UC San Diego

UNDERGRADUATE RESEARCH HUB

Virtual Conference
August 11 & 12, 2022

Division of Student Affairs
Student Retention and Success
Undergraduate Research Hub

Conference Program

2022 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 sixty undergraduate presentations whose home institutions range from across the country and international institutions.

The 2022 SRC features the scholarly work of undergraduates participating in faculty-mentored summer research programs and who attend schools ranging from local community colleges to large state universities and private institutions. In addition to UC San Diego, institutions represented include:

- University of San Diego
- San Diego State University
- CSU Long Beach
- CSU Northridge
- CSU San Bernardino
- Cal Poly Pomona
- UC Berkeley
- UC Davis
- UC Irvine
- UC Los Angeles
- UC Merced
- UC Riverside
- UC Santa Barbara
- Santa Ana College
- Southwestern College
- San Diego City College
- San Diego Mesa College
- San Diego Miramar College
- Arizona State University
- Baruch College
- Boston University
- Case Western Reserve University
- Centro de Investigación y Desarrollo Tecnológico en Electroquímica
- Fluminense Federal University
- Georgia Institute of Technology
- Howard University
- Northeastern University
- Pennsylvania State University
- Phoenix College
- Smith College
- Southern University at New Orleans
- Spelman College
- Texas A&M University
- Università degli Studi di Milano
- University of Florida
- University of Guam
- University of Massachusetts Amherst
- University of Nebraska – Lincoln
- University of Oslo
- University of Puerto Rico at Mayagüez
- University of Rochester
- University of the District of Columbia
- University of the Pacific
- University of Verona
- Winston-Salem State University
- Xavier University of Louisiana
- Yale University

We hope you will enjoy the conference and the students' presentations. 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, 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.

Thank you to all URH staff. Additional thanks to Veronica Bejar, Dr. Thomas K. Brown, Dr. Kirsten Kung, Dr. Sophia Tsai Neri, Dr. Marie Sheneman, and Beverly Fruto who helped to organize the panels.

#2022SRCUCSD

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Conference Schedule

Thursday, August 11th

8:30 AM – 9:00 AM	Opening Remarks
9:10 AM – 10:25 AM	Morning Session I
10:35 AM – 11:50 AM	Morning Session II
11:50 AM – 12:50 PM	Lunch
1:00 PM – 2:15 PM	Afternoon Session I
2:25 PM – 3:40 PM	Afternoon Session II
3:45 PM – 4:15 PM	Throwback Thursday Groove Session (Optional)

Friday, August 12th

8:30 AM – 9:00 AM	Opening Remarks
9:10 AM – 10:25 AM	Morning Session I
10:35 AM – 11:50 AM	Morning Session II
11:50 AM – 12:50 PM	Lunch
1:00 PM – 1:15 PM	Closing Remarks
1:15 PM – 1:45 PM	Fiesta Friday Groove Session (Optional)

Zoom Room Registration Links – Thursday

Thursday Zoom Rooms		Registration Link
Opening Remarks		https://ucsd.zoom.us/webinar/register/WN_9_81GoeBTd2QJzzZRWDGHA
Student Panel Rooms	University City	https://ucsd.zoom.us/meeting/register/tJcocO2vqjIsH9TG3CaBhHRqmglRoZXERexL
	Pacific Beach	https://ucsd.zoom.us/meeting/register/tJckc-iqrTwiGdSpRxioNPIhnGZcY_P9gSk4
	Mission Hills	https://ucsd.zoom.us/meeting/register/tJYqceCqpjkiG9Tj2_MVukQIYLCqUs9tAm6d
	Kensington	https://ucsd.zoom.us/meeting/register/tJcudeirpzouHNL0i0f2Fu4UbDwItR6Qt1eo
	North Park	https://ucsd.zoom.us/meeting/register/tJwvfumuqzIsEtDNvrPIDqQooLbZWU3PHIvd
	Hillcrest	https://ucsd.zoom.us/meeting/register/tJYod-CpqDkjHNJriFrJd8gkvoTJw3oLPF6l
	Little Italy	https://ucsd.zoom.us/meeting/register/tJcudu-pqzgsHdxAu9U3bkaJTOxnnfM-JYki
	Ocean Beