimer's

Disease due to the buildup of amyloid beta and tau that lead to neuronal cell death. Astrocytes are a class of glial cells important for the formation of the blood brain barrier, synapse development, and neuronal function by providing lipids to neurons. One lipid synthesized primarily by astrocytes is cholesterol. Astrocyte-derived cholesterol is the main source of brain cholesterol and plays an essential role in biological membrane function, vesicle fusion, and synaptogenesis. Dysregulation of cholesterol metabolism is evident in neurodegenerative diseases, including Alzheimer's Disease (AD), the most common form of age-related dementia. Cholesterol dyshomeostasis is also linked to increased inflammation in the periphery and brain. In our lab, we use human astrocytes induced from pluripotent stem cells (iPSC-iAs) to study AD-associated dysfunctions on astrocytes and neurons. Preliminary data showed that AD iPSC-iAs had altered expression of cholesterol transport genes. Additionally, these AD iPSC-iAs also had increased expression of proinflammatory cytokines and chemokines. My hypothesis is that targeting these differentially expressed cholesterol genes may rescue cholesterol metabolic dysregulation and the expression of pro-inflammatory cytokines in the AD astrocytes. To test this, our genes of interest will be targeted by pharmacological means and cytokine expression will be measured using qPCR. Total and secreted cholesterol will also be assessed. These experiments will give insight into how cholesterol metabolism dysregulation can be targeted in AD astrocytes.

Meline Norquist

Cell and Molecular Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Joe Pogliano

Investigating the Roles of Core Genes in the Nucleus-Forming Phage Life Cycle

It was recently discovered that some phages (viruses that infect bacteria) construct a complex subcellular compartment known as the phage nucleus which separates viral DNA from the host cytoplasm during replication and helps organize progeny assembly. The phage nucleus fully encloses viral DNA within a proteinaceous shell and displays functions that are analogous to a eukaryotic nucleus, including mRNA export to the host cytoplasm and selective protein import into the nucleus. A set of 72 genes, termed the core genome, are present in all nucleus-forming phages, but many of these genes have no known function. In this project, we aim to characterize nine core genes using the nucleus-forming Escherichia phage Goslar as a model. We employed Cas13d, a complex that targets RNA to inhibit the production of a specific gene product, to knock down proteins of interest during Goslar infection. Additionally, we used GFP fusion to visualize the localization of our proteins within infected cells. This study serves to further our understanding of the role these proteins play in the viral life cycle of nucleus-forming phages.

Sara Northup

Psychology B.S. with a Specialization in Clinical Psychology, UC San Diego

URS - Undergraduate Research Scholarships
Mentored by Dr. Jessica Bomyea

Differences in Working Memory Performance Before and After Cognitive Training in Veterans with PTSD, Both with and Without Comorbid Anxiety or Depression

Post-Traumatic Stress Disorder (PTSD) is a highly prevalent condition among military Veterans and is linked to a variety of cognitive impairments that have negative effects on daily functioning and quality of life. In addition, comorbid anxiety and depressive disorders are frequently observed in individuals with PTSD, further exacerbating their distress. Recent research indicates that participants diagnosed with PTSD, anxiety, or depression exhibit deficits in working memory. Although emerging research suggests that cognitive training interventions targeting working memory may decrease negative symptoms related to PTSD, anxiety, and depression, a gap exists in the literature regarding comparisons of cognitive deficits between these groups. Consequently, while prior research has highlighted the efficacy of working memory training in mitigating negative symptoms, further investigation is necessary to examine potential between-group differences in treatment outcomes. The present study aims to investigate differences in working memory performance and improvement in people with PTSD, PTSD and Generalized Anxiety Disorder, and/or PTSD and Major Depressive Disorder following a novel working memory intervention. Before and after the intervention, participants completed a clinical interview, self-report measures of PTSD, anxiety, and depression symptom severity, and the R-span to evaluate working memory. A repeated measures ANOVA will be used to examine differences in R-Span performance between diagnostic groups before and after treatment. A regression analysis will be used to assess the relationship between symptom severity and change in R-span score. These methods will compare respective group improvement outcomes post treatment and explore the association between symptom severity and changes in R-span performance.

Eric Oberholtz

Chemical Engineering, UC San Diego
UC Scholars
Mentored by Dr. David Fenning

Development of novel perovskite solar cells for tandem applications

Photovoltaic energy is a leading candidate in the renewable energy sector, but as our Silicon resources deplete, we must replace Silicon with alternative, greener materials. A promising candidate is a perovskite solar cell, where the photoactive layer generates power without relying on Silicon. In this work, we work to passivate defects within the perovskite to improve the performance of a wide band-gap solar cell.

Brenda Ochoa

Molecular & Cell Biology, UC San Diego

Multidisciplinary Approach to Addressing Cancer Disparities
Mentored by Georgia Sadler

Reducing Cervical Cancer Screening Disparities Among Trans Men and Non-Binary People

Cervical cancer screening (CCS) is critical for any person with a cervix over the age of 21. The widely known cervical cancer screening method is the Pap smear, but HPV testing has been emphasized in the last decade. Trans men and non-binary people face both biological and social barriers to cervical cancer screening. Social barriers include fear of discrimination, gender dysphoria, and misconceptions about screening guidelines. Biological barriers include discomfort due to anatomical & physiological differences and/or hormone replacement therapy effects that may interfere with the success of the procedures and test analysis. The risk perception of cervical cancer in trans men and non-binary individuals is complex and relies on distinguishing between sex and gender to clarify prevalence differences. A narrative literature review was conducted using Google Scholar, Proquest, and LGBT Life to review scientific literature including the keywords: trans men & non-binary people with cervixes, LGBT health, cervical cancer, cervical cancer screening, HPV testing, machine learning (ML), computational methods, and artificial intelligence (AI). This study includes people with intact cervixes only. Machine learning tools are currently being practiced to facilitate CCS, which improves self-sampling and the evaluation of samples using computational methods. The incorporation of computational methods in cancer research can enable personalized risk assessment, early detection, precise treatment planning, and behavioral interventions. Fostering a culturally competent healthcare system involves the development of those optimized procedures and the use of inclusive language pertaining to gender identity to bridge the barriers experienced by trans men and non-binary people.

Chester Olaes

Literatures in English, UC San Diego
McNair Scholars Program
Mentored by Dr. Joo Ok Kim

Asian comedians in the U.S.: Disidentifying with stereotypes that harm Asian communities

The enmity towards Asian communities that came from 19th and 20th century America has not gone away. From stereotypical depictions within popular culture and mass media to the violence that has occurred in recent years, the marginalization of Asian Americans is an ongoing strife that continues to be downplayed in American society. This is further reinforced by the stereotypes that are associated with Asian identity today in mainstream media. My project deconstructs the bits and jokes of several Asian comedians in the United States to analyze how they disidentify with stereotypes that target Asian communities. They achieve disidentification with their comedic rhetoric through demystification, subversion of stereotypes and informing their audiences about Asian cultures. The importance of this project is to spread awareness and provide insight to how important it can be to study comedy, along with how stand-up comedians of color use their platform to show others how they engage stereotypes through humor to create their own identity, one that is different from the assumptions that are portrayed in the media.

Alyssa Olivares

Education Science, UC San Diego
LAEP Scholars
Mentored by Dr. Debanjan Dhar

Elucidate TREM2 Dependent Mechanisms that Facilitate NASH and Fibrosis Resolution

Due to proprietary information this abstract has been redacted.

Alyson Otañez

Political Science: Data Analytics, UC San Diego
Summer TRELS
Mentored by Marisa Abrajano

The Politics of Warehousing in the Inland Empire, CA: How did we get here?

The Inland Empire (IE), CA, has developed into a warehouse center to meet growing production and industrial demands. In 1980, the IE had a little over 200 warehouses; there are now over 4,000 accounting for over 1 billion square feet of land. The IE has some of the highest concentrations of ozone in the country, with the number of unhealthy air quality days increasing from 13.2% in 2010 to 19.7% in 2020. These warehouses are disproportionately situated in low-income minority neighborhoods and are located adjacent to residential areas, healthcare facilities, and schools. Decisions on where to build warehouses are not random; they are decided on by local governments. My research seeks to understand the dynamics surrounding the decisions made by local elected officials in building these warehouses. By doing so, I analyze the policies established over time regarding the growth of warehouses, and under what conditions they've been approved and discussed. I expect local governments to play a considerable role in facilitating the growth of warehouses. Namely, I expect to find a notable difference between the amount of warehouses approved, in comparison to beneficial programs surrounding issues such as transportation, housing, and increased green spaces. To test these hypotheses, I use web scraping and text analysis from the city council minutes and agendas of five regions situated in the IE– Ontario, Fontana, Rialto, Chino, and the March Joint Powers Authority. These findings highlight how local policy decision-making affects marginalized communities in the IE.

Joshua Páez

Theatre and Dance, UC San Diego
McNair Scholars Program
Mentored by Professor Robert Castro

Research & Dramaturgical Development for an Original Play Based off the 1917's Gasoline Baths in the U.S-Mexico Border

This research focuses on and serves as the foundation for the creation of a theatrical world, supporting the play's structural narrative to raise awareness of a historical event and to spotlight historically silenced and suppressed voices of color. The gasoline baths occurred at the El Paso, Texas border in 1917 when Mexicans were inhumanely disinfected with toxic chemicals as they sought entrance into the U.S. as a result of discriminatory beliefs and practices. Primary research will include published articles and books, focusing on the event that will serve as source material for the play developmental process. Secondary research efforts will include U.S. immigration policies of the time as well as identifying key historical figures. Carmelita Torres, a central figure in the event, will serve as the main protagonist and voice of the play. The narrative will showcase her advocacy for her community as well as demonstrate the gender bias role of women. Ultimately, the intention of this play is to serve as a catalyst for change, creating a space for conversation, empathy and transformation to awaken an audience towards moral and social action.

Monsserrat Pallan

Human Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Karen Oegema

Examining the role of RhoA in syncytial germline development

Failure of cell or tissue shape changes can lead to problems ranging from infertility or developmental disorders to cancer emergence and spread. Cell shape changes rely on patterned cell surface contraction. A key cell shape change regulator is the molecular switch RhoA, which cycles between active and inactive forms that turn contractility "on" and "off". Syncytial germ cells, which form via multiple rounds of incomplete cytokinesis, are highly multinucleated but intricately structured, with nuclei in compartments connected to a common cytoplasm. We hypothesize that RhoA activity is required for syncytial cell development. To test this, I combined genetic approaches and confocal imaging in the Caenorhabditis elegans syncytial germline to determine whether germline development is impaired in the absence of known upstream RhoA activators, chiefly the RhoGEF ECT-2 and the two known ECT-2 activators NOP-1 and the centralspindlin complex (CYK-4/ZEN-4). Surprisingly, germlines developed normally from the L1 to L4 stage after upshift of a strong cyk-4 temperature-sensitive allele in animals that had the nop-1 gene deleted. This suggests that either RhoA activation is not required for germline development, that our cyk-4 mutant allele is not strong enough to impact RhoA activation in the germline, or that we are missing a piece to the germline RhoA activation puzzle. To distinguish between these possibilities, I will use the auxin inducible degradation system to degrade RhoA activators and inhibit them more completely in the germline. We anticipate that our findings will improve our understanding of whether RhoA activation contributes to shaping syncytial germline cells.

Adie Parinas Parinas

Computer Science, Cypress College, CSU, Long Beach
STARS
Mentored by Dr. Jejo Koola

Using Wearable Technology to Follow Patient Centered Outcomes After Kidney Injury

Acute kidney injury (AKI) is a sudden and severe decrease in kidney function, necessitating urgent medical intervention and treatment. It is a critical condition that carries significant morbidity and mortality rates. AKI typically affects individuals with multiple comorbidities, rendering them particularly vulnerable and contributing to a worsened frailty status over time. Additionally, the long-term implications of AKI, particularly its impact on a patient's frailty status, remain poorly understood. Frailty encompasses a state of increased vulnerability and decreased physiological reserve, leading to a heightened risk of adverse outcomes. Despite the severity of this condition, little is known about the long-term implications of AKI and how to improve patient’s frailty status, especially after patient’s discharge. Therefore, it is crucial to investigate strategies for improving a patient's frailty status post-discharge and comprehensively understand the long-term consequences of AKI to enhance patient outcomes and quality of life. Digital phenotyping is a method that utilizes digital technologies. In this study, we utilized wearable devices such as Fitbit. This collects and analyzes data on an individual’s behavior, activity, and physiological parameters. It enables the provider to continuously monitor the patients’ activities and use these data to contribute to their health and well-being. Another reason how digital phenotyping is helpful is because it provides information that is useful in managing AKI as it can help detect early warning signs or figure out a better way to enhance AKI patients’ condition. Along with the Fitbit given to patients, there is a post-AKI coordinated care bundle (CCB) that is provided to the patients to improve their well-being. With this method, we can compare if the wearable technology and post-AKI CCB method is better than the regular post-discharge care for AKI patients.

Seyeon Park

Chemistry, UC San Diego
MRSEC REU or RIMSE
Mentored by Michael Sailor

Photoluminescence blinking of n-type and p-type silicon quantum dots

Quantum dots (QDs) are semiconductor nanocrystals known for their photoluminescence (PL) which suggests many potential applications. Among them, silicon quantum dots (SiQDs) are noted for outstanding optical properties and biocompatibility, yet the phenomenon called "blinking," where QDs exhibit spontaneous emission fluctuations, is a challenge because it limits the performance and thus the application of SiQDs. A possible mechanism for the blinking "off" state is due to the non-radiative Auger recombination wherein the energy released by the electron-hole recombination gets transferred to the third carrier (either the electron or hole) instead of emitting photons. The blinking is normally observed on a millisecond time frame but the blinking off state of SiQDs has a much longer lifetime. Here, we seek to explore the PL blinking of phosphorus-doped silicon quantum dots (n-type) and boron-doped silicon quantum dots (p-type) to determine the effect of different laser intensities on PL. Understanding the blinking process can further suggest improvements in the stability of QD-based devices and fluorescence biosensors.

Josh Park

Neurobiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Sreekanth Chalasani

Comparing Sex Differences for Fear Response Neural Activations

Human males and females seem to have varying underlying mechanisms for processing trauma, as indicated by a higher rate of post-traumatic stress disorder (PTSD), depression, and anxiety disorders in women than men [1]. We are interested if this sexually dimorphic response to stress is also present within mice. PTSD is a psychiatric disorder an individual can develop after they undergo a traumatic or life-threatening event. Researchers rely on mice to model aspects of PTSD, specifically the process in which mice learn to associate stimuli to negative experiences (fear conditioning). It is well documented that mice exhibit fear by freezing in place [2]. In our experiments, we pair an auditory tone to a foot shock, and the mice learn to anticipate the foot shock when they hear the tone. By analyzing their freezing behavior and neural activity, we can determine if response to fear is sexually dimorphic. We analyze freezing behavior using a camera to detect the duration of freezing, and recent neural activations are determined using immunohistochemistry to visualize markers of recent neural activity, such as cFos, pPDH, and Arc. The purpose of this project is to determine if there are any significant sex differences in freezing behavior or neural activity during fear conditioning.

Jamie Park

Clinical Psychology B.S., UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Assistant Professor Lindsey J. Powell

Social Interaction Processing in Infants

Recognizing and attending to social interactions is an important ability for social development. Infants show increased attention to social interactions toward the end of the first year (Thiele et al., 2021), but there is little neural evidence regarding the development of social interaction processing in the brain. In adults, a region of the posterior superior temporal sulcus (pSTS) is functionally specialized for processing social interactions relative to independent actions (Isik et al., 2017). In the current study, we will aim to answer two questions. First, is there a functionally specialized region for processing social interactions in infant pSTS? Second, if there is such a region, is it initially responsive 1) to concrete, naturalistic features of interacting people, 2) to abstract, relational features of social interactions, or 3) both? To address our first question, we plan to test for differences in activation in the pSTS in 7-9 month-old infants (around the age of increasing attention to interactions) as they observe social interactions and independent actions, using functional near-infrared spectroscopy (fNIRS).We will optimize optode placement to cover the area of pSTS matching adult specialization (Powell et al., 2018; Liu et al., 2022). To address the second question, we will also manipulate the features in the videos, to test if concrete or abstract features drive early specialized responses to social interactions. Stimuli will feature either videos of two human actors or animations of two geometrical agents (with eyes). For each stimulus type, trials will depict either social interaction or independent actions.

Deiya Paul

Computer Engineering and Physics, CSU, Long Beach
MRSEC REU or RIMSE
Mentored by Robert Ramji

Computational Analysis of Nano-Structured Polyurethane Materials Through Molecular Dynamics Simulations

Polyurethane is a versatile and widely used polymer commonly found in foams and other insulating materials. However, due to its dependence on precursors derived from crude oil, the mass production of this polymer poses an environmental issue. Our collaborators in the Burkart lab have developed the first ever 100% biobased polyurethane foam formulation, deriving the diisocyanate and polyol components almost entirely from algae. We are supporting their experimental investigations through all-atom simulations of their polyurethane foams to analyze the molecular- and nano-scale structures of these materials. Through the simulations, we look to gain insight on the role of the algae-derived components in the formation of the polymer's hard and soft segments. We also investigate the distribution of these hard and soft segments in the new formulation and compare it to that of the conventional polyurethane materials. To conduct these investigations, all-atom molecular dynamics simulations are performed using the DREIDING force field and 1 fs timestep in a reduced system of ~15K atoms. A 100ns equilibration of the system is run to understand the hydrogen bonding effects within the material and analyze the location and behavior of the hard and soft segments present in the new formulation. Additionally, to capture critical polymer properties, we use united-atom (UA) or coarse-grained (CG) models, expecting ~5x acceleration (UA) or ~100x acceleration (CG). A CG model with ~25 fs timestep will be used to simulate a 10x larger system for ~1 microsecond, with similar per-simulation costs.

Marisol Paulino

Microbiology, UC San Diego
Summer TRELS
Mentored by Dr. Hiutung Chu

Expression of type I IFNs varies among different microbial communites

Due to proprietary information this abstract has been redacted.

Madelyn Peck

Neurobiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Eiman Azim

Evaluating the Role of Cerebellar Nuclei Inhibitory Projections in Maintaining Internal Models for Skilled Movement

It is theorized that smooth and accurate execution of skilled movement is dependent on an internal model of how the body interacts with its environment. The cerebellum is thought to implement this internal model and acts as a forward model that predicts the internal and external outcomes of the body's actions. However, as the environment changes, the internal model must be able to adapt to maintain proper motor coordination. The comparison of predicted and actual movement outcomes for driving internal model correction is believed to be computed by the inferior olive. However, it remains unknown what role the inferior olive’s input pathways from the cerebellar output nuclei have on the maintenance of the internal model and either ongoing or future movements. To expand our understanding of these roles, I am investigating interposed cerebellar nuclei inhibitory projections, including inhibitory input pathways to the inferior olive. In this project, I will use optogenetics to perturb the activity of inhibitory neurons of the anterior interposed cerebellar nucleus in mice performing skilled forelimb movements and assess their effects on movement kinematics to determine the role of these neurons in motor execution and stability.

Anakaren Perez

General Biology, UC San Diego
McNair Scholars Program
Mentored by Penelope J. Quintana

Pollution in the Tijuana-San Diego and Imperial Valley regions and their impact on the public's health

The northern Mexico cities of Mexicali and Tijuana have experienced a large influx of expansion in the last couple of decades. Processes such as industrialization, border mobilization and agriculture have caused these two cities to increase their development. With the promotion of the cities growth has come an influx of pollutants, negative health implications and the exploitation of natural resources. Pollutants such as black carbon and fine particulate matter have increased in emission due to the implementation of Maquiladoras and the introduction of high traffic rates in these border communities. Maquiladoras are industrial international companies that have settled in Northern Mexico and other areas in hopes of avoiding environmental regulations and exploiting cheap labor. The research hopes to highlight the significant increase of pollutants such as particulate matter, black carbon, carbon dioxide and other toxins in these areas and their promotion of illness such as asthma, arrhythmia, and bronchitis. Using statistical data analysis the study will demonstrate differences between emission of black carbon determined by season and time of day in the selected sites of San Ysidro, Otay Mesa and nearby coastal reference sites. The study hopes to promote the necessity for further research on both of the regions and introduces solutions for the lack of environmental and labor policies implemented.

Giselle Perez

Computer Science, UC San Diego
STARS
Mentored by Dr. Ming Tai-Seale

Perspectives on AI-Assisted Response from Physicians to Patients from Members of the Public

Due to proprietary information this abstract has been redacted.

Constanza Perez Romero

Psychology, CSU, Northridge
STARS
Mentored by Dr. Minju Kim

Gesture production and engagement in preschooler's analogical reasoning

Gesture production may help children's analogical reasoning, since gestures play a role in selectively schematizing structural information and removing superficial details (Gesture-for-conceptualization hypothesis, Kita et al., 2017). A previous study suggested that spontaneous gesture production predicts success in analogical transfer in children (e.g., Kim & Walker, 2021). In our study, we analyzed what content children remembered after the transfer task as a measure of level of engagement. Specifically, we observed whether children's overall and content-specific memory recall aligned with their gestures produced. Five- to 7- year olds (n=140) listened to two exemplar stories where a protagonist solved a problem with analogous solutions, participated in a retelling task while their speech and gestures were observed, and then were asked to generate their own solution in another analogous story. Then, they answered memory questions on solution-relevant and solution-irrelevant contents for each story, which were scored and summed for analysis. We predict that gesturing in general will result in higher scores in the overall memory task, while specifically gesturing solution-relevant materials will lead to higher scores in solution-relevant memory questions. These results suggest that children's gesture production and memory measures may offer valuable insights to researchers into their analogical reasoning abilities. We suggest that looking at the level of engagement along with gesture production can provide researchers a unique window to analogical reasoning — where children's co-speech gestures show real-time activation of relevant knowledge at children's fingertips, and engagement measure allows us to align which concepts were activated in gestures and memory recall.

Aatash Pestonjamasp

Computer Engineering, UC San Diego
ECE SRIP
Mentored by Dr. Edward Wang

Evaluation of Low-Cost, Accessible Materials for Ubiquitous Spirometry

Lung diseases such as Asthma and Chronic Obstructive Lung Disease (COPD) can severely hinder a person's wellbeing and present long-term challenges to their everyday lives. Being able to identify these or similar diseases is the first step in ultimately mitigating and overcoming them. Spirometry can be used to identify lung diseases and involves a person's vital capacity (VC), or maximum exhalation following a maximum inhalation, as an important measurement for diagnosis. Despite the necessity of diagnosing lung-related diseases, spirometers are often unattainable for vulnerable populations due to complexity and cost. To make spirometers more obtainable, we explore low-cost, highly accessible materials for use in vortex whistle construction. A vortex whistle is a device which can be used as an affordable spirometer that maintains a large degree of accuracy in determining user lung capacity. Usage of low-cost, highly accessible materials improves accessibility, not only by being cost-competitive to alternatives such as 3D printing, but also by having the ability to be shipped more conveniently with minor setup required. To test the potential benefits of using low cost, high accessibility materials, we first tested functionality to confirm that our design would suitably act as a proper replacement for a spirometer. We then compared our device's costs to those of state-of-the-art and other industry standard devices. In addition, we also studied the accessibility of our design by comparing form factors and ease of use for each device.

Kayla Pham

Chemistry, Columbia University
Laidlaw Fellowship and Deresiewicz Fellowship
Mentored by Dr. Milan Delor

Imaging Ultrafast Exciton-Polariton Transport

Two-dimensional semiconductors such as transition metal dichalcogenides (TMDs) have attracted a plethora of interest due to their strong light-matter interactions and unique electronic transport properties. Light is a powerful stimulus to investigate the behavior of particles such as electrons and excitons (electron-hole pairs) in these emerging materials. They have also been shown to exhibit polaritonic self-hybridization, resulting in intrinsic exciton-polaritons without the need for an external microcavity, requiring complicated fabrication techniques that are not suitable for widespread adoption (Munkbhat et al, ACS Photonics, 2019, 6, 139-147). The layers of van der Waal TMDs act as low-quality resonators, allowing for broad spectral overlap between exciton-polaritons states, resulting in an exchange between coupled and uncoupled exciton states. To further investigate this exchange, we study a particular form of light-matter interaction, polariton formation (quasiparticles that are half-light and half-matter), a mechanism to transport energy over large distances for next-generation optoelectronic devices. Utilizing Stroboscat, a non-invasive energy landscape imaging technique, to investigate self-hybridized TMDs, we observe long-lived ballistic transport (Delor et al, Nature Materials, 2020, 19, 56-62). These findings provide critical insights into what exotic properties TMDs have that can be exploited, particularly for photovoltaic and photocatalytic applications such as solar cells.

Nhat Pham

Mathematics, UC San Diego
McNair Scholars Program
Mentored by Professor Alexis Toda

Computational Analysis of Bubbles with Overlapping Generations Model

Bubbles arise in economic situations where the price of a good increases significantly compared to its fundamental value, but they are difficult to study and detect in their formation. The study of bubbles with general equilibrium theory has produced new results, especially Hirano and Toda's recent 2023 papers on the uniqueness of a rational bubble solution in equilibrium. We use the underlying main theorems in Hirano and Toda (2023) to induce possible bubble conditions in the overlapping generations model (OLG) by changing model parameters computationally to characterize how bubbles would form in any economy.

Sharfa Pital

Electrical Engineering, UC San Diego

ECE SRIP
Mentored by Dr. Dinesh Bharadia

Cylindrical Capacitive Sensor-Infused Baby Pacifier to Measure Baby's Biting Force.

Understanding the strength of a baby's biting force is crucial to determine feeding behavior and early oral motor skill assessment. Accomplishing this requires a force-sensor-backed baby pacifier. However, due to the demanding space constraints imposed by the tiny cm-scale cylindrical tube on which the baby bites, the development of such a sensor becomes challenging with today's sensor technologies. Furthermore, existing pacifier devices suffer from bulkiness, intricate wiring, and reliance on external batteries, thereby hindering the baby's biting experience. Hence, there is an absence of a dedicated space constraint device to quantitatively assess the biting force exerted by infants. Therefore, this research presents a thin-cylindrical capacitive sensor enclosed into the pacifier tube as a solution. It mitigates the baby's direct contact with the sensor, without the need for conventional wiring or batteries, and allows real-time data to be sent through the Radio Frequency Identification (RFID) tag. The robustness and precision of this sensor is evaluated by subjecting it to the typical baby-biting force range of 0 to 2 Newtons, with hundreds of trials executed to ensure structural integrity. The data from each trial is further analyzed in terms of the capacitor's magnitude and phase. The analysis of the measured capacitance responses enables the determination of optimal sensor parameters and influences the sensor's accuracy and reliability. In conclusion, the development of the capacitive sensor-backed pacifier offers a non-invasive and objective means to quantify infant biting force. The research pays the way for future investigation and novel applications.

Marjorie Pradhan

Global Health, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Alexander Kauffman

Examining the Feedback of DHT on the HPG axis during the GnRH/LH Surge in Female Mice

Infertility is considered to be a significant medical issue amongst women, and in some cases may be caused, in part, by high levels of androgens which can inhibit the reproductive axis in both men and women. The androgen 5a-dihydrotestosterone (DHT) inhibits the estrogen-induced LH surge in female mice, but how this works mechanistically is unknown. One possibility is that the DHT is inhibiting RP3V kisspeptin neurons. However, previous studies have shown that when androgen receptors are selectively knocked out of kisspeptin neurons using the Cre-lox system, female mice still do not show an estrogen-induced LH surge when treated with DHT. Therefore, the aim of this project is to test whether DHT is inhibiting the LH surge through some other central neuron population besides kisspeptin neurons or if DHT is bypassing that brain level completely and instead inhibiting the pituitary gland directly. Because inhibition of the LH surge interferes with fertility, it is highly vital to discover the mechanism that is causing the androgen-induced infertility. This project aims to elucidate some of these processes using a GnRH challenge in DHT-treated mice to help identify what specific parts of the hypothalamic-pituitary-gonadal (HPG) axis androgens target (e.g. hypothalamus or the anterior pituitary). I hypothesize that DHT-treated C57 female mice will show inhibition of LH secretion after GnRH injection when compared to sham-treated C57 female mice. If so, it will suggest that androgens can not only act in the brain, but also directly inhibit the pituitary.

Sirasit Prayotamornkul

Bioengineering, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Lingyan Shi

Investigating the Anti-Aging Effect and Metabolic Dynamics Regulated by Metformin in Drosophila with Raman Imaging

Aging is a time-dependent, progressive process of deteriorating physiological functions in most living organisms accompanied by decreased fertility but increased morbidity and mortality. Hallmarks of aging comprise cellular senescence, mitochondrial dysfunction, loss of proteostasis, altered metabolic activities, and impaired locomotor function. With its short lifespan and conserved genes, Drosophila is an ideal in vivo model organism for gerontological studies. Previous studies on Drosophila showed that metformin, a biguanide drug with anti-hyperglycemic effect, can prolong the lifespan while suppressing ubiquitinated protein aggregates in muscles and impeding age-related centrosome amplification in midgut stem cells through the inhibition of the mitochondrial respiratory complex 1, which results in a surge in AMP levels. Consequently, the phosphorylation of the mammalian target of rapamycin (mTOR)-autophagy pathway by the AMP-activated protein kinase (AMPK) inhibits TOR activity, thereby rescuing cells from aging phenotypes. In spite of these findings, the effects of metformin on lipid/protein metabolism and mitochondrial activity at the subcellular level still remain unclear. In this study, we aim to apply the multimodal stimulated Raman scattering (SRS) imaging system integrated with deuterium oxide (D2O) probing to investigate the spatiotemporal metabolic dynamics in the fat body tissues of metformin-treated flies. Combined with the readouts from longevity study and locomotion analysis, we will systematically assess the inherent correlation between lipid/protein metabolic activity and lifespan. We hypothesize that metformin will reduce lipogenesis and protein synthesis, thus extending lifespan and improving locomotor function. Our molecular visualizing study will be crucial in understanding the mechanisms underlying the anti-aging effect of metformin.

Samantha Prestrelski

Mathematics-Computer Science, UC San Diego

ECE SRIP
Mentored by Dr. Curt Schurgers

Machine Learning Models for Acoustic Species Identification of Avian Biodiversity

Wildlife population estimates can be used to measure environmental change and overall ecosystem health. One way to get such estimates is by analyzing audio recordings of the environment. Collecting recordings by deploying long-term microphone arrays presents a low cost method for gathering population statistics as compared to traditional observer-based surveys. Given the massive scale of audio collected, machine learning systems are necessary to automate the labeling process to extract the types and number of species present in a field dataset. However, deep machine learning models require large amounts of training data. Currently, open source audio datasets provide large amounts of field data labeled at a file level with no information on where the call appears. Previous work has developed the PyHa Python package, which generates training data from field data by precisely isolating species calls. Since time-specific annotations have been shown to improve the performance of deep learning classifiers, this project aims to outperform state-of-the-art classifiers by training models on this data. This work is done in collaboration with the San Diego Zoo Wildlife Alliance Population Sustainability group.

Katie Prinkey

Neurobiology, UC San Diego
Neurosciences, The Dore Lab
Mentored by Dr. Kim Dore

Blocking PSD-95 depalmitoylation rescues memory deficits in female APP/PS1 mice

PSD-95 is a scaffolding protein responsible for trafficking and stabilizing post-synaptic receptors, and this protein is known to be reduced in Alzheimer’s disease in both humans and in mouse models. Palmitoylation is essential to bind PSD-95 to the membrane, and PSD-95 has at least two cysteine palmitoylation sites. Palmostatin B (Palm B) is a depalmitoylation inhibitor, so we expect to see an increase in palmitoylation when it is injected in mice. In order to determine how PSD-95 palmitoylation differs in wildtype and APP/PS1 mice (Alzheimer’s model), and whether PSD-95 palmitoylation changes in mice injected with Palm B, the APEGS assay was utilized. The APEGS assay is a method used to quantify palmitoylation of proteins, and following this assay, a Western Blot is performed. Using this technique, a significant decrease in palmitoylation was found in the APP/PS1 females, and a significant increase in palmitoylation was found in the APP/PS1 females injected with Palm B compared to APP/PS1 females with vehicle. APP/PS1 female mice showed significant memory deficits in the Morris Water Maze behavioral test, which was rescued by Palm B. Surprisingly, male mice had no significant impairments and no difference was observed in male mice injected with Palm B. Given this, we expect that male APP/PS1 mice will show no difference in PSD-95 palmitoylation when injected with Palm B compared to vehicle, but further research is needed to test this.

Esperanza Quiñones Baltazar

Human Biology, UC San Diego
Genentech Scholars Program
Mentored by Dr.Fotis Asimakopoulos

Accessing the Effect of Bromodomain Inhibitor, JQ1, on Multiple Myeloma Cell Lines

Multiple Myeloma (MM) is a blood cancer characterized by the presence of malignant mature plasma B cells that produce abnormal antibodies. Our lab has developed a new mouse model for advanced/high-risk MM that accurately reflects many biological features observed in humans. This mouse model, called VQ mice, is characterized by Ras hyperactivation and MYC dysregulation. c-Myc is a proto-oncogene and transcriptional activator involved in metabolism, cell differentiation, and protein biosynthesis. During transcription, c-Myc is associated with an increase in histone acetylation leading to recruiting BET bromodomains, such as BRD4. BRD4 is an acetyl-lysine protein that regulates and recruits c-Myc through its function of chromatin-dependent signal transduction. Inactivating c-Myc leads to tumor regression. Direct inhibition of c-Myc is difficult due to the lack of a distinct ligand-binding domain and the absence of hydrophobic pockets. Therefore, targeting c-Myc through BRD4 can inhibit c-Myc-dependent transcription. JQ1 is a small competitive inhibitor molecule of BRD4 that binds to an acetyl-lysine recognition pocket in chromatin, suppressing cell proliferation via inducing autophagy. To elucidate JQ1's role on MM, we used 2 MM cell lines created by the VQ mice, 4935 and 4938, that differ in their characteristics related to extramedullary disease, antibody subtype, and survival. The VQ MM cells were assessed for cell viability in the treatment of JQ1 using the alamarBlue assay. We determined the IC50 along with dose-response curves to understand toxicity and cell survival. These results can prompt further investigation into using other MM cell lines as well as testing JQ1 in vivo.

Colby Rambo

Chemistry, San Diego Miramar College
MRSEC REU or RIMSE
Mentored by Dr. Michael Sailor

Temperature Dependence on Thermal Recovery of Off-Blinked Porous Silicon Quantum Dots

Quantum dots have been observed in porous silicon nanostructures and possess photoluminescent properties that result from the quantum confinement effects. These quantum dots can be blinked off through excitation with a 405nm laser, which is observed through a decrease in photoluminescence intensity that scales with power of the laser. The blinking effect in these quantum dots has been observed to return to the "on" state after a period of time passes and regains its initial photoluminescence intensity. This process has been observed to be accelerated via the addition of heat. The temperature dependence of the thermal recovery process will be explored further.

Julian Ramirez

Mechanical Engineering, UC San Diego
UC LEADS
Mentored by Dr. Alexey Arefiev

Geant4 Modeling and Experimental Demonstration of an Energy-Resolved Electron-Beam Profiler for Rep-Rated High-Energy-Density Physics Experiments

Novel petawatt-class, short-pulse laser facilities are presently capable of delivering high-intensity pulses at greater than 1 Hz repetition rates. These facilities can be used to generate extremely energetic particle beams. Many conventional diagnostics, however, employ single use recording media that impose severe limitations on shot rate. To effectively utilize these facilities, diagnostics must be upgraded from single-shot operation to comparable high repetition rates of the laser system. Here, we employ coded-aperture energy filters over a scintillating camera as a novel flexible electron beam profiler diagnostic to enable high-resolution, multi-spectral imaging. Geant4 was used to simulate particle interactions and trajectories, filter transmission profiles, and energy deposition in the scintillator. These simulations will inform the design of the diagnostic, characterize the detector response, and interpret experimental data to be shown and discussed.

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Ivan Ramirez

Psychology, University of Oklahoma
University of Oklahoma
Mentored by Shane Conelly

Effects of Online Ideological Group Rhetoric on Perceptions of Credibility

Ideological groups are formed with individual hold similar, often radical, belief systems that exceed normative expectations, resulting in the establishment of in-group dynamics and the vilification of out-groups. Leveraging social media platforms, these groups utilize persuasive strategies to attract potential followers and promote their rhetoric, often

employing moral calls to action. The present research sought to investigate the impact specific elements have on enhancing the credibility of said groups. By employing eight distinct paradigms, manipulating factors such as coherence (the extent to which an issue or belief is the primary focus), verification (the presence or absence of platform verification), and amplification (the level of engagement received by a post), this study revealed that coherence significantly influenced participants' likelihood to endorse/favorably rate the tweets associated with these groups, thereby affecting their perceived credibility.

Anna Rapp

Public Health, UC San Diego
Multidisciplinary Approach to Addressing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Dr. Leslie Crews

Allostatic Load as a Risk Factor for Cancer

Allostatic load [AL] can be described as the body’s biological response to the impact of prolonged, excessive stress. The association between AL and chronic diseases, such as cancer, is of increasing concern. This narrative literature review discusses whether AL should be considered a risk factor for cancer. Twenty-three full text articles in English and Russian were found via Pubmed, CINAHL, Ethnic NewsWatch, EBSCO, ProQuest, and Google Scholar between 2000 and 2023. Keywords used include allostatic load, chronic stress, social determinants of health, cancer, and breast cancer. A correlation was found between AL and cancer diagnoses, as well as reduced survival among patients diagnosed with cancer. Specifically, this correlation has been most researched with breast cancer. However, labs have also looked at all cancers, including less common cancers, such as Multiple Myeloma and endometrial cancer. Further, AL was shown to be highest in African American patients and correlated with cancer rates. More research needs to be done on the connection between all cancers and AL. Beyond this, by acknowledging AL as a risk factor for cancer, physicians can have a better understanding of which patients may be at elevated risk due to high AL. Understanding the interplay between AL and adherence to screening guidelines can help reduce the cancer risk where the AL load is highest. Finally, AL is one of the few modifiable risk factors that could be addressed.

John Ratliff

Cognitive and Behavioral Neuroscience, UC San Diego
UC Scholars
Mentored by Dr Takaki Komiyama

Temporal Dynamics of Serotonergic Modulation in the Olfactory Bulb During Olfactory Perceptual Learning

Olfactory perceptual learning is the process by which perceptual acuity towards certain odors is enhanced with longitudinal, repeated exposure to these odors. This is mediated

by plasticity mechanisms within olfactory bulb circuits that transform similar sensory input patterns into more distinct neural representations in an experience dependent manner. In addition to receiving sensory information from olfactory sensory neurons, the olfactory bulb also receives top down input from higher brain regions, some of which have been shown to influence these plasticity mechanisms. One of the sources of top down input that has not been studied in the context of olfactory perceptual learning is serotonergic neuromodulatory input from the raphe nuclei in the brainstem. Here, we have investigated the temporal dynamics of serotonergic activity in the olfactory bulb during olfactory perceptual learning as a preliminary step towards a functional characterization of serotonergic modulation in the olfactory bulb during olfactory perceptual learning. Our approach consists of longitudinal two photon calcium imaging of serotonergic projections from the dorsal raphe nucleus in the olfactory bulbs of awake, head fixed mice that are engaged in a water motivated, difficult odor discrimination task. Using this approach, we have found that serotonergic activity dynamics in the olfactory bulb differ between task engaged mice and mice that are passively exposed to the task context, with task engagement eliciting persistent, stereotyped activity patterns that are not present in mice passively exposed to the task context.

Alycia Raya

Political science, UC San Diego
McNair Scholars Program
Mentored by Dr.Heather Daly

The social and ecological determinants of gang violence in Stockton California

Stockton California is a place of great people and promise. Today, it is also a place of many challenges including upward trends of violent crime rates, homelessness, and extreme weather events due to climate change. Traditional responses to the high levels of gang violence in Stockton, California have been intensive enforcement efforts. There is very little literature about the need for land based solutions to community gang violence. This paper aims to analyze the intersections between areas of high levels of gang violence within inner city Stockton and environmental racism.

Brookelynn Reed

Psychology, CSU, Bakersfield
STARS
Mentored by Dr. Christina Gremel

Premotor cortex to dorsal medial striatum role in aberrant alcohol-seeking

Alcohol use disorder (AUD) has been shown to alter goal-directed decision-making processes contributing to alcohol seeking and relapse. However, the neural mechanisms underlying this disruption are still widely unknown, limiting treatment options for individuals suffering from AUD. Premotor corticostriatal circuits are implicated in regulating goal-directed and habitual control over actions. Previous studies with rodents under chronic intermittent ethanol (CIE) vapor exposure and repeated withdrawal have shown that premotor cortex (M2) neurons that project to the dorsal medial striatum (DMS) are involved in action control and become hyperactive after chronic alcohol exposure. Furthermore, the hyperactivity of M2 neurons leads to an inability to control goal-directed actions properly. Here, we are going to determine if restoring M2 activity to a normal range will help restore goal-directed control over an alcohol-seeking model. Stereotaxic surgery will be used to express a chemogenetic tool in M2-DMS projection neurons, following which mice will undergo Air or CIE vapor exposure. These Air and CIE-exposed mice will then be used to determine if inhibition of M2 neurons projecting to DMS can rescue the use of goal-directed control during alcohol seeking. We suspect that once M2 is inhibited to a normal activity range, there will be less disruption within M2 to DMS projection areas, leading to the restoration of goal-directed control over alcohol self-administration.

Akelah Reeves

Political Science, Spelman College
STARS
Mentored by Professor Marisa Abrajano

To what extent does the state of Florida provide fair immigration policy to immigrants from the African diaspora?

This abstract produces findings from four sources to explore the influence of Afro-Caribbean immigrants on black politics and group consciousness in the state of Florida. The first source, "Black Immigration and Ethnic Respectability: A Tale of Two Cities, New York and Los Angeles," examines Afro-Caribbean group attachment in New York City and Los Angeles County, emphasizing the importance of country of origin, ethnic, and racial identities. The second source, "Immigrants in Florida" by the American Immigration Council, provides statistical data on immigrants in Florida, including their origin, education levels, industry of work, occupation, and financial contributions. The third source, "The Caribbeanization of Black Politics: Race, Group Consciousness, and Political Participation in America," explores the impact of black immigrants on black political power, emphasizing the significance of racial and ethnic identity in shaping political behavior. Lastly, "From Consciousness to Coalition: Examining Racialization and Afro-Caribbean Inter-group Attitudes" discusses the shared sense of diaspora between Afro-Caribbeans and African Americans and investigates Afro-Caribbean attitudes towards coalitions with Asian Americans and Latinx Americans. These sources collectively shed light on the complexity of Afro-Caribbean identities, their contributions to the black political landscape, and the diversity of black public opinion in the United States.

Lucia Rejzek

Biological Anthropology (B.S.), UC San Diego

URS - Undergraduate Research Scholarships
Mentored by Dr. Amy Non

Exploring causes behind reduced preterm birth during the pandemic

Preterm birth rates have been steadily increasing for the past few decades; however, there was an unexpected decrease in preterm births in the first few months of the pandemic. Compared to other developed countries, the United States generally has poor metrics of maternal care, including unnecessary over-medicalization of pregnancy, and majority-centered care that often disadvantages marginalized communities. This study aims to analyze if any hospital policies, behaviors, or care changes may have led to this decrease in preterm birth. From analyses of nationwide birth outcomes, we observe the largest decrease among induced relative to spontaneous preterm births during this period, despite the fact that overall inductions increased. To further analyze this, we are interviewing obstetricians and midwives from different cities around the United States, sourcing individuals from more densely populated cities, as well as rural areas. This qualitative data will be used to contextualize the previously observed national trends by identifying themes around policy and women's behaviors that may explain these patterns. We hypothesize that the decrease in preterm inductions specifically resulted from reduced access to in-person prenatal care, particularly among socially disadvantaged women, which may have either prevented over-prescription of induction, or led to missed indicators that should have resulted in preterm induction. Through the analysis of this qualitative data, we hope to pinpoint the specific mechanisms that were driving these shifts in birth outcomes, to help improve prenatal and delivery care in the future, especially for those in the margins.

Gloria Renaudin

Marine Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Amro Hamdoun

Spatiotemporal expression of srcr142 throughout the development of Lytechinus pictus utilizing in situ HCR.

Sea urchins are a great model organism for developmental biology and immunology. They develop in the water column as larvae then metamorphose and settle on the benthos as adults. Mature adults spawn millions of gametes, forming an abundance of transparent larvae permitting the visualization of an organism-wide gene expression on a cellular basis. While Strongylocentrotus purpuratus was the original sea urchin model organism, Lytechinus pictus has larger clearer eggs and develops faster, making it a better candidate for developmental immunology. Their innate immune system includes coelomocytes which transcribe receptor cysteine-rich (SRCR) genes. SRCR genes in vertebrates involve regulating and developing the immune response. While sea urchins lack an adaptive immunity, S. purpuratus has over a thousand SRCR domains to combat the microbial-rich benthos after metamorphosing. The expression of srcr142 in S. purpuratus was identified during the early pluteus stage, yet it is unknown in L. pictus. To further understand the role of SRCRs in innate immunity, I will use HCR-FISH to visualize the spatiotemporal expression of srcr142 throughout the development of L. pictus. I predict these results will show an upregulation in the expression of srcr142 as they approach metamorphosis due to higher microbial activity in the benthos. This will establish the baseline spatiotemporal expression pattern of srcr142 throughout L. pictus's development. One could then investigate the difference between regular and injured expression, which will further elucidate the specific functions of SRCR proteins.

Joe'l Reyes

Philsophy, UC San Diego
McNair Scholars Program
Mentored by Monte Johnson

"Psychomusicology: Ancient Greek views about how the musical modes affect character and the soul"

The aim of this project is to explore the effect of music on the soul. Ancient Greek philosophers such as Pythagoras, Plato, Aristotle, and Aristoxenus all held that music can affect the soul, not only feelings and emotions, but also reason and character. This project studies how ancient conceptions of the modes such as Dorian, Lydian, Phrygian, etc. were supposed to have various psychological effects. The project also compares how ancient psychomusicology persists in popular conceptions of the ethical significance of Classical music ("the Mozart effect"), Jazz, Hip Hop, Rock'n'Roll, and other genres of popular music.

Savannah Rhoades

Chemical Engineering, UC San Diego
STARS
Mentored by Dr. Oliver Schmidt

Modal Analysis of Twin Rectangular Jet Flow Schlieren Data

Jet screech is a phenomenon that is observed in supersonic jet noise. It results from the development of a feedback loop between the upstream part of the acoustic field and the production of new disturbances at the nozzle lip, resulting in an extremely loud screech tone. Studying jet screech is useful for nozzle design, so that hearing damage and fatigue may be reduced amongst those who work closely with these aircraft. It also has a role in structural vibrations. Schlieren images of twin rectangular jets producing the jet screech were recorded by colleagues at Monash University. Once at a nozzle pressure ratio of 2.6 and another at 3.1. Utilizing Spectral Proper Orthogonal Decomposition on the symmetric and anti-symmetric decomposed data, it is expected that the modes at various frequencies that contribute to this phenomenon will be identified as well as the processes that cause them. With these tools we expect to identify any rapid mode switching, repeating peaks, and any discrepancies between the two nozzle pressure ratios. This research will ultimately shed light into the properties of jet screech and its underlying mechanisms.

Esmeralda Rico

Molecular and Cell Biology, UC San Diego
PATHS Program
Mentored by Dr. Mia Huang

Utilizing proximity labeling methods with Basigin, a cell surface-localized glycoprotein

Glycoproteins mediate important physiological processes such as cell adhesion and stem cell differentiation through glycan-protein interactions, however, the biological mechanisms behind healthy and diseased glycosylation states have not been well studied. Basigin (Bsg), a cell surface glycoprotein, has been shown to chaperone proteins to the cell surface. Irregularities in Bsg expression and glycosylation have been linked to a variety of diseases such as cancer and endometriosis. Proximity labeling is an in-situ method where APEX2, an engineered peroxidase, is recombinantly fused to a glycoprotein. With the addition of biotin-phenol, APEX2 generates biotin-phenoxyl radicals that tag proximal proteins with biotin thus allowing downstream identification of glycan dependent interactions through proteomics. Mapping the effect of glycosylation on the interactome of Bsg could not only help uncover glycosylation dependent disease pathophysiology but also a new therapeutic target for disease glycosylation-state Bsg. Localization of the APEX2-Bsg construct to the membrane is crucial for accurate proteomic analysis due to the non-specific nature of APEX2. Additionally, because Bsg acts as a chaperone for proteins, its function is reliant on proper localization to the cell surface. The introduction of APEX2 could lead to challenges regarding localization by impeding protein folding, stability, and trafficking. To ensure that the APEX2-Bsg construct properly localizes properly and labels cell surface proteins, we used ultracentrifugation to isolate cytosolic and membrane fractions post proximity labeling. Bsg and its labeled protein clients were indeed found in the membrane fraction establishing the utility and validity of using proximity labeling on cell surface-localized glycoproteins.

Jonathan Rodriguez

Cognitive Science and Global Health, UC San Diego
Summer TRELS
Mentored by Dr. Carrie McDonald

Co-Lateralization of Language and Memory: Is Knowing Language Dominance Enough for Pre-Surgical Planning?

Evaluation of language and memory lateralization is important for predicting risk of post-surgical language and memory decline. For language lateralization, the Wada procedure and fMRI are commonly used. Reports that fMRI language lateralization correlates with post-surgical verbal memory outcomes suggest that knowledge of language dominance may be enough to predict both language and memory outcomes. However, no study has systematically compared co-lateralization of language and memory using a causal technique to support this possibility. Fifty-three individuals (n=41 with epilepsy and n=12 with brain tumor) completed Wada language and memory testing. Language lateralization was classified as left, right, or bilateral based on evidence of speech arrest or aphasia. Memory lateralization was based on left versus right memory recognition discriminability scores using a 10% cut-off. Left-lateralized language predominated (~76%) whereas memory lateralization was more variable (49% left). Overall concordance was 64% and considered fair/moderate agreement. Concordance was significantly higher for those with a younger age of diagnosis. We demonstrate fair to moderate concordance between language and memory co-lateralization on the Wada. Lower concordance was driven by individuals with left or bilateral language lateralization who showed variable memory lateralization. In contrast, when language re-organizes to the right hemisphere, memory is likely to jointly re-organize. This implies that whereas left or bilateral hemisphere language dominance may require separate memory assessment with the more invasive Wada test, right-lateralized language dominance on fMRI may be sufficient for understanding memory function.

Julian Rodriguez

Neurobiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Professor Alexander Kauffman

Does Inhibition of Kiss1 Neurons Improve LH Levels, Hypererandrogenemia, and Body Weight in a Mouse Model of PCOS

Polycystic ovary syndrome (PCOS) is a common reproductive disorder in females that involves imbalances of hormones in the hypothalamic-pituitary-gonadal (HPG) axis. One of the diagnostic features that characterizes the disorder is hyperandrogenemia (elevated levels of circulating androgens) which is caused by increased pulsatile luteinizing hormone (LH) secretion from the pituitary. Since, the frequency of LH pulses is found to be stimulated by gonadotropin-releasing hormone (GnRH) neurons in the hypothalamus, hyperactivity of GnRH neurons would drive abnormally increased LH secretion. These disruptions in the neural circuits of the HPG axis lead to perturbed ovarian maturation and fertility impairments in PCOS women. Additionally, PCOS also encompasses many metabolic dysfunctions such as obesity. In order to study the underlying mechanisms, a PCOS-like mouse model treated with letrozole (LET), an aromatase inhibitor blocking the conversion of testosterone (T) into estradiol (E2), has been developed. Previous studies have shown that LET-treated female mice successfully reproduce many of the PCOS phenotypes, alongside providing evidence that the hyperactivity of GnRH neurons is likely induced by upstream neural regulators, such as the neuropeptide kisspeptin.

Kisspeptin is expressed by Kiss1 neurons in the hypothalamic arcuate nucleus (ARN) and are involved in stimulating GnRH/LH pulses. In this study, we will examine whether elevated body weights, abnormally high LH levels and therefore high T levels are caused by hyperactive Kiss1 neurons. To test this, we will employ Designer Receptors Exclusively Activated by Designer Drugs (DREADDs) to inhibit Kiss1 neurons in LET-treated female mice.

Guadalupe Rodriguez

Psychology, CSU, Fullerton
STARS
Mentored by Xu Chen

Tau Mouse Model of Alzheimer's Disease and Reducing Tau Pathology

Alzheimer’s disease (AD) is a neurodegenerative disease that impairs the memory and other cognitive abilities crucial for daily life. The AD brain has deficits in energy metabolism and is insensitive to glucose, amino acids, insulin, and other energy substrates. One alternative energy substrate is beta-hydroxybutyrate, a ketone body that supplies energy to peripheral tissues and brain in the absence of glucose and other energy sources. Our lab has shown that a therapeutic intervention in AD mice using a BHB-precursor diet can decrease AD pathology. In this study, we utilize a tau mouse model of AD and give them a BHB-precursor diet in a preventative (6-month-long) intervention and look for reduced AD pathology. We hypothesize that by using a preventative intervention will also rescue AD pathology, perhaps more dramatically than a therapeutic intervention. We sectioned AD mouse brains and used immunohistochemistry to assess tau pathology, atrophy in their hippocampus and cortices, and signs of neuroinflammation and lipid droplets, all hallmarks of AD.

Krystyn Roldan

Physics, Chabot College
STARS
Mentored by Dr. Carl Melis

Relationships Are Complicated: Magnetically-Driven Ultraviolet Activity and Stellar Age

While the ages of stars >1 billion years old are difficult to deduce, they are critically important to studies of stellar and Galactic evolution, as well as exoplanetary systems. Driven by magnetic processes initiated within the star, this activity is manifested as ultraviolet emission in the star’s outer atmospheric layer, the chromosphere. We present an examination of how this ultraviolet chromospheric emission evolves throughout stars’ lives with a focus on ages >1 billion years. Using spectroscopic data from the Hubble Space Telescope and International Ultraviolet Explorer satellites, we measured chromospheric emission from the MgII h + k near-ultraviolet transitions and plotted them

as a function of stellar age. With these values, we investigate the possibility of constructing an ultraviolet age-activity relationship for stars older than 1 billion years.

Joseph Romero

Neurobiology, Chemistry, UC San Diego
Research Internship
Mentored by Dr. Nicola Allen

Cholesterol Metabolic Dysregulation in Aged Mouse Astrocytes

Astrocytes, non-neuronal glial cells in the mammalian brain that support neuronal function, are key components of a healthy network of synaptic connections. In healthy aging, synaptic and neuronal functioning decline, leading to behavioral changes. I hypothesize that cholesterol metabolism is dysregulated in aged astrocytes, resulting in decreased neuronal support, synapse dysfunction, and age-related deficits in locomotion. Astrocytes synthesize cholesterol which is metabolized by neurons and used for a variety of physiological processes. In previous studies by our lab, transcriptome analyses of astrocytes showed a downregulation of genes associated with cholesterol biosynthesis, suggesting that cholesterol output is altered during the aging process. These changes in cholesterol homeostasis could impact the structural integrity of synapses and thus result in behavioral alterations in the aged mouse. In this project, I aim to characterize cholesterol pathway dysregulations in astrocytes and the synaptic and behavioral consequences of this dyshomeostasis. I will quantify levels of synaptic proteins using western blotting and immunohistochemistry. Locomotor, learning, and memory behaviors will also be assessed. These experiments will give insight into the consequences of astrocytic cholesterol dysregulation and its connections to aging-associated deficits. Investigating this link between cholesterol metabolism dysregulation specifically in astrocytes and aging allows us to unveil the underpinnings of aging, potentially leading to the discovery of novel therapeutic targets.

Leanna Rondon

Biology, UC San Diego
STARS
Mentored by Dr. Yishi Jin

The Functional Impacts of Mutant Pacs-1 on Neuronal Morphology

Pacs-1 Syndrome is a rare neurodevelopmental disorder that causes neurodevelopmental delays, seizures, and craniofacial dimorphisms. Pacs-1 syndrome is caused by a genetic de novo mutation that is localized in the Pacs-1 protein that is used for transport in the trans-Golgi network(TGN). PACS was found in a study in 1998 that unveiled that this protein's function was in the TGN to direct the localization of phosphorylated furin. PACS-1 has since been found to have a role in regulating calcium flux and genomic stability. In this study, we aim to use C.elegans to model human Pacs-1 syndrome and examine the functional impacts of an R to W change in the neurons.Through investigating the well characterized mechanosensory neurons within C.elegans labeled with a transgenic marker, we intend to uncover the functional impacts of mutant Pacs-1 on neuronal morphology. Prior experiments have shown that certain Pacs-1 mutants from two other genes exhibit defective neuronal morphology. Utilizing this information we want to discern other types of mutant PACS-1 genes on the neuron structures. The goal for our study is to contribute to better understanding the functions of the Pacs-1 proteins and its functional relevance on mutant Pacs-1 in the nervous system.

Elijah Khalil Rosales

Biochemistry, UC San Diego
Summer TRELS
Mentored by Gene Yeo

U1 snRNA Transplicing

My project aims to test if U1 snRNAs can be guided to a specific site and paste together two exons from different strands of mRNA. I will engineer and target a reporter using U1 snRNAs to tether two halves of a fluorescence molecule together. If the U1 snRNA can successfully paste these two halves together, we will see fluorescence activity as measured using fluorescence microscopy. With this reporter, I will test differences in targeting parts of the reporter and U1 snRNA length. Then to validate my findings, I will perform real time polymerase chain reaction to confirm that the two halves of the RNA have been pasted together.

Yvania Rubio

Political Science & Sociology, UC San Diego
Summer TRELS
Mentored by Professor Michel Estefan

Exploring Cultural Capital as a Catalyst for Empowerment and Academic Success among First-Generation, Low-Income Scholars in a 4-Year College or University: A Research Proposal

As high school-serving organizations remove financial barriers and increase access to college for low-income, first-generation scholars, the opportunity for historically underrepresented communities in the Central San Diego region to pursue 4-year universities has improved. When students embark on their college journey, they often encounter sociological discomforts that challenge their path to success. Overcoming these internalized obstacles is difficult without recognizing the various forms of wealth embedded within the communities of these scholars. Drawing on Dr. Tara Yosso's six types of capital - aspirational, linguistic, familial, social, navigational, and resistant - this study examines how Community Cultural Wealth (CCW) can empower scholars to navigate insecurities in college. It explores the role of CCW as a resource for scholars and organizations. The two primary research questions guiding this study are: 1) How can understanding Community Cultural Wealth (Yosso, 2005) as a sociological advantage empower first-generation, low-income scholars to cope with insecurities they may face at a 4-year college or university? and 2) What are the drivers of "Authentic Empowerment" and academic success for first-generation, low-income scholars at a university? Data collection will involve in-depth interviews with scholars who participated in high school-serving organizations and with the founders of these organizations. This research will inform universities and organizations, enabling them to enhance support systems and improve college retention rates among this student population. Ultimately, this project strives to empower first-generation, low-income scholars, and highlight the potential of community cultural wealth as a sociological advantage.

Edwin Ruiz

Cognitive Science (ML & Neural Computation), UC San Diego
UC LEADS
Mentored by Dr. Muotri

Predictive Model for Marker Genes of Pyramidal Neuron-Cells in the Prefrontal Cortex using Gene Expression Patterns

The prefrontal cortex plays a crucial role in complex cognitive processes and executive functions, yet little is known about how specific cell types contribute to these cognitive processes. Understanding the genetic basis underlying the function of pyramidal neuron cells within the prefrontal cortex is essential for discovering the mechanisms of cognitive processing. This research aims to develop a predictive model that identifies marker genes associated with pyramidal neuron cells in the prefrontal cortex by analyzing gene expression patterns. The dataset used consists of gene expression data obtained from the NCBI website, specifically the transcriptomic profiling of pyramidal neuron cells within the prefrontal cortex. We utilized two models, Random Forest Classifier and Support Vector Machine (SVM), to handle high-dimensional data and capture non-linear relationships. Through K-fold cross validation, the models achieved an accuracy of 95%. The SVM model with undersampling demonstrated better precision and recall for identifying pyramidal neuron cells. The results indicate weak associations between gene expression patterns and pyramidal neuron cells, suggesting the complexity of marker gene identification solely based on gene expression patterns. To improve our comprehension, it is advised to delve deeper into optimizing thresholds, expanding datasets, and incorporating additional data types such as epigenetic and proteomic data. Despite the limitations, this research provides valuable insights and lays the foundation for future predictive models targeting pyramidal neuron cells in the prefrontal cortex, potentially contributing to advancements in neuroscientific research and targeted therapies.

Ella Ryan

General Biology, UC San Diego

URS - Undergraduate Research Scholarships
Mentored by Dr. Amir Zarrinpar

The Role of Gut Microbial Bile Acid Deconjugation on Polycystic Ovary Syndrome

Despite affecting 18% of people with ovaries, polycystic ovary syndrome (PCOS) is poorly understood and often ineffectively treated. Recent mouse studies suggest that gut microbiome functions, particularly changes in bacterially-modified bile acids, may contribute to PCOS pathophysiology. Based on preliminary results, the serum bile acid pool, modulated by the gut microbiome, likely alters bile acid receptors FXR and TGR5 signaling pathways, and thus, directly impacts the gonads and reproductive health. The overall goal of this current study is to understand how the gut microbiome influences PCOS and illustrate crosstalk between the gut microbiome and the gonads. The Zarrinpar lab has developed a stably-colonizing engineered native bacteria (ENB) that overexpresses the bacterial bile salt hydrolase (BSH) enzyme, thus altering the luminal bile acid pool. In male mice, the BSH-expressing ENB improved glucose homeostasis and insulin sensitivity, and reduced serum testosterone. We have established a letrozole daily gavage model that mimics the PCOS phenotype metabolic and reproductive features of PCOS, including insulin resistance, anovulation, and elevated serum androgens. Our preliminary results show that BSH-expressing ENB restores insulin sensitivity and blood glucose levels in this letrozole-induced PCOS mouse model. The central hypothesis is that introducing specific bacterial bile acid biotransformations with ENB will ameliorate metabolic and reproductive dysfunction in a PCOS mouse. To pursue this hypothesis, we will evaluate further therapeutic effects of our ENB on letrozole-treated female mice. This study will investigate the newly recognized gut-reproductive axis and explore the potential of the gut microbiome as a therapeutic target for PCOS.

Daniel Ryu

Biochemistry, Yonsei University
Summer CAMP
Mentored by Professor Ji-Ho Park

The Potential of pSiNPs-based RNAi Delivery for siRNA and Oligonucleotide Delivery

RNA is involved in many biological processes in various organisms. Among several types of RNA, regulatory RNAs have been discovered and suggested to play a central role in genomic interference, regulating gene expression, and silencing. Recently, a nanoparticle-based RNA interference (RNAi) delivery platform has been developed, which enables the synthesis, modification, characterization, and down-regulation of the RNA transcriptome. This platform utilizes biodegradable mesoporous silicon nanoparticles (pSiNPs) as nanocarriers, with the internal voids of the nanoparticles loaded with siRNA. This delivery system provides sustainability, stability, and target-specific regulation of mRNA in its regulatory system. Previous studies have successfully achieved gene-silencing therapy by utilizing siRNA contained in lipid-coated pSiNPs. Building upon the efficient accessibility of RNAi and the synergistic effects of oligonucleotide delivery with pSiNPs, our goal is to investigate whether the bioavailability of pSiNPs can be extended to deliver multiple siRNAs and even larger polynucleotides(including mRNA) and examine their effects on mRNA expression in a cellular model.

Aaron Saavedra

General Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Eric Schmelz

Development of a simple comprehensive metabolic profiling method for diverse biological samples

Since the 1950's gas chromatography-mass spectrometry (GC-MS) has grown to become a powerful analytical method for the analyses of diverse small molecules. Following extraction and chemical derivatization, to promote volatilization, GC-MS analyses are ideal for the quantification of small acids, alcohols, hydroxyl acids, sugars, fatty acids, many isoprenoids, and xenobiotics. Moreover, due to the separation and detection challenges, diverse hydrocarbon olefins including most biochemicals underlying flavor and fragrances are almost exclusively analyzed by GC-MS. Despite strengths in isomer separation, standardized ionization, and large existing spectral libraries, a massive number of potential GC-MS applications are prevented by co-existing non-volatile contaminants incompatible with the GC inlets and columns. Specific applications overcome some challenges by replacing the GC inlet liners and pre-columns every 10 injections; however, broad GC-MS metabolomics of complex lipophilic samples simply remain analytically off-limits. 20 years ago, a sample preparation method termed Vapor Phase Extraction (VPE) was developed to selectively acquire diverse small molecule acids (as methyl ester derivatives) and natural volatile organic compounds from non-volatile matrixes. VPE can also selectively acquire small molecule trimethylsilyl (TMS) derivatives of analytes containing carboxylic acids, alcohols, and some amines. Using diverse plant models, my summer research is to finalize optimization of sample extraction conditions and VPE protocols that will result clean GC-MS samples containing conserved polar primary metabolites alongside species specific monomeric and dimeric specialized metabolites. These efforts have the potential to dramatically grow the use and application of GC-MS analyses in the biological sciences.

Mohammad Sadegi

Microbiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Amir Zarrinpar

Fecal Metabolites Correlated to Atherosclerosis in an Obstructive Sleep Apnea Mouse Model

Obstructive-sleep-apnea (OSA) is characterized by intermittent episodes of hypoxia/hypercapnia (IHC) and results in cardiovascular diseases (CVD), such as atherosclerosis. However, the mechanisms for this are unclear. IHC in mouse models of atherosclerosis affects the dynamics of the gut-microbiome and metabolome, including bile-acids. Bacterial deconjugation of bile acids with the enzyme bile-salt-hydrolase (BSH) allows the formation of secondary bile-acids, which can impact host processes such as lipid metabolism and immune function. Our lab has recently developed a novel technique to functionally manipulate the gut microbiome using engineered-native-bacteria, which we have used to determine the physiological effects of BSH-overexpression. We hypothesized that increased BSH-expression impacts atherosclerosis in mice exposed to IHC. To test our hypothesis we gavaged Ldlr-/- mice with engineered native bacteria either with or without BSH expression, and subjected them to room-air (control) or IHC conditions. After 12-weeks, the mice were euthanized, and we assessed the development of atherosclerosis. Our data show that increased BSH-expression in the gut results in increased atherosclerosis in Ldlr-/- mice under IHC conditions. Targeted metabolomics revealed that both IHC and BSH overexpression resulted in similar changes in fecal bile-acid levels in Ldlr-/- mice. However, further investigation is required to determine the specific changes in the entire metabolome,including other bile-acids and metabolites, as assessed through untargeted metabolomics. Thus, we aim to evaluate the relationship between fecal metabolites and atherosclerotic lesions Ldlr-/- mice exposed to BSH overexpression and IHC. This research will contribute to our understanding of the complex interplay between OSA, gut-microbiome, and atherosclerosis.

Joseph Sadiki

Public Health, UC San Diego
Summer TRELS
Mentored by Dr. Tala Al-Rousan

Knowledge, Attitude, and Behavior Toward Hypertension Management Among East African Refugees in San Diego: A Mixed-Method Study

Cardiovascular disease (CVD) is the leading cause of death globally, and hypertension (HTN) has a prime association with CVD. A recent systematic review and meta-analysis found that refugees are more likely to have HTN than non-refugee immigrants. Although the African refugee population in the United States has increased, HTN among this group remains understudied, particularly those from East Africa (EA). Due to the paucity of data surrounding EA refugees and HTN, this study aims to assess HTN knowledge among EA refugees in San Diego and how that affects their attitudes and behaviors toward blood pressure (BP) management. This study uses a mixed-method design with a quantitative questionnaire formulated from the 22-item Hypertension Knowledge Test (HKT) and a qualitative semi-structured interview adapted from the Explanatory Model

Interview Catalogue (EMIC). The HKT scores are calculated by counting the number of correct responses, and a thematic analysis framework within the lens of EMIC is used to understand knowledge, attitude, and behaviors associated with HTN management. The preliminary analysis indicates a low HTN knowledge among EA refugees, and most hold cultural as opposed to medical definitions, attitudes, and behaviors toward BP management. This study will be one of the first to illuminate the perception of East African refugees toward hypertension and highlight a cultural approach toward BP management. The findings could help community organizations, healthcare providers, and different institutions initiate interventions and treatment plans that are culturally appropriate and directed toward the health needs of this growing population.

Jadon Salazar

Mechanical Engineering, San Diego City College
SDNI REU
Mentored by Dr. David P. Fenning

"Detecting Differences in Operational Stability of Perovskite Solar Cells"

Renewable energy is highly sought after for its eco-friendly nature. One option in this avenue is solar energy. While silicon solar cells are currently the most prevalent, research is ongoing in alternative materials and among them is the perovskite solar cell, (PSC). In the past ten years PSCs have reached power efficiencies comparable to silicon solar cells. However, degradation has continued to be an ongoing issue as perovskites are vulnerable to moisture, oxygen, and UV light. Hence, perovskites hold great promise but also areas of needed improvement. Research in PSCs is a time consuming, repetitive process, of implementing additives and exploring various charge transport layers and device architectures. Because of this, efforts are being made to automate the process in the lab and possibly industrial setting. This will permit fabrication and testing of numerous possible combinations at a time. The aim of this project is to help streamline this automatization of PSC fabrication, characterization, and stability testing. Focus is made on the final testing stages which comprises automatic characterization and building a degradation chamber. In automatic characterization, initial power efficiency is tested prior to the degradation chamber, which in turn tests the stability of the PSC. In summary, perovskite solar cells hold great potential and research is currently made to make them a suitable enterprise. The nature of this endeavor has made automation desirable and has resulted in a developing streamlined process in perovskite solar cell research.

Andrew Salcedo Alvarez

Psychology, CSU, Northridge
STARS
Mentored by Dr. Gail Heyman

"It's like an all-knowing oracle!": Beliefs about how ChatGPT works and how its use will impact education

Since ChatGPT became widely available in November 2022, many individuals who previously knew nothing about Generative A.I. began discussing and using it. Undoubtedly, it will have a huge impact on the future of education, but because the technology is so new, we know little about what its impact will be. Now it is critical to examine how lay people with no expertise in engineering and machine learning understand what ChatGPT is and what it can do. Anecdotally, many people have incorrect beliefs about it, with some overestimating its limitations (e.g., can only be used as a calculator) and others overestimating its capabilities (e.g., it is a sentient being). Our project will investigate college students' and educators' beliefs about the capabilities of ChatGPT and the consequences of using it for education. In online surveys and follow-up interviews, we will ask participants to evaluate statements such as "ChatGPT can produce accurate responses all the time" and predict whether common uses of ChatGPT will benefit or hinder students' learning. We expect participants to have misconceptions that ChatGPT can solve any problem and detect its own previously generated outputs. We also believe that students will think using ChatGPT will help with learning, while educators see it as a hindrance. The findings will inform decision making for the integration of Generative A.I. in college coursework by revealing misguided beliefs that need to be corrected and identifying points of risk that threaten learners' abilities to think critically and generate original ideas.

Dannia Saldivar

Mathematics, MiraCosta College
STEMULATE
Mentored by Dr. Osvaldo "Ovie" Soto

Summer Math Academies: Collaborating to Enrich and Elevate Mathematical Teaching and Learning

The present racialized outcomes in STEM education require critical attention. In 2012, the non-profit Math for America San Diego established Summer Math Academies (SMA) to enrich San Diego's underrepresented/underserved students' mathematical knowledge in a setting that offered an authentic opportunity to enhance their teachers' knowledge of mathematics, pedagogy, and student thinking. SMAs range from 1 - 3 weeks, involve 2 - 10 teacher-participants (some facilitating learning and others observing), and serve up to 30 students each. Facilitators frequently teach students by elevating contextualized math problems. In 2023, funding allowed for a collaboration between Math for America San Diego and the UC San Diego Mathematics Project to scale up the SMAs and refine the SMA model. To do so, we collected and analyzed data on (a) how students felt about mathematics before and after the SMAs and (b) what teacher-participants claimed they learned about mathematics, pedagogy, and student thinking. In this presentation, we will review some early findings in the form of three main questions that arose during the SMAs; (1) How do teachers benefit from SMAs, and how might their learning influence students' thinking, specifically regarding their problem selection? (2) What changes can the teacher make in the classroom that can create an environment where a student can be challenged and enlightened? (3) Would, and if so, how would the benefits for teachers and students be more prevalent if the SMA were longer than two weeks? These questions and preliminary findings may be helpful in planning future SMAs.

Gabriella Salvador

Ethnic Studies, UC San Diego
Summer TRELS
Mentored by Professor Yến Lê Espiritu

Reclaiming Oaxacan Narratives through Oral History

Due to proprietary information this abstract has been redacted.

Matthew San Pedro

Molecular and Cell Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Saiba Varma

Care and Occupational Stressors of Filipino Registered Nurses

Recent anthropological research on labor has shown that “caregiving” roles, such as nursing, custodial work, and domestic work, are undervalued professions that are disproportionately performed by racialized and gendered bodies. Building on this work, I seek to study the experiences of Filipino nurses in America, who comprise over half of all internationally educated nurses working in the US healthcare system. Previous studies on Filipino Registered Nurses (RNs) emphasize nursing education before emigration, “brain drain” and the challenges of working as foreign healthcare professionals among American peers post-immigration (Ortiga, 2018; Rodriguez, 2011; Connor, 2014). However, further research is needed on Filipino RNs’ experiences providing care to Americans in a novel cultural environment. Through in-depth interviews and an extensive literature review, this study will explore how Filipino RNs experience and reflect on the everyday challenges and labor of nursing, including “role strain”, workplace isolation, affective labor, and definitions of care (MacWilliams, 2013). Given that a high proportion of healthcare professionals are susceptible to burnout (Reith, 2018), this study also seeks to examine how Filipino nurses may adapt to burnout compared to non-international nurses.

Lia Sanchez

Applied Biotechnology, University of Georgia
VERSA
Mentored by Dr. Thomas Bussey

Usability Analysis of BiochemAR: Exploring Biochemistry Students' Understanding of an Augmented Reality Visualization Tool of Hemoglobin

As a Biochemistry student, being able to understand biochemical structures and processes is an important learning objective in introductory biochemistry courses. Students' ability to visualize molecular structures is essential in biochemistry, and with the addition of augmented reality (AR) to the range of existing instructional tools for visualization, we are interested in exploring the possibilities for learning about three-dimensional molecular structures using AR. Semi-structured clinical interviews were conducted with three biochemistry students using the BiochemAR tool, an AR app that displays several three-dimensional models of hemoglobin. All interviews were video and audio recorded and annotated transcripts were created to include the verbatim discussion along with analytical memos of the video data. Using a phenomenographic approach, the interviews were coded using an emergent qualitative coding scheme and the constant comparative method. In this presentation, I will discuss students' ability to use their prior knowledge of biochemistry to identify structures and processes of the hemoglobin models. I will also present an analysis of students' comments and nonverbal cues expressed during their experience using the AR app with the intention of exploring the usability of augmented reality apps in a biochemistry instructional setting.

Daniel Sandoval

Mechanical Engineering, Rio Hondo College
MRSEC REU or RIMSE
Mentored by Richard Averitt

Design and characterization of mechanical metamaterials with terahertz light

In this project, we design and characterize metamaterials with light at terahertz frequencies. Specifically, we demonstrate how mechanically actuated metamaterials can help us control interactions with light enabling the realization of functional devices.

Gio Sarabia

Bioengineering, San Diego Miramar College
STEMULATE
Mentored by Dr. Vazquez-Mena

Efficacy of graphene and quantum-dot hybrid devices under varying light conditions

The ability for photodetection is an important requirement and capability for much of modern technology through the use of bioimaging, medical imaging and material analysis. Graphene-enhanced devices have exhibited excellent use for such technologies as a result of graphene's inherent electronic arrangement. Its ultra-strong carbon-carbon bonds provide it with high electron mobility, large theoretical specific surface area and high Young's modulus. Quantum dots are layered on graphene-enhanced devices to complement these properties by increasing photodetection and photoconductivity of the device. Through experiments measuring the effects of various light conditions on graphene and quantum-dot enhanced devices, it is demonstrated the potential for such devices as a versatile, high-sensitivity application for photodetection and other technologies.

Ella Say

Biology with Specialization in Bioinformatics, UC San Diego
Summer CAMP
Mentored by Dr. Kay Tye

Social Exclusion Modifies the Neural Representation of Physical Pain

Social pain, the emotional pain caused by negative experiences with one's social group, is known to negatively affect both physical and mental health. While the "pain overlap theory" suggests that social and physical pain converge within the brain, we do not know the neural substrates where social and physical pain overlap. To test this, we created a novel rodent model of social exclusion (the "FOMO task" - Fear of Missing Out). In this paradigm, one mouse is separated from its cagemates and observes its cagemates on the other side of a barrier collect a reward. We used keypoint-MoSeq, an unsupervised machine learning platform that constructs an autoregressive Hidden Markov Model, to characterize the behaviors of the excluded mouse. By clustering the behavioral modules ("syllables") output using keypoint-MoSeq, we have discovered two main behavioral motifs, which we have operationally defined as either "FOMO" behavior or "Fine." Mice that undergo Social Exclusion spend a significantly greater amount of time engaging in "FOMO" behavior, compared to controls. To assess the effect of Social Exclusion on pain behavior, we injected mice with formalin in their hindpaws after the social paradigm. Using B-SOID, an open-source behavioral dimensionality reduction and clustering algorithm, we were able to successfully obtain meaningful behavioral clusters, which can be used to quantify changes in pain behavior. Overall, our findings suggest that by utilizing unsupervised machine learning algorithms, we have found that mice exhibit social exclusion-like behavior, which can then potentially modulate future physical pain behavior.

Nina Sediki

Mechanical Engineering, San Diego Miramar College
STEMULATE
Mentored by Dr. Tania Morimoto

Haptic Grasper for Variable Force Rendering via Pneumatic Actuation

Haptics is a growing field of technology that implements kinesthetic and/or tactile feedback, typically through generating forces or vibrations. Haptic feedback can be used to improve user control of teleoperated robots, particularly in medical settings, where

precise and careful control of instruments is critical for safe interactions between operators and patients. However, most commercially available haptic interfaces used for teleoperation do not provide grip force feedback, which limits users' ability to grasp objects with the appropriate amount of force and can lead to breaking or dropping the objects. This work proposes a novel grasper that can provide force feedback at the fingertips via pneumatic actuation. The grasper is designed to mimic the normal forces felt when grasping objects of varying sizes, ranging from thin structures such as tissue to wider structures such as bones. By mounting this lightweight grasper onto existing haptic devices, the rendered grip force feedback provided through the pneumatic actuation system will supplement the kinesthetic feedback provided by the commercially available haptic interfaces. The performance of the grasper, including its range of motion, range of forces, and speed of response will be characterized. It is expected that the grasper will help make user control of teleoperated robots safer and more precise in medical settings.

Pablo Segundo

Cell and Molecular Biology, CSU, Northridge
STARS
Mentored by Dr. Amir Zarrinpar

Implementation of Novel CRISPR-Cas System to Engineer Native Bacteria as Live Bacterial Therapeutics (LBTs)

The human body is a meta-organism comprised of a 1.3:1 ratio of human cells to microbes. These microbes, the bacteria, fungi, and eukaryotes collectively called the microbiome, can influence human physiological functions ranging from obesity to aging. Thus, if they can be manipulated, or engineered, to express therapeutic functions, they can potentially alter human health. Engineered live bacterial therapeutics (LBTs) can autonomously self-replicate, detect abnormal conditions, produce and deliver therapeutics inside the human body. Compared to traditional therapeutics these functions are advantageous and may be more efficient in treating difficult diseases. To implement LBTs safely and effectively, it is crucial to understand what affects bacterial survival and maintenance of functionality in the gut. The Zarrinpar lab has demonstrated native Escherichia coli (E. coli), from a C57BL/6 mouse (EcAZ-1), can be used to functionally manipulate the gut microbiome. Now, to test the ability of EcAZ-1 to retain different functions, an efficient and precise method of genetic engineering must be established. The CRISPR/Cas system is often used to precisely create gene edits. However, using this system causes double-stranded breaks that lead to cytotoxicity in bacteria. Our goal is to employ novel applications with the CRISPR-Cas system to limit negative repercussions and develop an efficient method to precisely engineer microbes.

Thomas Sendino

Pharmacological Chemistry, UC San Diego
MRSEC REU or RIMSE
Mentored by Professor Michael Sailor

Optimization of Zwitterionic Polymer Stealth Coating on Silicon Nanoparticles to Extend Nanoparticle Residence Time

Non-specific protein absorption on nanoparticles can cause rapid clearance of nanoparticles from the body via the mononuclear phagocyte system. Polyethylene glycol (PEG) is the most commonly used stealth polymer known to increase stability and decrease protein absorption. One drawback of PEG is continued treatment with PEGylated nanoparticles can lead to an accelerated blood clearance phenomenon due to the formation of antibodies. Zwitterionic polymer stealth coatings have emerged as an alternative to PEG and have been shown to offer numerous biochemical advantages in terms of reducing nonspecific protein adsorption and extending in vivo lifespan. Studies suggest that surface density of the zwitterionic polymers on nanoparticles is proportional to the biofouling ability of the nanoparticles. Our work aims to parametrically investigate factors affecting the density of zwitterionic polymers on the surface of porous silicon nanoparticles (pSiNP), as well as determine the optimal polymer chain length to maximize nanoparticle lifespans in vivo. Zwitterionic polymers will be grafted onto the surface of porous Si nanoparticles, and characterized by thermogravimetric analysis, Fourier transform infrared spectroscopy (FTIR), dynamic light scattering, and Zeta potential analysis to quantify the relative surface density between samples. We will utilize Bicinchoninic acid assays to examine the effect of the surface density and chain length of zwitterionic polymers in relation to the rate of non-specific protein adsorption on pSiNPs.

Nandini Seth

General Biology, Psychology Specializing in Developmental, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Richard Daneman

The Effect of a Western Diet on the Blood-Brain Barrier

The blood-brain barrier (BBB) refers to the selective properties of the blood vessels in the central nervous system that regulate the movement of ions, molecules, and cells between the blood and the brain to maintain homeostasis. These properties, including tight junctions, selective transporters, and reduced vesicular trafficking, have been shown to have the ability to change. Because the BBB sits at the interface between the blood and the brain, we hypothesize that this key barrier plays a role in mediating changes in brain function that occur in response to environmental factors including diet. This project aims to determine how a Western (high-fat/high-sucrose) diet affects cognitive function through its actions on the blood-brain barrier. Here, we examine blood-brain barrier structure and function, looking at vesicular transport, tight junction length, as well as its permeability using tracer assays. Next, we look at its functioning at the level of gene expression, using RNA sequencing data to look at the expression of genes in the endothelial cells of mice on a Western diet. Finally, we assess how the Western diet may affect learning and memory using a novel object recognition task to test episodic memory. We hope the research provides exciting implications for diseases such as neurodegeneration and neuroinflammatory diseases which have been linked to dietary intake.

Ashley Sevier

Kinesiology, California Stare University, Bakersfield
STARS
Mentored by Dr Adam Engler

Characterization of Satellite cells and Fibro-adipogenic progenitors isolated from patient muscle samples

SCs and FAPs are crucial stem cell populations involved in muscle regeneration. SCs form new myofibers, while FAPs support their growth by releasing tropic factors. However, research on isolating both SCs and FAPs from human muscle samples is limited. Therefore, our ongoing study focuses on investigating the simultaneous isolation of SCs and FAPs and exploring their functional applications. SCs and FAPs were isolated from muscle biopsies obtained from ACL reconstruction surgeries. Enzymatic digestion with Dispase, Collagenase Type I and II was used for tissue dissociation followed by cell sorting of CD56+CD31-CD45- and CD56-CD31-CD45- cell populations using FACS. SCs were identified by CD56+CD31-CD45- phenotype using flow cytometry and Pax7 expression using immunofluorescence (IF) staining. Myogenic differentiation was induced for SCs and fusion index was calculated as the ratio of nuclei in MyHC-positive myofibers to the total number of total nuclei. FAPs were characterized by CD140a+CD140b+CD56-CD31-CD45- phenotype and TE7 expression. Results are presented as mean ± standard error of mean. Using our isolation method, we were able to isolate and sort 32,000±4,000 CD56+CD31-CD45- cells/gram and 110,000±2,900 CD56-CD31-CD45- cells/gram of muscle tissue. SCs were positive for Pax 7 and 93.5% ± 1.1% retained their CD56 expression after multiple passages. SCs demonstrated fusion index of 0.2 ± 0.01 after myogenic differentiation induction. After expansion of FAPs in culture, 86% ± 2% of CD56-CD31-CD45- cells were also positive for both CD140a and CD140b. Based on our findings, SCs and FAPs can be simultaneously isolated using our digestion method and provide functional stem cell pools.

Michael Shao

Computer Engineering, UC San Diego
ECE SRIP
Mentored by Professor Dinesh Bharadia

UWB/IMU Sensor Fusion for Robust Motion Capture

Due to proprietary information this abstract has been redacted.

Erin Shen

NanoEngineering, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Prof. Shaochen Chen

3D BioPrinting Cardiac Micro-Tissues Reveals Direct Promoter Competition in Switching from MYH6 to MYH7 in Human Cardiomyocytes

The heart voluntarily beats anywhere from 60 to 100 times per minute, yet little is understood about the mechanisms and functions that induce beating. Abnormalities in heart beating can lead to permanent tissue damage, which can fatally impact the body's oxygen supply and function. Recent studies in cardiology suggest that MYH6 and MYH7 genes are key for mammalian striated muscle in heart tissue. However, little is known about how these genes interact and function, individually or in unison.

We investigate heart beating frequency and force to understand how contractility will be affected in MYH6 or MYH7 knockout cardiomyocytes (CMs) by using DLP-based printing. Because MYH6 and MYH7 are the only two myosin heavy chain proteins expressed in CMs, myosin consisting of MYH6 has a higher ATPase activity than myosin composed of MYH7. Therefore, hearts expressing MYH6 have more rapid contractile velocity than hearts expressing MYH7. In this study, we utilized our in-house developed micro-continuous optical printing system to fabricate a cardiac micro-tissue rapidly. Following a period of 7 days, the cardiac micro-tissue displayed a remarkable level of sarcomere organization, indicating the formation of functional muscle units. Additionally, there was a noteworthy upregulation in the expression of maturity markers, further confirming the increased maturation and development of the micro-tissue that recapitulates the in vivo microenvironment and interactions between cells better than 2D models. These developments offer a promising opportunity to study, promote, and/or control beating and further investigate these genes' mechanisms.

Jennifer Shin

Human Biology, UC San Diego
Ahmadian Summer Fellowship
Mentored by Philip Gordts, PhD

Exploring Syndecan-1 as a Diagnostic Marker for Hepatic Diseases in Plasma of Patients with Type 2 Diabetes

Due to proprietary information this abstract has been redacted.

Eduard Shkulipa

Electrical Engineering, UC San Diego
ECE SRIP
Mentored by Dr. Vitaliy Lomakin

Fast evaluation of Helmholtz potential

This research aims to implement a parallel algorithm for rapidly evaluating spatial convolutions between the Helmholtz potential and a large-scale source distribution. The algorithm implements a non-uniform grid interpolation method (NGIM), which uses amplitude and phase compensation and spatial interpolation from a sparse grid to compute the field outside a source domain. NGIM reduces the computational time cost of the direct field evaluation at N observers due to N co-located sources from O(N^2) to O(N) in the static and low-frequency regimes, to O(NlogN) in the high-frequency regime, and between these costs in the mixed-frequency regime. Memory requirements scale as O(N) in all frequency regimes.

Bretton Simpson

Physics with Specialization in Astrophysics, UC San Diego
Cool Star Lab
Mentored by Dr. Adam Burgasser

Examining Seyfert Galaxies with Archival Infrared Spectra from IRTF/SpeX

Observing galaxies at infrared wavelengths enables close study of the structure of distant galaxies, and how they evolve with time. Seyfert galaxies are distinguished by the presence of an active galactic nucleus (AGN) in their cores, a high-luminosity source maintained by the accretion of material into a supermassive black hole. Infrared observations of Seyfert galaxies have been obtained by the SpeX spectrograph device on the NASA InfraRed Telescope Facility (IRTF), which since its first light in 2000 has accumulated more than 20 years of data on a vast set of objects, including galaxies. From the IRTF IRSA and IRTF Legacy Archives, I have identified five Seyfert galaxies with SpeX data, which I reduced using a new python-based code called pyspextool. I analyzed each of these galaxy's spectra using the SpeX Prism Library Analysis Toolkit (SPLAT), and compared them to other Seyfert galaxies with infrared spectra. By comparing spectral properties to other galaxy information (age, structure, orientation), I identify several diagnostics of AGN and host galaxy properties. Understanding the properties of galaxies in the infrared is essential to observing the universe at great distances, where the expansion of the universe begins to shift the spectrum of ancient galaxies to larger wavelengths and the interstellar medium obscures optical measurement.

Satvik Singh

Computer Engineering, UC San Diego
ECE SRIP
Mentored by Prasad Gudem

Image Processing for Boomerang flight dynamics

The flight dynamic of a boomerang is complex. We must track the boomerang's flight trajectory to understand the complex physics behind its motion. The first idea was to use GPS. The setup for GPS is simple and easy to calibrate and use. GPS, however, has a low accuracy (~5m). Given the size of a typical boomerang, this is not a reasonable range. The next approach is to use UWB. UWB has an accuracy of < 10cm and this is a good accuracy range for tracking the X, Y, and Z data of the flight. The setup for UWB is hard to assemble and time-consuming and can also be expensive. Both these technologies, UWB and GPS have a low sampling rate, which can lead to losing data points of a fast-moving boomerang. Furthermore, these approaches require a PCB board to be hooked to the boomerang itself. Compared to the size and thickness of the boomerang the PCBs are bulky and can affect the aerodynamics of the boomerang. This motivates us to use image processing since it does not alter the boomerang’s shape at all and sampling rate is decided by camera quality. The setup only requires a drone, hence it is easy to set up. The challenge lies in developing an algorithm that accurately tracks the motion of boomerang. The aim of this project is to develop ways to accurately track the X, Y, and Z data as well as the orientation of the boomerang (phi, theta and Psi) using image processing.

Emily Smith

Public Health, UC San Diego
Multidisciplinary Approach to Addressing Cancer Disparities
Mentored by Dr. Georgia Sadler, Dr. Sandra Leibel, Dr. Evan Snyder

Cancer in Post-Roe America: It is beyond abortion rights

In 2022, the Supreme Court overturned Roe versus Wade, ending all federal protections for abortion. As women across America braced for the repercussions, few realized how that landmark decision could threaten access to life-saving cancer care. This narrative literature review explores data regarding access to cancer drugs and treatment within the lay and peer-reviewed scientific literature. Articles were identified using: PubMed, Ethnic News, CINAHL, Westlaw Campus Research, Nexis Uni, Newspaper, Google Scholar, and JSTOR databases. The search terms included: cancer, drugs, Methotrexate, Mifepristone, Roe v. Wade, post-Roe, abortion bans, and limitations. Eligible articles were published in English from 2001 to 2023 and are accessible in full-text. The citations of eligible articles were explored. Most abortion-restrictive states also have the highest cancer mortality rates. Scientists and clinicians fear Roe v. Wade's overturn will further exacerbate those disparities. This review highlights how abortion-restrictive states may have to limit access to "standard of care" cancer medications, such as Methotrexate and Mifepristone. Those drugs are crucial in effectively controlling cancer but have abortion-inducing effects that could limit their use. As physicians struggle to comply with new regulations, there is a growing concern that the lack of access to such drugs will compromise cancer care for women of childbearing age. It is essential that the public understands the broader implications of Roe v. Wade's overturn. Clinicians, patient navigators, scientists, and all others concerned with women's successful fight against cancer must help advance the public's understanding of how this overturn will negatively influence cancer care.

Crystine Sobrian

Cognitive and Behavioral Neuroscience, UC San Diego
CoB-KIBM
Mentored by Dhananjay Bambah-Mukku

The Impact of Maternal Touch on Infant Development: Insights into Neural Processing and Social Behavior

Maternal Touch is important for infant development. The presence of a mom for young children is essential for ensuring safety and promoting behavioral activity. Adults with childhood emotional neglect or separation often exhibit social dysfunction later in life, similar to the postnatal stress seen in mother-separated mice. However, we know very little about how the infant nervous system processes maternal cues. Mice are born deaf and blind, relying on touch, taste and smell to detect and process environmental information. We hypothesize that touch confers the primary appetitive valence to multi sensory cues received from mothers. Our study aims to examine how maternal touch during infancy contributes to the development of adult social behaviors. For infant social processing, we use olfactory imprinting and maternal separation. Olfactory imprinting is performed by painting a non innate odor onto the mother during the first ten days of infancy. We will examine LTMR specific Piezo2 knockout animals to determine if touch stimulation is essential for the formation of early life odor preferences. Second, we will use an early life adversity paradigm where infant mice will be separated from their mothers for 3 hrs daily for the first 2 weeks of life. Half the mice will receive gentle brushing stimulation to assess if touch can rescue adult social deficits. Our findings will illuminate neural mechanisms that the infant brain uses to process maternal cues. More broadly, our studies will provide molecular and cellular entry points to understand early life determinants of adult social behaviors.

Kevin Soto

Clinical Psychology, UC San Diego
STARS
Mentored by Dr. Lindsey Powell

Children’s evaluations of empathizers and counter-empathizers

Observing the emotional reactions between people, like empathy and counter-empathy, may provide important information about others’ social relationships. Children appear to use vicarious emotions to infer whether two people are friends or foes, and knowledge of relationships to predict vicarious responses (Smith-Flores, Bonamy, & Powell, 2023). This study aims to investigate further how children socially evaluate empathizers and counter-empathizers. Four to seven-year-old children were told stories about three characters: one experiencer and two observers. The observers react empathically, counter-empathically, or neutrally to the experiencer’s positive or negative outcome.

Children are asked 1) to rate how okay each observer's response was, 2) who the experiencer is friends with, and 3) which observer is nicer. Data collection is ongoing, with 58 of the target sample of 72 children reached. Preliminary results suggest that children view empathy as more okay than counter-empathy and neutral responses and neutral responses as more okay than counter-empathy. Children also rated the empathizer as nicer and more likely to be friends with the experiencer. However, when children were told about an empathizer who did not help the experiencer and a counter-empathizer who did help the experiencer, children rated the counter-empathizer as nicer and likely to be friends with the experiencer. This suggests that children may use prosociality as a cue for friendship over vicarious emotions. Future research may seek to explore whether children prefer to affiliate empathizers over counter-empathizers in their own interactions.

Megha Srivatsa

Molecular and Cell Biologu, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Sara Gianella and Dr. Sarah LaMere

Testosterone Shaping the Immune System: A Comparative Analysis of Cytokine Expression Between Transgender Men and Cisgender Women

Sex differences exist in the human immune system and its response to viral infections that are partially regulated by sex hormones. The exact mechanisms underlying distinct immunological profiles between cisgender men and women are unknown, and even less is known about the effect of gender affirming hormonal therapy (GAHRT) in the transgender population. This is important since HIV disease progression occurs more rapidly in cisgender women than men, which might be due to a sexually dimorphic immune response. Research conducted in hypogonadal men suggests that exogenous testosterone levels may contribute to regulating the expression of pro-inflammatory cytokines like TNF-α, IL-1β, and IL-6, and the anti-inflammatory cytokine IL-10. These cytokines can facilitate the activation and control of the innate and adaptive immune systems. This study aims to compare the soluble inflammatory milieu in stored blood plasma samples between a cohort of 46 transgender men undergoing GAHRT and a control group of cisgender women, enrolled as part of two clinical studies in San Diego (CCTG600 and CCTG603). Cytokines TNF-α, IL-1β, IL-6, and IL-10 will be measured using a sensitive immuno-qPCR assay, and plasma testosterone levels will be measured using an ELISA. Results will be compared between groups using T-tests and linear regressions. We hypothesize that transgender men will have lower levels of pro-inflammatory cytokines and higher levels of anti-inflammatory cytokines than cisgender women. If confirmed, our results will provide important insights about the implications of GAHRT on risk and treatment for inflammation-related diseases for transgender men.

Jason Stanley

Computer Engineering, UC San Diego
ECE SRIP

Mentored by Assistant Professor Nikolay Atanasov

Hamiltonian-based Neural ODE Networks for Adaptive Control of Differential Drive Robots

As we envision robot deployment in increasingly unstructured and dynamic environments, adaptive control stands out as a necessity to handle the varying conditions autonomous robots operate in. However, hand-designed models based on first principles are often too simple to generalize to changing environments. In this work, we focus on learning system dynamics models using sensor data and synthesizing controllers for learned dynamics. We employ a neural network to model the dynamics and a continuous-time neural ordinary differential equation to update the model parameters. We use prior knowledge about the physics satisfied by a rigid-body system by imposing Hamilton's equations of motion in our design. In contrast with existing works which focus on specific systems, our method allows learning a general Hamiltonian dynamics model from data. In order to control how the system behaves, we design a desired Hamiltonian function and shape its potential energy to allow control of underactuated systems such as differential-drive robots. In preparation for real-world implementation, we designed and built a visual-inertial sensor that can be used to collect trajectory data to train our neural network model. Our method is able to efficiently learn and adapt a Hamiltonian model of an underactuated ground robot and control it using the shaped Hamiltonian function.

Jared Stearns

General Biology, UC San Diego
Colors of the Brain
Mentored by Dr. Deena Greene

Correlation of Subcortical Volume and Tic Severity in Patients with Tourette Syndrome

Tourette Syndrome (TS) is a developmental neurological disorder-characterized by involuntary repetitive movements (motor tics) or sounds (vocal tics). Researchers continue to examine the differences in brain anatomy in TS compared to controls, with a large focus on subcortical structures. However, studies present inconsistent evidence relating measurements of subcortical brain structures to symptom (tic) severity. This study aims to test if volumes of particular subcortical structures, namely the thalamus, caudate nucleus, putamen, pallidum, and nucleus accumbens, are associated with (tic) severity in children with TS. We will use high quality T1 weighted magnetic resonance imaging (MRI) scans from 63 children (46 boys and 17 girls) ages 10-14 with TS to calculate individual volumes of subcortical structures using an automated segmentation software (volBrain). We will then correlate tic severity as measured by the expert rated Yale Global Tic Severity Scale, with various subcortical structure volumes. Through this study we hope to advance our understanding of the relationship between subcortical volume and the primary symptoms of TS.

Tessa Sterns

Microbiology, San Diego Miramar College
STARS
Mentored by Dr. Sonya Neal

Exploring the Role of Rhomboid Protease in a Novel Model

Rhomboid proteases are intermembrane proteins conserved throughout most species of life and play a vital role in cellular regulation. RHBDD1 is a rhomboid protease that has been found to have role in apoptosis. A study in mice models showed that the suppression of RHBDD1 caused errors in apoptosis during spermatogenesis in mice models. However, a stable knock out animal has not been well studied. In order to gain further understanding of RHBDD1's influence on fertility, gene editing can be used to analyze their functions through knockouts in live organisms. Having a live model can help gain a deeper understanding of the function of RHBDD1 in vertebrate development. We are using CRISPR/Cas9 to knock out the RHBDD1 gene in zebrafish by targeting the promoter region of the gene. Zebrafish make an ideal model organism because their fully sequenced genome and external fertilization allows for easier genetic manipulation. The rate in which zebrafish reach sexual maturity will yield quicker results in understanding if the knockdown of RHBDD1 interferes with spermatogenesis. I hypothesize that once a stable knock out line of zebrafish is established the males will produce less sperm due to RHBDD1's influence on apoptosis during spermatogenesis. We will determine this by examining gonad size and development, measuring the number of apoptotic germ cells at 25 days post fertilization, and by comparing fertility rate of the knockdown line against wild type fertility. If the knockdown line of zebrafish is sterile it could warrant further investigation into targeting RHBDD1 for male birth control.

Lilyane Stessman

Mechanical Engineering, California Polytechnic State University - San Luis Obispo
SDNI REU
Mentored by Dr. Ester Kwon

A protease-based theranostic as a tool to understand and inhibit calpain in brain injury

Following traumatic brain injury (TBI), increases in intracellular calcium activate the calcium-dependent protease, calpain. Calpain is activated in neurons and endothelial cells, resulting in neurodegeneration and blood-brain barrier dysregulation. Calpastatin is a calpain-inhibiting protein that could act as a prospective therapeutic against the proteolytic activity of calpain. Customary methods of measuring calpain activity only allow for bulk analysis and lack the ability to visualize regional activation in the brain. Recently, we have developed a theranostic that includes a calpain-specific activity-based nanosensor and a calpastatin peptide as a tool to measure calpain and calpastatin dynamics in the brain after TBI. We synthesized PEG-CS1, PEG-CS1-calpastatin, and

PEG-CS1-scramble conjugates. We show that recombinant calpain-1 activates both the PEG-CS1 and PEG-CS1-scramble conjugates, and that calpastatin effectively inhibits activation of the sensor in the PEG-CS1-calpastatin conjugate. Both the PEG-CS1 and the Scramble-PEG-CS1 show an increase in sensor activation over time, as measured by fluorescence. This aligns with our hypothesis that calpain-1 was uninhibited by the conjugates and able to cleave the peptide FRET pairs. The PEG-CS1-calpastating showed no sensor activation. This indicates that calpain-1 was inhibited by the calpastatin and unable to conduct cleaving activity. In a preliminary experiment, conjugates were injected in a mouse controlled cortical impact model and we observed calpastatin inhibits calpain activation in neurons and endothelial cells. We will investigate the interaction between calpain and calpastatin in neurons and endothelial cells within the hippocampus and the cerebral cortex to quantify the therapeutic potential of calpastatin regionally in the brain.

Haley Steuber

Physics, CSU, Sacramento
STARS
Mentored by Dr Adam Burgasser

The Reduction and Analysis of New Brown Dwarf Spectra Contained in the IRTF/SpeX Archive

Brown dwarfs are a class of star that do not have enough mass to undergo hydrogen fusion. Near-infrared spectra are important for brown dwarfs because it allows for the analysis of aspects such as the atmosphere. A large repository of brown dwarf infrared spectra are contained in the IRTF IRSA Archive and IRTF Legacy Archive, which contain over 20 year of data collected by the SpeX spectrograph. In this presentation, I present previously unpublished spectra of brown dwarfs contained within these archives which are reduced using the new python-based reduction code pyspextool. I analyze these spectra using tools contained in the SpeX Prism Library Analysis Toolkit (SPLAT), including classification, index measurement, and spectra model fitting. By expanding the sample of brown dwarf spectra, we can better understand the stellar composition of the immediate Solar Neighborhood, and by extension the Milky Way galaxy at large.

Sascha Stevens

Structural Engineering, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Professor Hyonny Kim

Optimizing Sandwich Composite Structures for Resilient Surfboard Design: A Study on Buckling Resistance and Material Properties

This research aims to develop a more resilient and durable surfboard design capable of withstanding the forces produced by waves, thereby reducing waste and promoting the use of sustainable materials. To achieve this goal, a new sandwich composite structure will be developed with enhanced torsional strain and greater flexibility in bending, while compensating for the reduced strength of the outer skin with a high-strength carbon fiber stringer. The optimal design of this composite structure will be determined through a series of analytical and numerical simulations, considering the influence of key design parameters such as material properties and geometric configurations. The findings of this research will contribute to the larger body of knowledge on composite materials and structural engineering, with potential applications beyond the surfboard industry.

Julia Stoneburner

Bioengineering, UC Los Angeles
SDNI REU
Mentored by Dr. Michael Sailor

Stability and Protein Adsorption of Lipid-Coated Porous Silicon Nanoparticles

Porous silicon nanoparticles (PSiNP) themselves are not stable in many biologically relevant solutions such as PBS, which is commonly used in cell culture and animal studies. Bare porous silicon nanoparticles tend to adsorb proteins in vivo which decreases their blood circulation time and their ability to reach the targeted location. This is an important limitation in biological applications of PSiNP such as drug delivery. Coating the porous silicon nanoparticles in lipids could make them more stable in these biologically relevant solutions. Further, increasing the ratio of PEG-lipid could decrease the amount of protein adsorbed onto the nanoparticles. This is investigated by coating the porous silicon nanoparticles with different lipid compositions. This composition contains different ratios of DSPE-PEG:DSPC:CHOL. DSPE-PEG referring to 1,2-Distearoyl-sn-glycero-3-phosphoethanolamine-Poly(ethylene glycol) with two saturated 18 carbon chains, DSPC referring to Distearoylphosphatidylcholine with two saturated 18 carbon chains containing, and CHOL referring to cholesterol. Nanoparticles will be prepared via thin-film hydration. Particle size and zeta potential will then be characterized using dynamic light scattering (DLS). Nanoparticles will be tested in different biological solutions: PBS, DMEM, DMEM supplemented with 10% FBS, and pure FBS. Protein adsorption of each formulation will be quantified with a BCA assay. Formulations will additionally be incubated at biological relevant temperatures (37°C) and the stability and protein adsorption tested.

YungYi Sun

Electrical Engineering, UC San Diego
ECE SRIP
Mentored by Dinesh Bharadia

Smurfs: A Smart Surface-based Privacy Attack for Machine Learning-enabled Wireless Sensing Systems

Machine learning-enabled wireless sensing systems have been extensively developed for context-aware services due to their accuracy in sensing capabilities. However, their vulnerabilities have not been sufficiently explored, especially considering the machine learning and wireless sensing technological aspects in real-world settings. In this work, we present Smurfs, a system that can obfuscate machine learning-enabled wireless sensing systems with smart surfaces. The attacker can deploy the smart surface to obfuscate the wireless communication signals, such that user privacy (e.g., human activity recognition) from the machine learning-enabled wireless sensing systems are disabled. However, In a real case scenario, the attacker cannot obtain the dominant wireless channel affected by the human. This makes it difficult for the attacker to control the smart surface to achieve optimal obfuscation. Consequently, we attempt to develop a novel algorithm to strengthen the obfuscated signals between the transmitter and receiver of the wireless sensing systems with multiple smart surfaces. As a result, the backscattered signals from the smart surfaces become dominant, allowing the attacker to accurately control these surfaces to conduct the privacy attack. We plan to evaluate and demonstrate the effectiveness of our proposed attack in real-world settings.

David Sung

Electrical Engineering, UC San Diego
ECE SRIP
Mentored by Professor Patrick Mercier

Power Distribution Microgrid on eTextiles

External devices which may track parameters on the human body are generally worn with direct contact to the skin. A potentially revolutionary step for progressing these devices is the use of electronic textile (eTextiles) clothing which integrate the devices into a person's clothing directly. This introduces possibilities of larger, yet still unobtrusive, systems being able to operate on a subject in comparison to the majority of small but clunky devices used today. Challenges with this development is ensuring security, reliability, and efficiency of the system through day-to-day use. Clothing can be damaged over time from environmental factors, washing, and general use; to ensure the reliability of an eTextile system, the system must be durable and sustainable. Additionally, for any electronic system, energy must be provided to the various loads, and for an efficient system this power must be controlled. In this project, we discuss the development of a power distribution microgrid (PDM) directly incorporated into the fabric of the eTextiles clothing.

Tina Tahiraj

Mechanical Engineering, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Professor Frank Talke

Developing a Multi-Chamber Soft Robotics Inspired Dilator for Treating Radiation Induced Vaginal Stenosis

Women who receive radiation treatment for cervical cancer often experience vaginal stenosis, which is the narrowing and shortening of the vaginal canal. Current medical intervention for vaginal stenosis involves the use of hard plastic or silicone vaginal dilators, which are stiff, uncomfortable, and often painful. In order for dilation therapy to be successful, consistent and continuous sessions are necessary. However, patients often stop following their prescribed treatment plan due to pain and discomfort. The development of a soft robotics inspired inflatable dilator aims to improve patient comfort and therefore improve patient adherence. Preliminary testing done by the Talke lab had shown promising results with a single chamber inflatable dilator. However, because vaginal stenosis does not affect the vaginal wall in a uniform manner and there is a great deal of variability in severity amongst patients, the development of a multi-chamber dilator with sections that can inflate and deflate independently of each other will allow for personalized treatments for all cases of vaginal stenosis. The highly customizable properties of this dilator will also improve patient comfort, thus improving patient adherence and the likelihood of positive treatment outcomes. This project is a continuation of previous work done in the Talke lab and focuses on the iteration and improvement of multi-chamber prototypes for personalized dilator therapy.

Tina Tebyanian

Biology, San Diego Miramar College
STARS
Mentored by Dr. Sonya Neal

Investigating the role of rhomboid protease in neuronal function using targeted CRISPR/Cas9 technology

Rhomboid proteases play important roles in cellular processes, such as protein signaling and maintaining protein membrane homeostasis. Recent studies have established a link between a type of rhomboid protease, RHBDL1, and the membrane of primary neurons. Despite their significance, limited knowledge exists about the specific function of RHBDL1, mainly because its substrates remain unidentified. Furthermore, embryonic lethality in traditional animal models like mice have made protease knockouts difficult. Therefore, I propose using zebrafish as an alternate vertebrate model to study RHBDL1 knockout. Zebrafish have emerged as a favorable animal model for gene deletion experiments due to their external development and high fecundity. Their successful application in neuron studies makes them an ideal candidate for studying RHBDL1 knockout effects. My objective is to achieve RHBDL1 knockout and subsequently analyze its involvement in neuronal function, expecting to see changes in neuron maturation. To disrupt the RHBDL1 gene, I will utilize CRISPR-Cas9 technology to generate a promoterless mutant allele. Once a stable knockout line is generated, I will focus on observing the embryonic development and using confocal microscopy and transgenic fish lines to monitor any potential abnormalities in neurons. This experiment marks one of the early studies done on RHBDL1, serving as a catalyst for numerous future studies on this topic.

Girma Terfa

Computer Science, San Diego Miramar College
STEMULATE
Mentored by Minhtuyen Mai, Dolores Lopez, Dr. Alberto "Beto" Vasquez

Equitable Pedagogical Approaches in K12 CS Learning Communities

Over the last five years, the landscape of computer science (CS) education has changed dramatically. CS has shifted from a niche subject to the fastest-growing subject in the US. While it's gained increased popularity, research shows issues of inequities as it pertains to access and pedagogy. This presentation, therefore, focuses on the possibilities of implementing pedagogical approaches that can more equitably support diverse student populations in K12 CS learning communities. Specifically, it explores the following research theme: How can teachers in K12 CS learning contexts employ pedagogical approaches in their CS classrooms that better support student engagement and understanding of Computer Science Content? Through empirical investigation and collaboration with educators, this presentation highlights three K12 studies: Curriculum design for Elementary grades, Strategies and Approaches for Middle School Students and Computer Science for English Learners (CSforEL), seeking to address the posed inquiry.

Tanzi Terry

Neurobiology, UC San Diego
CoB-KIBM Scholar
Mentored by Dr. Matthew Lovett-Barron

The Influence of Internal States and External Stimuli on Visually-Evoked Behavior in Larval Zebrafish

Animals must react to both internal and external stimuli to survive. Less work has focused on how scalable internal states (i.e., hunger and fear) may change perception of external sensory stimuli and behavior. We will use larval zebrafish (Danio rerio) to investigate the impact of fear and hunger on the optomotor response (OMR), a well studied visually-evoked behavior. Internal states are important to investigate behavior in vertebrates. We are interested in how internal states impact behavior, potentially increasing behavioral responsiveness to specific external sensory stimuli. In larval zebrafish, a long-lasting, fear-like state can be caused by a brief exposure to cadaverine, a chemical odorant produced by decaying fish. We will study the influence of internal states on behavior using OMR. Previous work has shown that a "fear-like" state can have a long-lasting influence on swimming, however, their influence on varying contrast of OMR is unknown. We will present three varying contrasts of gratings with and without a brief cadaverine exposure. We expect an increase in swimming to lower contrast gratings with cadaverine exposure relative to baseline. This potentially indicates an increased sensitivity to the visual stimuli. We will also study the importance of red and ultraviolet light in OMR in hungry and fear-like states to better understand the correlation of internal states and visual stimuli. We predict an overall increase in swimming in UV light compared to red light across states. Taken together, this project will provide novel information about the influence of internal states on behavioral responsiveness to drifting gratings.

Kyle Thomas

Microbiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Joe Pogliano

Investigating the Roles of Core Genes in the Nucleus-Forming Phage Life Cycle

It was recently discovered that some phages (viruses that infect bacteria) construct a complex subcellular compartment known as the phage nucleus which separates viral DNA from the host cytoplasm during replication and helps organize progeny assembly. The phage nucleus fully encloses viral DNA within a proteinaceous shell and displays functions that are analogous to a eukaryotic nucleus, including mRNA export to the host cytoplasm and selective protein import into the nucleus. A set of 72 genes, termed the core genome, are present in all nucleus-forming phages, but many of these genes have no known function. In this project, we aim to characterize nine core genes using the nucleus-forming Escherichia phage Goslar as a model. We employed Cas13d, a complex that targets RNA to inhibit the production of a specific gene product, to knock down proteins of interest during Goslar infection. Additionally, we used GFP fusion to visualize the localization of our proteins within infected cells. This study serves to further our understanding of the role these proteins play in the viral life cycle of nucleus-forming phages.

Elizabeth Thompson

Biochemistry and Molecular Biology, Truman State University
MRSEC REU or RIMSE
Mentored by Mentor: Dr. Maurice Retout, PI: Dr. Jesse Jokerst

Colorimetric Sensor Arrays Based on Peptide-Driven Plasmonic Nanoparticles Assembly

Plasmonic nanoparticles are promising colorimetric reporters due to their efficient optical properties and their use in colorimetric sensors has been widely reported. An interesting color change is obtained during the assembly of plasmonic nanoparticles due to the coupling of the individual localized surface plasmon resonance (LSPR) bands. Recently, peptides containing bridging motifs have been employed to modulate the assembly of nanoparticles. In this research, we investigated the peptide-induced assembly of BSPP-coated silver nanoparticles (AgNPs-BSPP) via either electrostatic or hydrophobic interactions. When the AgNPs-BSPP assemble, the color of the sample varies from bright yellow to bright blue as the LSPR band deforms through the whole visible region of the light spectrum. Multiple batches of AgNPs-BSPP were synthesized and titrated with diverse peptide sequences and the assembly was systematically characterized by UV-Vis spectroscopy. First, this strategy was applied for the discrimination of multiple human proteins in buffer (thrombin, trypsin, hemoglobin, BSA) and subsequently for the discrimination of different microorganisms in culture media responsible of oral disease (P. gingivalis vs F. nucleatum vs C. albicans). Finally, engineered peptide sequences were developed and tested against the AgNPs-BSPP for the detection of the enzymatic activity of P. gingivalis and F. nucleatum.

Ashley Thorshov

Physics w/Specializ Astrophys, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Alex Frañó

Mapping the Time Development of Hydrogel Inhomogeneities using Laser Interference

Hydrogels are materials composed of inhomogeneously crosslinked polymer chains. When exposed to aqueous solutions, hydrogels can expand up to ten thousand times their dehydrated size. The intense swelling of these materials, along with their inhomogeneous structure, results in widely varying polymer chain density in hydrated states. This unique property has made hydrogels a material of interest in many fields, such as biochemistry and Health care; hydrogels are used as contact lenses, tissue reinforcers, and even distributors of medicine within the body. However, the nonuniform swelling of hydrogels is still widely unexplored. To better understand the time evolution of the polymer chain structure, our team is using two laser interference techniques (Bragg scattering and coherent interference) to develop a three dimensional mapping of polymer chains within hydrogel samples. In each method, a light source is shone into a hydrogel sample, where it interacts with the polymer chains and scatters accordingly. The resulting interference pattern can then be analyzed to gain information about internal spacing between polymer chains. By employing these techniques at different sizes in the swelling process, we can quantify a sample’s time evolution. Preliminary results suggest that these experiments produce valuable information on the density and structure of our samples. The ability to accurately study the internal configuration of hydrogels will allow us to explore how swelling changes in response to environmental conditions, such as temperatures, solvent pH level, etc. Better understanding the swelling of these materials may help advance their current applications and uncover other relevant uses.

Marissa Todesco

Cognitive and Behavioral Neuroscience, UC San Diego
UC LEADS
Mentored by Dr. Timothy Gentner

The Magnetic Compass in Avian Brains: Exploring Neural Responses to Magnetic Fields

Although it is well-established that migratory birds use a process known as radical-pair magnetoreception to access information about Earth's magnetic fields, the neural processes underlying this ability remain a mystery in sensory biology. It is known that the radical-pair process occurs in the eye, but little is known about how this information is processed once it reaches the brain. A specific area of the avian brain known as cluster N receives visual input and is critical for magnetic orientation behavior, making this area a possible center for processing magnetic information. In order to verify the accuracy of neurophysiological data recorded from cluster N, it is necessary to locate cluster N relative to each recording site. A process known as immunohistochemistry, a chemical staining process for visualizing specific antigens, is used to determine the location of cluster N in each brain sample. These findings will establish more precise targeting of cluster N in neurophysiological experiments, with the ultimate goal of finding magnetic responses in the avian brain.

Hailey Tran

Chemical Engineering, UC San Diego
MRSEC REU or RIMSE
Mentored by Professor Jon Pokorski

Design and Development of Cellular Scaffolds for Examining Phototactic Movement of Cyanobacteria in Hydrogels

Developing stimuli-responsive materials at the living/nonliving interface has been an area of research interest in the past few years for scientists across many disciplines. In our work, we combine cyanobacteria, a photosynthetic microorganism with different polymeric scaffolds to fabricate stimuli-responsive materials. Some species of cyanobacteria like Synechococcus elongatus UTEX 3055 and Leptolyngbya sp. BL0902 are capable of positive phototaxis, or movement in the direction of light stimuli and formation of biofilms. In this project, we investigate the phototactic response of cyanobacteria within hydrogel structures and how external environmental factors can promote cellular motility. We investigate the potential of hydrogels with varying chemical and charge properties, namely agarose, sodium alginate, and chitosan as a substrate for cellular attachment and facilitating the movement. We investigate the interactions between the material surface and the cell membranes. Factors like light wavelength, intensity, direction and different substrates properties are controlled and modified to observe their influence on cyanobacterial phototactic motility. The results of this project can be helpful in further studying the behavior of cyanobacteria-based engineered living materials (ELMs) and in particular, their biofilm-forming and self-repairing abilities.

Colin Tran

Data Science, UC San Diego

McNair Scholars Program
Mentored by Professor David Danks

Enhancing Suicide Prevention: Addressing Data Integration Challenges in Multi-source Analysis

Suicide has become a significant public health concern over the past several decades, prompting urgent calls for effective prevention strategies. In recent years, technological advancements have enabled machine learning and AI methodologies to be deployed in this critical area. The power of AI and machine learning have allowed researchers to amalgamate heterogeneous data from diverse sources and employ AI platforms to develop sophisticated risk algorithms. Such algorithms can effectively determine the key factors influencing suicide outcomes and help design targeted interventions. However, dealing with heterogeneous data involves intricate data cleaning and wrangling processes, which come with many challenges due to data complexity and variability. This research discusses potential challenges in-depth, exploring their implications on the effectiveness and accuracy of suicide prevention studies and suggesting possible solutions to improve the overall data management process.

An Truong

Pure Chemistry, UC Riverside
UC LEADS
Mentored by Dr. Erik Romero

Exploring the potential of aryl thianthrenium salts for Pd-catalyzed C–H arylation reactions

This research project explores the application of a wide range of aryl thianthrenium salts as aryl radical precursors in Pd-catalyzed C–H arylation reactions. Unlike other sources of aryl radicals, aryl sulfonium salts are easy to synthesize and offer a wide breadth of scope. Combining this diversity with the mildness of light-driven C–H activation will lead to an attractive strategy for the synthesis of complex organic molecules. My work this summer focused on synthesizing these versatile salts, optimizing and performing several photocatalytic amide-directed arylation reactions, and isolating the resulting product to determine the yield. Future studies will focus on expanding the scope of the Pd-catalyzed process and publishing the results in a peer-reviewed journal.

Ahmad Turkistani

Chemical Engineering, UC San Diego
MRSEC REU or RIMSE
Mentored by Michael Sailor

Clofazimine-loaded porous Si NPS for the treatment of tuberculosis and leprosi

According to the WHO, In 2019, Some countries are still reporting new Leprosy cases, and more than 10000 Leprosy have been reported. Moreover, tuberculosis is the 13th leading cause of death and the second leading infectious killer. Clofazimine is one of many antibiotics that are used to treat them. However, using conventional systemic drug delivery methods (oral tablets) can have a variety of unwanted side effects affecting the whole body. Therefore in this project, we're aiming for the targeted delivery of Clofazimine to either Mycobacterium tuberculosis or Mycobacterium Leprae bacteria (causing tuberculosis or leprosy respectively) by loading said drug to a targeting peptide-conjugated porous silicon nanostructure. To improve loading efficiency, we also conjugate octadecylsilane into the surface of the porous silicon nanostructure for better compatibility with our hydrophobic drug.

Gloria Udogu

Human Biology, UC San Diego
Summer TRELS
Mentored by Dr. Shiri Gur-Cohen

Lymphatic Circuits Shape Stem Cell Fate in Health and Disease

Due to proprietary information this abstract has been redacted.

Matthew Uzelac

Neurobiology/Biochemistry, UC San Diego
Genentech Scholars Program
Mentored by Dr. Weg M. Ongkeko

tRNA-Derived Fragments as Translational Regulators in Head and Neck Carcinoma

In the United States, roughly 50,000 individuals are diagnosed of head and neck cancers yearly. Many of the genetic alterations commonly observed of these cancers are well characterized, though noncoding transcripts are being given increased consideration for their potential oncogenic effect. A novel class of these transcripts, tRNA-derived small RNAs (tsRNAs), results from the enzymatic cleavage of precursor tRNAs and is capable of cellular regulation at the level of translation. In this study, we investigate tsRNAs for oncogenic dysregulation, with specific consideration of translational regulation of oncogenes (OG) and tumor suppressor genes (TSG). 499 tumor tissue and 44 solid normal tissue samples were sequenced and mapped to tsRNA transcripts. 29 tsRNAs were found to be differentially abundant. Upregulated in cancers, LeuCAA 3'-tRF and LeuCAA 5'tRF exhibited significant inverse correlation to the expression of several of studied OGs and TSGs, suggesting the likelihood of a potential mechanism of cleavage. AsnGTT 3'-tRF displayed a similar trend, those was downregulated in cancers. Moreover, tsRNA-gene pairs of significant anticorrelation were further assessed for sequence complementarity of a precise "seed" region, necessary for Argonaute-mediated degradation. Indeed, these tsRNAs contained numerous regions of sufficient

complementarity to induce this degradation, with statistical calculations suggesting against the likelihood of spurious base pairing. Ultimately, characterizing the influence that these tsRNAs exert may prove useful toward understanding the cellular pathology of head and neck cancers. By considering the relevance of the transcriptome and its noncoding transcripts to these cancers, additional measures may be taken in their diagnosis, prognosis, and treatment.

Leslie Vallejo-Avila

Political Science: Race, Ethnicity, and Politics, UC San Diego
McNair Scholars Program
Mentored by Dr Gerardo Arellano

A transformed neighborhood: understanding how cultural displacement continuously affects the Latinx community in San Francisco's Mission district

As urbanization continues to expand and prosper, it is imperative that we remain conscious of the socioeconomic, linguistic, racial, and other identity-based factors that have exacerbated communities of color from having access to the necessary resources to adapt throughout the changes that come as a result of what a gentrified transforming neighborhood brings to its residents. Gentrification is the cultural, economic, and social transformation of a community that is a result of the financial investments of historically overlooked and abandoned neighborhoods to cater for the needs of incoming wealthier residents. This shift results in urban displacement where low-income residents and families become pushed out of their homes and are displaced while their middle and upper-class resident counterparts are provided the space to move-in. San Francisco's rapid population increase of tech workers is matched with an increase in rent prices and cost of living. Increase in evictions, and demographic changes have specifically impacted San Francisco's oldest neighborhood, the Mission District, which is home to the city's largest Latinx population. The diversity within Mission residents include multigenerational Latinx residents, undocumented Latinxs, Latinxs with different levels of education background and Latinx immigrants. My study is to focus on the intersectionality between citizenship, housing, and how it is intertwined with the politics of space, race, and technology. Despite gentrification being able to benefit communities by increasing the income revenue of the city it also harms them through cultural displacement which is what this study will be highlighting.

Manuel Vasconcelos

Cognitive and Behavioral Neuroscience, UC San Diego
STARTNeuro
Mentored by Dr. Kay Tye

Examining the acute effects of psilocybin on neural representations of valence in the medial prefrontal cortex

Psychedelic drugs have been shown to modify emotional processing in humans. Specifically, when dosage and context are controlled, psilocybin has been shown to increase positive mood while decreasing reactivity to negative emotional stimuli. Yet, precisely how psychedelics mediate these changes in emotional processing is unknown. To model the emotional fluctuations observed during the psychedelic experience, our lab used a modified Pavlovian discrimination task to drive conflicting motivational behaviors and capture subtle perturbations in valence processing (i.e., determining whether something is good or bad). In this conflict task, freely moving mice given either saline or psilocybin faced stimuli of ambiguous valence as reward-predictive cues were simultaneously presented with shock-predictive cues. Employing a machine learning approach to estimate animal pose and quantify behavior, we assessed whether psilocybin reduced fear-related behavior during conflict trials. Furthermore, to examine whether neural representations of valence are altered by psilocybin during the conflict task, we used Neuropixels probes to perform high-yield, spatiotemporally precise in vivo electrophysiology in the medial prefrontal cortex–a region known to be critical for context-dependent emotional processing. A successful outcome of this project would illuminate the role of the medial prefrontal cortex in psilocybin-induced changes in valence processing and begin disentangling the contributions of context versus individual differences in the variability in emotional responses to psychedelics.

Andres Vasquez

Biochemistry, UC San Diego
Summer CAMP
Mentored by Dr. Gourisankar Ghosh

The phosphorylation of BCL3 regulates transcription of the p52:p52 NF-kB complex

NF-kB is a family of transcription factors that regulate many diverse biological responses, notably inflammation and the immune response. NF-kB assembles into homo- and heterodimers derived from 5 fundamental subunits: p50/NFkB1, p52/NFkB2, RelA/p65, c-Rel, and RelB. The activity of these NF-kB complexes is regulated by the IkB protein family by promoting or repressing NF-kB gene expression. B cell lymphoma 3 (Bcl3) is a IkB family member and functions as a transcriptional coactivator through complex formation with the p52:p52 homodimer on DNA. Recent studies suggest that Bcl3 phosphorylation a key step in complex formation with p52:p52. I plan to explore how phosphomimetic mutations on Bcl3 influence complex formation with p52:p52 on DNA using in vitro biochemical assays and cell-based luciferase assay. The results of my studies will elucidate the mechanism of how Bcl3 phosphorylation influences p52:p52 transcriptional regulation, furthering our understanding of gene regulation.

Josue Vega-Jungo

Cognitive Science with a Specialization in Design and Interaction, UC San Diego
Summer TRELS
Mentored by Dr. Haines

UC San Diego's Alacrán Community Station: A Migrant Community with Knowledge on Diversity and Food

Not far from the US-Mexico border wall is the location of UC San Diego's Alacrán Community Station in Tijuana, Baja California, México. The Alacrán Community Station is a community within Tijuana's Alacrán Canyon that is made up of migrants from different parts of Latin America and beyond. Within the Alacrán Community Station, migrants wait their turn for when they are allowed to enter and possibly immigrate to the United States. The constant immigration of migrants from the Alacrán Community Station to the United States has created a constantly changing environment within Alacrán. Within the Alacrán Community Station, people of different backgrounds are brought together due to their common goal of immigrating to the United States, but this ever changing environment that is the Alacrán Community Station allows for it to be a place of knowledge due to its diverse environment. As it is a common sight to see people of different backgrounds come together, the diversity of the community within Alacrán can especially be seen through food. In order to continue cultivating this environment, I explored the diversity of the Alacrán Community Station through food by allowing myself to learn about the people within Alacrán through food making.

Mya Verrett

Bioengineering: Biosystems, UC San Diego
Summer TRELS
Mentored by Dr. Tina Ng

Improvement of User Interface for a Multi-Modal Glove

Hypertonicity is an increase of muscle tone most commonly found in neuromuscular diseases that can lead to muscle deformity if left untreated. Currently, common ways to assess hypertonicity in patients are highly subjective and can vary from doctor to doctor. To address this, we created a multi-modal glove with pressure sensors and an inertial motion unit that correlates the force and movement fluidity to the severity of hypertonicity. The glove is paired with a user interface, yet the interface needs improvement for the use in the clinical settings. There is no indicator of when the muscle tone reached equilibrium. We improved the user interface to allow for multiple file inputs and display the changes over time through histograms. This is done in LabVIEW and cross referenced with current data analysis procedures in MATLAB. The improved interface will assist the clinicians to conduct their own data analysis at the point of care and provide statistical guidance throughout the procedure.

Carlos Villalobos Nava

Biochemistry, CSU, Long Beach
MRSEC REU or RIMSE
Mentored by Dr. Michael Burkart

Scalability of sustainable polymer synthesis

5-Hydroxymethylfurfural (5-HMF) is a platform chemical that can be synthesized from the acid-catalyzed dehydration of carbohydrates like glucose and fructose. After synthesis, 5-HMF can undergo oxidation, giving 2,5-Furandicarboxylic acid (FDCA) as a result; FDCA can then undergo a polymerization reaction to produce fuel and consumer goods. Due to the vast presence of glucose in organisms like algae, 5-HMF provides a viable pathway for production of polymer products using organic, renewable sources. However, large-scale production of biobased 5-HMF and FDCA polymers presents difficulty in scalability, for the reactions tends toward mid-range yields due to the number of reactions glucose undergoes, as well as difficulty for 5-HMF retrieval due to the use of organic solvents with high boiling points at synthesis. Extensive research is being made in both of these areas. Herein, the scalability of a proven high-yield 5-HMF synthesis method was tested using Glucose as the carbohydrate source, AlCl3 and HCl as a Lewis acid catalyst, and 2-sec-butylphenol as the organic extracting solvent. A high-conservation extraction of 5-HMF using hexane and water was also scaled up. After, the polymerization reaction using 2,5-Furandicarboxylic acid (FDCA) as a substitute for 5-HMF was tested using different starting masses. The results of this project can point towards the usability of these high-yield 5-HMF production methods in large-scale quantities.

Kyle Walter

Biochemistry, UC San Diego
Multidisciplinary Approach to Addressing Cancer Disparities
Mentored by Drs. Georgia Robins Sadler and Jerel Adam Fields

TREM2: A New Element of Targeted Cancer Therapy

Cancer affects millions of people worldwide, and new therapies are needed to address its immune evasive nature. The ability of triggering receptor expressed on myeloid cells-2 (TREM2) to influence tumor growth through interactions with the tumor microenvironment (TME) paves the way for innovative targeted therapeutics. This literature review was initiated for a research project studying TREM2's role in tumor development, guided by Dr. Jerel Adam Fields of UC San Diego's Department of Psychiatry. The hypothesis proposes that increased TREM2 expression promotes tumor growth in people with HIV. To survey the literature for data supporting this hypothesis, we searched for articles published between 2015 and 2023 containing the keywords cancer, TREM2, tumor-associated macrophages (TAM), TME, and immune checkpoint therapy (IMT) in the following databases PubMed, CINAHL, EBSCO, and ProQuest. Of the 15 English, full-text articles, two were reviews, and the remainder were original research. TREM2 is expressed on epithelial cells and TAMs in solid tumors. The tumorigenic capacity of TREM2+ epithelial cells varies by cancer type. In TREM2+ TAMs, the TME becomes immunosuppressed. Importantly, when TREM2 is not expressed on TAMs, tumor growth decreases. TREM2 is being targeted in clinical trials with IMT to treat solid tumors. Additionally, TREM2 can serve as a prognostic biomarker because of its role in tumor growth. Thus, there has been increased interest in TREM2 as a therapeutic target for solid tumors. Initiating bench studies for cancers lacking therapeutic options has the potential to jumpstart the discovery of alternative treatment methods.

Kelly Wang

Molecular and Cell Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Cole Ferguson

Effect of BAP1 on Histone Ubiquitination and Neurodevelopment

Histone post-translational modifications represent a major mechanism by which cells enact specific programs of chromatin and gene regulation required for development. While some histone modifications have been extensively investigated, histone ubiquitination to generate H2AK119ub (H2A ubiquitinated at Lys119) is poorly understood despite being widespread and abundant. BAP1 is the enzyme responsible for deubiquitinating H2AK119ub, thereby controlling its abundance and distribution. Previously, BAP1 has been investigated as a tumor suppressor gene, but recently it was shown that germline BAP1 mutations cause a neurodevelopmental disorder in humans, supporting the assertion that proper chromatin regulation is essential for brain development. However, the specific roles of BAP1 and histone ubiquitination in brain development have not been investigated. Using mice with a floxed Bap1 allele, we generated mice with cerebellum-specific loss of BAP1. My project aims to systematically examine and classify differentially labeled loci where H2AK119ub increases upon BAP1 loss using the high-resolution chromatin mapping method CUT&RUN (Cleavage Under Targets and Release Using Nuclease). The CUT&RUN data will be processed using sophisticated computational analyses and visualized through KaryoploteR. Genome-wide heatmaps of H2AK119ub CUT&RUN data centered around enhancers and promoters will provide a global view of where BAP1 operates. We will also examine how expansion of histone ubiquitination impacts chromatin conformation and loop formation using micro-C. Finally, we will explore the effect of BAP1 loss on key stages of neuronal differentiation including neuronal morphogenesis and synaptogenesis. Through this multifactorial approach, we will execute a comprehensive exploration of the role of histone ubiquitination in neurodevelopmental chromatin regulation.

Stephanie Washburn

Psychology, University of Central Florida
STARS
Mentored by Dr. Lindsey Powell

Using Joint Attention in Infancy as an Early Indicator of Autism Spectrum Disorder

Due to the fact that Autism Spectrum Disorder (ASD) is characterized by social deficits, it presents challenges in identifying signs during infancy, primarily because social interactions in early life are mainly limited to caregivers. However, previous research has shown that the coordination of gaze within social interactions, specifically joint attention, is a way to study social markers in infancy. Joint attention is the shared focus of an object in a social context through the use of an attentional cue. This study aimed to examine social markers in infants with siblings diagnosed with autism by analyzing their novelty preference, or the inclination to look at something you are more familiar with, after being presented with scenarios that could evoke joint attention. We utilized a preferential looking paradigm and fNIRS to measure joint-attention. The infants were presented with different videos: one where two adults would look at each other and then an object, another where one adult would look at an object and then the infant, and a set of control videos. Afterwards, the infant was shown two objects: 1) a familiar object that the person in the video had previously looked at and 2) a novel object that the infant had not seen. We tested two groups: one with infants who had siblings with autism and another with infants without siblings with autism. We hypothesize that typically developing infants will gaze longer at the more familiar object and aim to use findings for developing early diagnoses and interventions for autism.

Grant Wass

Biology, Palomar College
GEO REU at Harvard University
Mentored by Dr. Gonzalo Giribet

Thinking of Thrasychirus: Evolutionary and Phylogenetic Analysis of South American Long-Legged Harvesters (Arachnida, Opiliones, Neopilionidae)

The vast majority of life on this planet remains undiscovered or undescribed; for instance, around 80% of insect and arachnid species are still undescribed. Harvesters, colloquially known as “daddy long-legs”, are especially in need of taxonomic revision as their diversity is highly underestimated due to their limited geographic dispersal. The Gondwanan long-legged harvester family Neopilionidae consists of over sixty species spread over South America, Africa, Australia, and New Zealand, many of which were described over fifty years ago without molecular techniques. As of now, we lack a published in-depth phylogenetic analysis of South American long-legged harvesters within the genera Thrasychirus, described in 1884, and Thrasychiroides, described in 1947. In addition to this, the three currently known species of Thrasychirus have only been recorded from the southern tip of Chile, whereas specimens of Thrasychirus have been collected and recorded from all across Chile and the residing Andes mountain range (with Thrasychiroides in Brazil). In this project, we use Sanger sequencing of COI and 18S for phylogenetic analyses for both genera, adding to previously sequenced data. Using integrative taxonomy combining genetics and comparative morphology, we then determine whether genetic lineages within these broader clades can be considered as separate species. Our findings indicate that there are at least four broadly distinct clades, most with high levels of genetic variance indicative of species while suggesting the

taxonomic assimilation of Thrasychiroides and Thrasychirus. Through furthering our knowledge of the systematics and phylogeny of Thrasychirus and other Gondwanan members of Neopilionidae, we contribute to our understanding of harvester diversity and reaffirm that there remains a great deal of diversity left to describe.

Kaitlyn White

Physics w/Specialization in Computational Physics, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Professor Javier Duarte

Discover Momentum Conservation via Knowledge Distillation

According to Noether's Theorem, "...given a physical system, for every infinitesimal symmetry, there is a corresponding law of symmetry." The central idea of this project surrounds a specific observable which is governed by this theorem, the conservation of momentum. While we know that momentum can be determined to have been conserved in a system after being experimentally observed, we ask ourselves in this project instead: Can we utilize machine learning to recognize the conserved momentum of a classical particle? In order to find the solution to this question, this project will implement machine learning processes by taking into account multiple samples. Each sample will respectively have a dataset consisting of its positions, timestamps, and the particle's momentum. For the simplest case, we will only simulate one constant velocity particle and project its position to a Cartesian axis. If the simplest case's result proves to be accurate, we will generalize the dataset to more dimensions, more particles, and even possibly with a constant magnetic field. The conclusion of this project will be a product which relies on machine learning to accurately determine the conservation of momentum in a given scenario.

Joel Wilkinson

Psychology, Howard University
STARS
Mentored by Dr. Deanna Greene

Comparison of Subcortical Volumes Between Patients with Tourette Syndrome and a Control Group

Tourette Syndrome (TS) is a neurodevelopmental disorder of the nervous system characterized by involuntary sounds and movements called tics. The cause of Tourette Syndrome is still unknown, but it is assumed to be associated with abnormalities in the subcortical brain regions, specifically the basal ganglia and thalamus, which are involved in movement inhibition. This study aims to investigate differences in subcortical volumes in people with TS using modern analytic methods and a large study sample. Structural magnetic resonance imaging (sMRI) data from 101 participants with TS and 101 participants without tics (age 7-35 years old) will undergo automated volume segmentation in order to estimate volumes of several subcortical structures (thalamus, caudate nucleus, putamen, globus pallidus) in each participant. Volumes of each structure will be compared between the TS and control group. We will also test if there are any differences depending on the age group of the participants (e.g., children vs. adults). Our study findings may help advance our understanding of subcortical structure in people with Tourette Syndrome.

Amber Williams

Chemistry, Fisk University
STARS
Mentored by Dr.Dionicio Siegel

Glioblastoma Multiforme Potential Compounds

Glioblastoma Multiforme (GBM) is an aggressive brain tumor known by the rapid growth facilitated by the over expression of the transcription factor, RE-1 silencing transcription factor (REST). An approach to hinder REST activity involves inhibiting its SCP1 enzyme, which removes phosphorylation sites and promotes REST degradation. Through a screening process of over 300,000 compounds, the NIH Chemical Genomic Center successfully identified a specific SCP1 inhibitor known as compound T-65.Significantly, T-65 showed a dose-dependent reduction of REST when tested in GBM cell lines.The objective of this project is to further synthesize and optimize the efficacy of a series of compounds, known as the T-series, with the aim of effectively targeting and impacting GBM cells. The development of suitable compounds holds immense potential to transform the current treatment for Glioblastoma Multiforme, offering new hope to patients and altering the trajectory of their prognosis.

Kenndal Williams

Biomedical Engineering, The University of Texas at San Antonio
SDNI REU
Mentored by Dr. Ester Kwon

ECM-Targeting Peptides as a Prophylaxis for the Treatment of Traumatic Brain Injury

Traumatic brain injury (TBI) is termed a ‘silent epidemic,’ annually affecting 85 million people worldwide. It is a leading cause of mortality and morbidity in children, teens, and active adults. TBI can lead to acute and potentially long-term neurological impairments, such as loss of motor control and memory. Despite the prevalence and associated complications, there are no effective treatments for TBI due to poor pharmacokinetics. Following primary injury, the blood brain barrier (BBB) is transiently dysregulated, allowing for passive accumulation of nanomaterials in the injured brain. However, these materials are rapidly cleared. The brain extracellular matrix (ECM) provides structural support and modulates intercellular communication in the brain. Following TBI, dynamic changes occur to the ECM, such as the upregulation of tenascin-C, which can therefore be leveraged as a specific target for TBI. CAQK is a short-length peptide that has been shown to target tenascin-C and has therapeutic properties which promote better histological outcomes, motor control, and memory after TBI. But this peptide has low retention and subsequent clearance from the body. For this reason, we will synthesize a nanoformulation to target the ECM, increase the peptide blood half-life, and potentially form a prophylactic treatment. This project aims to utilize polymeric nanomaterials to increase the bioavailability of CAQK peptide towards the development of a prophylactic treatment for TBI. The therapeutic efficacy of this TBI prophylaxis will be evaluated through phenotypic, motor function, and memory recovery.

Linisa Williams

Clinical Psychology, UC San Diego
STARTNeuro
Mentored by Dr. Daniel Stout, Dr. Victoria Risbrough

Effects of Working Memory Training on Fear Extinction

Due to proprietary information this abstract has been redacted.

Joman Wong

Physics, Specialization in Astrophysics, UC San Diego
UCSD Cool Star Lab, Dept. of Astronomy & Astrophysics
Mentored by Professor Adam Burgasser

Expanding the SpeX Prism Library Analysis Toolkit (SPLAT) for Asteroid Classification

The SpeX instrument on the Infrared Telescope Facility (IRTF) has obtained thousands of spectra of asteroids and other objects over the past 20 years, many of which have been integrated into publicly-accessible libraries. However, roughly 90% of observations remain unanalyzed and unreduced in archival libraries. As part of a NASA-funded program to make these archival data available for scientific exploration, I present new tools developed to analyze the near-infrared asteroid spectra implemented in the SpeX Prism Library Analysis Toolkit (SPLAT). I present a reproduction of the standard Bus-Demeo classification which employs principal component analysis. I also introduce a new classification method using asteroid templates for direct comparison and compare the equivalence of these methods. Both methods are then applied to a large set of published and newly-reduced asteroid spectra to report an updated list of classified asteroids and their taxonomic distribution.

Simone Wright

Computer Science, UC San Diego
CSE ERSP
Mentored by Christine Alvarado

How Do I Get There From Here? A New Tool for Evaluating How Well Community College Articulations Match Computer Science Bachelor's Degree Requirements in California

Due to proprietary information this abstract has been redacted.

Ellen Wrightsman

molecular and cell biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Gene Yeo

Development of Bioinformatic tool for spatial transcriptomics

The human thalamus acts as the central relay station in the brain network. This structure is responsible for receiving and sending sensory information to the appropriate brain regions, maintaining proper communications among different types of cells. The thalamus's impairment is strongly linked to developing severe neurological disorders such as Alzheimer's. This project aims to investigate the specific genes and cell types that may contribute to its onset and progression. Although the specific cause of Alzheimer's remains unknown, scientific studies have established a clear association between Alzheimer's and genetic factors. By focusing on the thalamus, we seek to find potential contributing genes to the neurodegenerative disorder.This project will utilize comprehensive thalamus data obtained from single-cell RNA sequencing. Through this technique, we aim to identify critical marker genes that could potentially influence the development of Alzheimer's disease. Furthermore, we will employ spatial transcriptomics to explore the gene expression patterns in the thalamus tissue sample. This approach will enable us to quantify the abundance of genes associated with Alzheimer's and map their spatial distribution within the thalamus tissue. By combining these methodologies, we hope to enhance our understanding of Alzheimer's disease, particularly in relation to the thalamus. This comprehensive analysis of gene expression and spatial localization will provide valuable insights into the pathological processes of bringing structures and help develop therapeutic strategies to improve or potentially cure Alzheimer's patients.

Jerry Wu

Bioengineering: Biotechnology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Pallav Kosuri

Enhancing Cell Segmentation for Spatial Transcriptomics in the Heart

Hypertrophic cardiomyopathy (HCM) can cause heart-related sudden death in people of all ages, yet the precise mechanisms driving its progression remain poorly understood. The disease involves complex interactions between various cell types within the cardiac

tissue, such as cardiomyocytes, fibroblasts, endothelial, and immune cells. We seek to unravel this complex interplay in HCM progression with single-cell resolution by leveraging multiplex error-robust fluorescence in situ hybridization (MERFISH) to detect spatial gene expression patterns in sections of cardiac tissue. In the cell-cell interaction analysis, it is critical to segment cell membranes accurately in an automated fashion; however, we found that current algorithms for cell segmentation proved inadequate in handling the unique characteristics of our data, including variations in cardiac cell size, density, and morphology. My current research aims to improve the cell segmentation in cardiac tissue using custom-trained machine learning algorithms. I will also develop metrics to evaluate model performance and to compare against alternative segmentation algorithms. Robust cell segmentation will remove a critical bottleneck in the cardiac MERFISH pipeline, providing the foundation for understanding the interactions between neighboring cells that contribute to HCM pathology.

Athena Wu

Electrical Engineering, UC San Diego
ECE SRIP
Mentored by Dr. Karcher Morris

Assessing Surgical Ergonomics with Inertial Sensors

Surgeons dedicate an extensive amount of time to physically conducting surgeries throughout their career. Surgeons are often required to maintain a fixed position for prolonged, sensitive portions of a surgery. The repeated practice of poor ergonomics may lead to the development of short-term and long-term physical injuries. The goal of this research is to evaluate and improve surgeon ergonomics. In this study, neck flexion, rotation, and protraction data is measured and calculated through use of commercially available earphones with embedded inertial sensors such as accelerometers and gyroscopes. In the presentation, we will share details on how to calculate neck position. We will also share the design and development work associated with a custom printed circuit board with inertial capability for use in a surgical setting. In the near future, we intend to translate these devices to be used on medical clinicians during surgeries. This data can be used to provide meaningful feedback to the surgeon and hopefully improve their surgical performance going forward.

Calvin Xiao

Neurobiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Stefan Leutgeb

Control of circuit computations for cue-guided movement initiation by dopamine

This study challenges the standard model of basal ganglia function, which proposes that the direct and indirect pathways play opposing roles during movement. Recent recording studies have demonstrated that direct and indirect pathway medium spiny neurons behave similarly during simple motor behaviors, suggesting the coordinated activation of both pathways is critical during action selection. To clarify this, my project aims to investigate the contribution of the dorsal striatum and its downstream targets, the external globus pallidus and the substantia nigra pars reticulata, in motor control. We will use a toxin- and genetic-based mouse model of Parkinson's disease (PD) at different severities of dopamine depletion to study the onset and progression of basal ganglia dysfunction: the 6-hydroxydopamine and MitoPark mouse model. Our experiments will involve acute, head-fixed recordings in awake mice navigating a virtual linear track to obtain sugar rewards. Since previous studies have shown memory deficits precede motor impairment in a PD mouse model, we hypothesize the neuronal firing activity of striatal circuits involved in cognitive control to be disrupted at an earlier timepoint than the neuronal firing activity of striatal circuits engaged in sensorimotor integration. We will also reveal how dopamine supports the firing patterns of striatal neurons during movement initiation and cessation, expecting adaptive mechanisms to stabilize population firing properties when dopamine depletion is more gradual in MitoPark mice compared to mice with sudden dopamine depletion after 6-OHDA administration. Our study will provide insight into how large-scale activity and oscillation patterns contribute to motor and cognitive function.

Cindy Xu

General Biology, UC San Diego
Ahmadian Summer Fellowship
Mentored by Dr. Seunghwan Son

Insulin and Its Inflammatory Properties in Adipocytes

Generally, insulin is thought to have numerous anti inflammatory properties. However, we found that insulin may have some proinflammatory properties in adipocytes. We found that treating insulin alone does not increase inflammatory genes in 3T3L1 adipocytes. However, when the cells are pretreated with insulin followed by a treatment of TNFa, inflammatory genes such as TNFa and NLRP3 spike greatly compared to just TNFa and insulin alone. To investigate the molecular mechanism, we treated 3T3L1 adipocytes with various inhibitors and isolated their RNA to perform qPCR. We found that insulin's effect converges into the TNFa-induced NFkB pathway. We are currently investigating FOXO1 as the candidate unknown intermediate that serves as the link between insulin and the NFkB pathway.

Junyi Xu

Electrical Engineering, UC San Diego
ECE SRIP
Mentored by Professor Dinesh Bharadia

Navigating 5G Millimeter Wave through Multi-User Mobility Tracking and Path Prediction with Radar and Camera Fusion

5G millimeter-wave (mmWave) system offers massive capacity, high throughput, and low latency, but the limited penetration ability of mmWave can compromise throughput and spectral capacity. Therefore, 5G New Radio employs MIMO support and beam management techniques to enable packet transmissions in optimal directions. However, current beam management relies on time-consuming radio scanning and handshaking across all directions. Although radar-assisted beam management narrows the scanning range by estimating users' location, radar sensing data is often noisy and unstable. To address this issue, we investigate multi-modal signal processing techniques that combine the use of radar sensing data with the analysis of real-time video for multi-user tracking and future movement prediction. Our proposed algorithm uses 2D MUSIC, K-Means Clustering, and Kalman Filter to maintain accurate and stable tracking with radar sensing data, even in complex scenarios like crossing. For multi-user path prediction, we design an LSTM architecture and compare it with the widely used Kalman Filter-based prediction. We test various computer vision techniques, including object detection and image segmentation, in extracting complementary information alongside radar sensing data and analyze the impact of this information on improving tracking and path prediction. We evaluate our algorithms based on the deviation of their estimations from the ground truth in Angle of Arrival (AoA) and the distance from the radio station using a self-collected, self-labeled dataset. For this purpose, we develop a synchronized data collection platform and a GUI for ground truth labeling to record and label radar sensing and camera data from outdoor multi-user mobility experiments.

Justin Xu

Human Biology, UC San Diego
BISP 197
Mentored by Dr. Jorge Espinoza-derout

Electronic cigarette with nicotine induces a transcriptomic shift in adipose tissue

The effects of chronic exposure to e-cigarette aerosol are not well known. Our laboratory showed e-cigarettes induce metabolic changes and cardiac dysfunction associated with elevated serum free fatty acids(FFAs). We hypothesized nicotine induced a transcriptomic pro-inflammatory response and metabolic gene dysregulation. We performed RNA-seq analysis using adipose tissue from ApoE knockout mice exposed to saline, e-cigarette without nicotine[e-cig(0%)] and e-cigarette with 2.4% nicotine[e-cig(2.4%)] aerosol for 12 weeks. After mRNA extraction, differentially expressed genes were identified using fold change>1.5 and p-value<0.05 . Ingenuity Pathway Analysis(IPA) and Gene Set Enrichment Analysis(GSEA) were performed to identify upstream regulators. Primary component analysis(PCA) showed the e-cig(2.4%) group clustered separately from the e-cig(0%) and saline groups. In e-cig(2.4%) vs saline, e-cig(2.4%) vs e-cig(0%) and e-cig(0%) vs saline, 572, 561 and 93 genes were differentially expressed, respectively. Clock genes were differentially expressed in e-cig(2.4%) vs e-cig(0%) and saline. Transcription factors and cytokines predicted by IPA to be activated in e-cig(2.4%) compared to e-cig(0%) and saline include CREB1 and IFNG, and transcription factors and cytokines such as Smad4 and Il13 were predicted to be inhibited. IPA returned nothing statistically significant for e-cig(0%) vs saline. GSEA analysis showed negative enrichment of angiogenesis and MTORC1 signaling and positive enrichment of FOXP3 targets in e-cig(2.4%) compared to e-cig(0%) and saline, and negative enrichment of Inflammation pathway and positive enrichment of oxidative stress in e-cig(0%) vs saline.. Hence, e-cig(2.4%) induces metabolic and inflammatory transcriptomic changes in adipose tissue of ApoE knockout mice.

Rishi Yalamarty

General Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Weg Ongkeko

Analyzing Dysregulation of the Archaeome in Head and Neck Squamous Cell Carcinoma

Head and Neck Squamous Cell Carcinoma (HNSCC) is the 8th most common cancer in the world and had 744,944 new cases in 2020. HNSCC has many subsets as it can develop in many anatomical locations including the oral cavity, pharynx or larynx. Even with improvements in treatments, the overall survival rate for patients with HNSCC is still around 40-50%. In recent years, more and more studies have analyzed the microbiome in relation to gastrointestinal, cardiovascular, neurological and respiratory conditions. There are between 10-100 trillion microbial cells within the human body and recent studies have found the intratumor microbiome environment of cancer may play a role in cancer progression and development. Furthermore, these microbiota can influence the way cancer responds to various treatments such as immunotherapy and cancer therapy. Data has shown many fungal and bacterial species in the HNSCC intratumor microbiome environment to be dysregulated such as Candidatus Mycoplasma haemolamae, Escherichia coli str. K-12 substr. MG1655, and Teratosphaeria gauchensis. However, limited studies have been performed on the archaeal landscape within the intratumor microbiome environments, specifically in HNSCC. Researching the influence of archaea in HNSCC may provide important and pertinent information and insight into treating HNSCC.

Kobe Yang

Electrical Engineering, UC San Diego
ECE SRIP
Mentored by Dr. Michael Yip

Robotic Catheter Reconstruction from Mono-Endoscopic Image

Robotic catheters have emerged as potential solutions for aiding minimally invasive surgical procedures. One of the challenges in accomplishing catheter manipulation in the real world is the accurate reconstruction of the catheter's configuration from mono-endoscopic images. This task is particularly difficult due to issues related to depth perception and limited information from mono-endoscopic images. To address this challenge, we develop a reconstruction technique that leverages the near-continuous curvature of catheters by utilizing Bézier curves as the basis for the catheter state. By reconstructing the catheter in a three-dimensional space using Bézier curves, we hope to iteratively calculate the loss between the reconstruction and the mono-endoscopic image of the catheter. This approach allows us to refine the reconstruction and improve the accuracy of catheter manipulation. It also has the potential to enhance the capabilities of robotic catheter control by providing a more accurate representation of the catheter's shape and configuration. This can lead to improved procedural outcomes, reduced complications, and increased safety for patients.

Evelyn Yee

Data Science, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Leon Bergen

The Role of Reasoning and Truthfulness in Large Language Models

Large language models present human-like ability to write stories, edit essays, and answer questions, but these systems still struggle with basic reasoning tasks, such as solving math problems, evaluating logical statements, and performing basic arithmetic. One way to improve large language models' performance on these tasks is a prompting technique called Chain of Thought (CoT) reasoning. With CoT, a model provides step-by-step reasoning, working through each piece of a problem before giving the final answer. This technique has been empirically shown to boost performance on complex reasoning tasks, but the working mechanism behind its success is largely unexplored. In this project, we investigate the relationship between large language models' outward CoT reasoning text and their internal reasoning processes. Using OpenAI's GPT-3.5 (ChatGPT) and GPT-4 models, we analyze the downstream effects of mistakes in the models' reasoning text for elementary-level math word problems. Through these experiments, we hope to develop a more thorough understanding of how these systems process text and perform reasoning. This could aid the development of performance-boosting tools, like Chain of Thought, and it would also benefit the growing research field of AI interpretability, addressing the ways in which these systems may manifest unexpected and dangerous behaviors.

Nadeen Youhanan

Cognitive and Behavioral Neuroscience, UC San Diego
McNair Scholars Program
Mentored by Dr.Jody Corey-Bloom

Using a Simple Balance Device, the BTrackS™, to Predicting Disease Progression and Fall Risk in Huntington's Disease

Huntington's Disease (HD) is a neurodegenerative disease that affects the basal ganglia causing a progressive decline in motor, cognitive, and behavioral functioning. Motor deterioration is exhibited by chorea, bradykinesia, dystonia, and increased balance difficulties. Currently, an individual's balance is one of the strongest predictors of the need for nursing home placement [1]. Despite this, research examining balance and mobility in HD is limited primarily due to expensive and difficult-to-use clinical equipment [2]. Our objectives in this study are to determine whether the BTrackS, a simple and practical body sway assessment device that utilizes a balance plate and laptop software, can 1) distinguish between normal controls (NC) and pre-manifest (PM) HD and 2) effectively predict disease onset of motor-manifest HD. We will assess NC, PM, and HD subjects on the BTrackS using eight static balance trials that include combinations of eyes open or closed while standing on a stable surface. A one-way ANCOVA adjusting for age will be used to compare total body sway (TBS) in each condition among the cohorts. In addition, HD subjects will be stratified with regard to fall risk on the basis of performance on the Timed Up and Go (TUG) and a fall questionnaire. Correlations between TBS and clinical measures will be assessed using Pearson's r. We expect that increased TBS and fall risk will serve as important functional markers in patients with, and during the transition to, HD.

Olivia Young

Neurobiology, UC San Diego
STARTNeuro
Mentored by Dr. Jyoti Mishra Ramanathan

Nurturing Interoceptive Attention and Emotional Cognitive Control: The Impact of Breath-Focused Cooperative Compassion Training in Parent-Child Dyads

Childhood mental illness affects approximately 1 in 10 families and is often a predictor of low quality of life that can persist into adulthood. Further, families that have a child with mental illness can suffer from chronic stress, and extant pharmacological treatments can be inaccessible or ineffective for long-term resolution of symptoms. Therefore, the current study aimed to create and test a non-pharmacological, technological, accessible intervention for children, specifically those with above average depression scores, by delivering an app-based meditation and cooperative compassion training approach that simultaneously engages both the child and their parent. Behavioral and cognitive measures were assessed in 23 parent-child pairs at baseline and post-intervention. The parent-child dyads also underwent electroencephalography (EEG) recording while completing cognitive assessments using BrainEⓒ, a neuro-cognitive platform. Results demonstrated enhanced interoceptive attention (i.e., the ability to pay attention to internal sensations such as the breath) and emotional cognitive control (i.e., the ability to perform a cognitive task in the presence of emotional distractions) in both parent and child ($p < 0.05$). A significant reduction in depression and anxiety symptoms was also observed specifically in parents ($p < 0.05$). As next steps, our ongoing EEG analyses will focus on the neural underpinnings of the cognitive findings and investigate co-neural synchrony between child and parent brains.

James Young

Computer Science with a Specialization in Bioinformatics, UC San Diego
MRSEC REU or RIMSE
Mentored by Dr. Andrea Tao

Two-dimensional binary superlattices from self-assembling gold nanoparticles

The 'bottom-up' assembly of two-dimensional binary superlattices provides a means to design metamaterials with programmable properties typically more difficult to achieve via traditional synthetic processes. This spontaneous organization facilitates the fabrication of diverse functional structures for catalysts, electronics, luminescence, and plasmonics, among other applications. Furthermore, this exploration of diverse structures and compositions of nanoscale components continues to make critical contributions to the library of metamaterials, thereby enabling the field of predictive assembly. Extensive prior research has been conducted on metastructure fabrication and applications from the assembly of uniform nanoparticles, whereas the use of binary nanoparticles for self-assembly remains scarce. We herein report the interfacial assembly of binary-sized gold nanoparticles at the air-water interface through the tweaking of material nature, surface properties, shapes, and sizes and by using different assembly protocols to achieve a variety of two-dimensional binary assemblies with different properties. We believe our work represents not only a major advance in two-dimensional assembly, but also has applications in plasmonics with particular relevance to fluorescence, spectroscopy, electrocatalysis, solar energy harvesting, biodetection, and more.

Thomas Young

Computer & Mechanical Engineering, Boston University
MRSEC REU or RIMSE
Mentored by Professor Zheng Chen

Engineering Metal-Organic Framework-based Composites for Novel Ionic Conductors

The development of solid-state batteries has demonstrated advantages to their liquid counterparts, such as improving stability and avoiding the use of flammable organic solvents. While many inorganic and organic solid electrolytes have been developed, achieving adequate ionic conductivity still remains a challenge. Metal-organic frameworks (MOFs) have been shown as ideal candidates for solid-state electrolytes due to the confinement effect of ions facilitated by their ordered channels, which can act to improve ion diffusion and conductivity. The highly tunable functionalization of MOFs can be effectively used to develop novel solid-state electrolytes. Furthermore, poly(ethylene oxide) is commonly used in LiTFSI-polymer composite systems due to its large quantity of oxygen atoms which facilitate the hopping of oxophilic lithium ions. In this context, our project aims to develop solid-state electrolyte composites through the functionalization of MOF channels with grafted ethylene oxide chains. This method provides dual enhancement of lithium-ion migration through the confinement of ions in MOF channels and improved mobility through the increased lithium-hopping sites. The synthetic versatility of the UiO-66 MOF provides synthetically versatility to equip ethylene oxide chains. In this work, the engineering processes for the composite material are optimized by manipulating the pressure during fabrication. Consequently, these solid-state electrolytes are anticipated to not only exhibit high ionic conductivity, but also lead to improved safety and stability of solid-state battery components.

Yao Yu

Philosophy & Ecology, Behavior and Evolution, UC San Diego
UC Scholars
Mentored by Professor Rick Grush

One mind, many bodies: How a group of interacting microbes shares a mind

Groups of biological individuals can behave in ways inexplicable by the behaviors of individuals. This inexplicability makes it tempting to describe a group of this kind as having a mind of its own (i.e., hive minds of beehives). This temptation can be justified in two ways. One way is to speak of group minds metaphorically. Another is to treat group minds as something that resembles our minds in at least some key aspects. I would like to argue for the latter proposal. I do so by delineating some features of mind and what is required to support these features. My account implies that a group doesn't need minded group members to perform group-level cognitive activities. It follows that groups of interacting microbes can be potential vehicles of group minds. I then apply the group mind account to cases where groups of microbes collectively sense, explore, colonize, and survive environmental conditions. I argue that 1) the boundary of (group) minds can extend to the environment; 2) group minds can remain the same without group members remaining the same; 3) the members of groups don't have to be of the same species. I focus on 3) since most literature is about group minds held by groups of conspecific individuals. Lastly, I contrast the group minds of interacting microbes with our minds. I argue that the differences between the two are no threats to the group mind account. This interdisciplinary project can shed light on both microbial ecology and philosophy of mind.

Kori Yun

Microbiology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Sara Jackrel

Effect of Temperature and Limited Diet Diversity on Growth of Rotifers

Increasing temperatures of the planet due to climate change are causing freshwater ecosystems to experience a decrease in phytoplankton diversity, resulting in a decline in the diversity of nutrients available to zooplankton. Zooplankton's role in freshwater ecosystems as a bridge between primary producers and higher trophic levels means that their decline could also threaten the stability of an ecosystem. This emphasizes the importance of research targeted towards rotifers and their ability to reproduce via parthenogenesis under stressors like warmer temperatures and lack of diversity of nutrients. Based on the study performed by Han et al. (2020), if the temperature of the rotifers' environment is increased, then the lifespan of the rotifers will be reduced significantly. To test for the additional variable of limited diversity of nutrients, the rotifer species, B. calyciflorus was initially cultured and inoculated with C. vulgaris before being separated into 11 different groups each inoculated with one of eleven different phytoplankton species. Despite the phytoplankton species covering a broad phylogenetic distance, the rotifers showed the ability to proliferate in most phytoplankton species but will be separated into different groups that have different temperature stressors. Within these groups, there will also be additional treatment groups consisting of low, medium, and high diversity diets of different phytoplankton species. The population of the rotifer groups will be tracked through a growth curve to determine the effects of warmer temperatures and a limited diversity diet. Due to a diversity of nutrients, the effects of the temperature stressor will likely be reduced.

Ulia Zaman

Computer Science, UC Irvine
UC LEADS
Mentored by Dr. Michael Coblenz

Investigating Computational Scientists' Struggles with Scientific Programming

Software engineering tools and processes are designed for the needs of traditional software engineers but are utilized by a diverse set of users from various fields, including computational scientists. Computational science is the application of advanced computing techniques and mathematics to solve scientific problems. In this study, we wanted to gain insight into the experience of scientific programming. An important aspect of the work that computational scientists do is exploratory in which they write software to test theories, simulate the behavior of complex, real-world phenomena, and analyze the results of scientific models. While experts in their respective domains, scientists generally have limited formal training in software engineering which creates impediments to scientific progress such as struggling to analyze large amounts of data, creating graphs, and validating results. This study uses a qualitative analysis with grounded theory techniques to explore the struggles of scientific programming. We conducted 24 semi-structured interviews with scientists from various disciplines. We identified key issues that scientists are dealing with (i.e., testing, collaboration, confidence/self-efficacy) and considered the potential causes (i.e., lack of appropriate tools/process guidance, insufficient understanding of abstractions, lack of resources/opportunities for expanding technical skills). With this information, we developed a theory of scientific programming efficacy which can provide guidance to help scientists alleviate some of the technical challenges that they face.

Chris Zhang

Marine Biology, UC San Diego
Multidisciplinary Approach to Addressing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler

Possible Relationship between Microplastics in Seafood and Cancer in Asian American Communities

Microplastics in marine environments contaminate fish and shellfish within food chains. Ingestion of microplastics correlates with adverse human health effects. These effects may be of significant concern for Asian communities due to their seafood-rich diet. This review explores whether microplastic contamination correlates with an increase in cancer in Asian communities. Multiple databases were used for this literature review, including: Aquatic Sciences & Fisheries Abstracts, PubMed, Google Scholar, and Academic Search Complete. Keywords used included: microplastics, cancer, Asian, American, and seafood. Thirty full-text articles were found on either the relationship between microplastics in seafood and cancer or cancer among Asian Americans. Eleven of those articles were relevant for inclusion for this review. Those articles were accessible in full-text, written in English, and published from 2000 to 2023. This literature review suggests that microplastic intake directly correlates with breast cancer incidence rates. In the body, these microplastics mimic estrogen activation, a factor potentially linked to breast cancer. Relative to other ethnicities, a higher proportion of Asian Americans consume seafood at least twice a week. Among Asian Americans, cancer is the leading cause of death, with breast cancer having the highest incidence rate. Despite this, there is a lack of research relating Asian American health to microplastics. The urgency to address the lack of research regarding microplastics in seafood grows as the carcinogenic risk among Asian Americans may be increasing. Researchers exploring this topic need to take into account the wide variety of Asian cultures and the diversity of seafood consumption within their diets.

Carolyn Zhang

Computer Engineering and Applied Mathematics, UC San Diego
ECE SRIP
Mentored by Prof. Yatish Turakhia

Large-scale Genomic Surveillance of SARS-CoV-2 via Wastewater-based Epidemiology

Wastewater-based epidemiology involves monitoring the genetic mutations occurring in a pathogen by analyzing genetic samples obtained from wastewater. This method is cost-effective, avoids clinical testing bias, and is capable of detecting emerging variants of a virus in both symptomatic and asymptomatic individuals. Our project aims to build a

pipeline for wastewater-based epidemiology for the SARS-CoV-2 virus, by aligning and placing reads collected from wastewater samples onto a phylogenetic tree, refining the placement to recover lineages, and identifying the nodes to which each sample belongs. Our method demonstrates greater accuracy in lineage detection compared to previous surveillance methods. It can identify lineages that may not be detectable using the Freyja method and reduces the number of irrelevant lineages detected. Although our current pipeline has been tested on simulated reads, future work involves applying the pipeline to reads obtained and sequenced from real wastewater samples.

Merlin Zhang

Computer Engineering, UC San Diego
ECE SRIP
Mentored by Professor Curt Schurgers

Enhancing Efficiency and Communication across UCSD's Makerspaces through a Centralized Database and Server Infrastructure

Hands-on learning is a crucial component of UCSD's educational environment, which has led to the establishment of student makerspaces equipped with tools and machines like 3D printers and laser cutters across campus. However, the independent nature of each makerspace creates inefficiencies as students often need to undergo redundant training on the same machines in different spaces. To address this issue and enhance the student experience, we have developed a service that promotes efficiency and communication across UCSD's makerspaces. Our solution revolves around a centralized database and server infrastructure that acts as a pass-through, facilitating seamless data relay. The primary objective is synchronizing information among local databases, ensuring consistency, and improving the student experience. The central database serves as a hub, receiving records from local servers and propagating the data to enable smooth communication between client backend systems. We have implemented API calls that enable local servers to send records which are then propagated to all other makerspaces. In the event of failed propagations, our service simultaneously stores the records in the central database. To demonstrate the functionality, we have conducted simulations and tests using the EnVision Maker Studio and ECE Makerspace. In conclusion, our service explores a possible path toward a comprehensive solution for efficient space management at UCSD. By employing a centralized database and server infrastructure, our system facilitates effective data relay and synchronization, resulting in improved communication and streamlined operations.

Alyssa Zhang

Human Biology, UC San Diego
URS - Undergraduate Research Scholarships
Mentored by Dr. Hui-chun Irene Su

Socioeconomic Disparities in Access to Fertility Preservation Benefits Among Adolescent and Young Adult Cancer Patients

Socioeconomic variables have historically been contributing factors to disparities in access to healthcare. To improve access, California recently passed the Senate Bill 600 requiring some commercial insurance plans to cover fertility preservation services for patients at risk for infertility due to medical treatment. However, exclusion of certain health plans and inconsistencies in downstream implementation of the mandate leave room for disparities in access to care. How are social determinants of health- ethnicity, income, employment status, and education- associated with eligibility for fertility preservation health insurance coverage under SB600? A total of 80 commercially insured patients recently diagnosed with cancer will be recruited to complete a comprehensive questionnaire regarding their health insurance and experiences with fertility preservation insurance benefits. Additionally, participants will submit their insurance benefit handbook for further analysis to determine the extent of fertility preservation coverage. Data from questionnaires and insurance handbooks will be analyzed using a logistic regression model to determine association between the exposure – socioeconomic determinants of health- and outcome – eligibility for fertility preservation services under SB600. While results are not yet available at the time of this abstract submission, we expect this study to provide insight as to whether the SB600 accentuates disparities in fertility preservation coverage. Through this study we hope to contribute to existing knowledge on the impact of recent state insurance policies across diverse demographic groups. By understanding how these groups are differentially affected, we can improve policymaking for the future.

Chen Zhang

Sociology and Political Science, UC San Diego
199 or other independent study for credit
Mentored by Professor Christena Turner

Social Development and Post-Graduation Decisions of Chinese Students

The top 4 factors influencing Chinese international students' post-graduation decisions are job opportunities, parental influence, cultural and lifestyle preferences, and education opportunities, each working via different mechanisms. While the literature suggests parental influence is the most powerful factor, this research reveals that it is a passive influencer without exerting pressure. Politics and ideology have little effect on decision-making. Despite valuing diversity, interaction with different cultures is limited, but those who engage gain new perspectives and reduce bias.

Will Zhao

Electrical Engineering, UC San Diego
ECE SRIP
Mentored by Saharnaz Baghdadchi

Optical Voice Recorder Using Digital Holography

In this project, we will use interference to reconstruct audio signals using light. This process will first involve understanding how the phase of light can be modified with sound waves. Then, using an interferometer, the phase shifted light will be used to create an interference pattern. Spatial filtering and Fourier transform will be used to extract the phase information from the interference pattern and reproduce the original audio signal. By the end of this project, we expect to be able to record a voice signal from light and play it.

Gavin Zhao

Astrophysics and Applied Math, UC San Diego
UNDERGRADUATE SUMMER RESEARCH AWARD
Mentored by Professor Theissen

Spectral Typing All of Gaia Data Release 3: A Study of Low-Resolution Spectra

The advent of Gaia Data Release 3 (DR3) presents an opportunity for the astrophysics community to study stars with an unprecedented data volume of over 200 million low-resolution ($\lambda/\Delta\lambda \approx 70$) spectra released in 2022. This research aims to characterize these spectra using spectral typing, a methodology that allows us to analyze stellar features such as temperature, surface gravity, and chemical composition. My research will result in a comprehensive set of low-resolution spectral templates for stars using Gaia DR3, anchored to spectral standards from the Sloan Digital Sky Survey (SDSS), and will be combined with some advanced machine learning techniques to maximize spectral typing efficiency. These templates will assist diverse astrophysical studies that necessitate the spectral typing of stars. The application of our machine learning model will furnish a robust and efficient method for spectral typing that others can use with their own projects.

Miranda Zhou

General Chemistry, UC San Diego
MRSEC REU or RIMSE
Mentored by Professor Michael J. Sailor

Stability and Protein Adsorption of Lipid-Coated Porous Silicon Nanoparticles

Porous silicon nanoparticles (PSiNP) themselves are not stable in many biologically relevant solutions such as PBS, which is commonly used in cell culture and animal studies. Bare porous silicon nanoparticles tend to adsorb proteins in vivo which decreases their blood circulation time and their ability to reach the targeted location. This is an important limitation in biological applications of PSiNP such as drug delivery. Coating the porous silicon nanoparticles in lipids could make them more stable in these biologically relevant solutions. Further, increasing the ratio of PEG-lipid could decrease the amount of protein adsorbed onto the nanoparticles. This is investigated by coating the porous silicon nanoparticles with different lipid compositions. This composition contains different ratios of DSPE-PEG:DSPC:CHOL. DSPE-PEG referring to 1,2-Distearoyl-sn-glycero-3-phosphoethanolamine-Poly(ethylene glycol) with two saturated 18 carbon chains, DSPC referring to Distearoylphosphatidylcholine with two saturated 18 carbon chains containing, and CHOL referring to cholesterol. Nanoparticles will be prepared via thin-film hydration. Particle size and zeta potential will then be characterized using dynamic light scattering (DLS). Nanoparticles will be tested in different biological solutions: PBS, DMEM, DMEM supplemented with 10% FBS, and pure FBS. Protein adsorption of each formulation will be quantified with a BCA assay. Formulations will additionally be incubated at biological relevant temperatures (37°C) and the stability and protein adsorption tested.

Sky Zhou

Astrophysics, UC San Diego
Summer TRELS
Mentored by Dr. Chris Theissen

A Machine Learning Approach to the Spectral Classification of Ultracool Dwarfs

We present a model capable of classifying ultracool dwarfs, exploring metallicity and gravity classifications by utilizing data in the near-infrared wavelength range (0.85-2.45 microns). Currently, there are numerous methodologies to classify astrophysical objects based on their spectra, however, each method has its own biases. Here we present a spectral classification framework rooted in machine learning to attempt to homogenize the spectral typing process. We also compared our machine-learning model with traditional methods of spectral classification. The dataset chosen primarily comprises M6 to T9 dwarf standards (3100-500K) including low-metallicity, extremely low-metallicity, and low surface gravity dwarfs, generated from the SpeX Prism Libraries. We utilized a synthetic training dataset of 6500 spectra generated from the 65 standard spectra in SPLAT. We validated our models on an unseen test set with moderately high signal-to-noise ratios to ensure the robustness of our model.

Sunny Zhu

General Biology, UC San Diego
Ahmadian Summer Fellowship
Mentored by Dr. Nicholas Webster

In Vitro Study of Loss of cAMP Signaling in CD11c Immune Cell Leads to Protection Against Diet Induced-Obesity Through Sebum Secretion

Obesity is a major worldwide health problem as it predisposes people to various metabolic associated disorders, such as cardiovascular diseases and type 2 diabetes. As the largest organ of the body, skin contributes immensely to the health of the body and recent research has shown how the immune system can influence the whole body metabolism by interacting with skin sebaceous glands. The previous research showed genetically modified mice (GnasΔCD11c), whose CD11c immune cells have lost their cAMP signaling through the knockout of the Gnas gene, displayed lean phenotypes under high fat diet feeding. It was observed that such protection from diet induced obesity was possible by the overproduction of lipids through the skin as sebum by the sebaceous glands. However, the precise mechanisms and extent of immune cell communication with skin sebaceous glands remain unclear. In this project, we aim to test whether CD11c+ immune cells stimulate sebocyte proliferation and sebum secretion in vitro. To achieve this, CD11c+ bone marrow-derived macrophages and dendritic cells from Flox and GnasΔCD11c mice will be incubated for 48 hours with SEB-1 sebocytes using transwell culture inserts and pulsed with BrdU for 8 hours. The lipids in the supernatants will be quantified by thin layer chromatography and sebum generation related genes will be measured and compared by qPCR. Similar experiments will also be performed with cell-cell direct contact. It is our hope that this finding can contribute to the identification of new therapeutic approaches for treating obesity and associated metabolic disorders.

Emma Zhu

Computer Engineering, UC San Diego
ECE SRIP
Mentored by Professor Curt Schurgers

Enhancing Efficiency and Communication across UCSD's Makerspaces through a Centralized Database and Server Infrastructure

Hands-on learning is a crucial component of UCSD's educational environment, which has led to the establishment of student makerspaces equipped with tools and machines like 3D printers and laser cutters across campus. However, the independent nature of each makerspace creates inefficiencies as students often need to undergo redundant training on the same machines in different spaces. To address this issue and enhance the student experience, we have developed a service that promotes efficiency and communication across UCSD's makerspaces. Our solution revolves around a centralized database and server infrastructure that acts as a pass-through, facilitating seamless data relay. The primary objective is synchronizing information among local databases, ensuring consistency, and improving the student experience. The central database serves as a hub, receiving records from local servers and propagating the data to enable smooth communication between client backend systems. We have implemented API calls that enable local servers to send records which are then propagated to all other makerspaces. In the event of failed propagations, our service simultaneously stores the records in the central database. To demonstrate the functionality, we have conducted simulations and tests using the EnVision Maker Studio and ECE Makerspace.In conclusion, our service explores a possible path toward a comprehensive solution for efficient space management at UCSD. By employing a centralized database and server infrastructure, our system facilitates effective data relay and synchronization, resulting in improved communication and streamlined operations.

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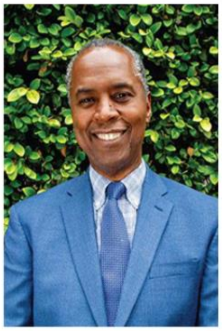

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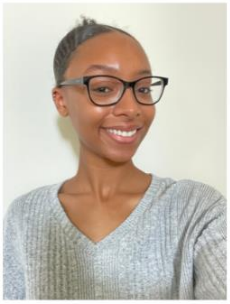

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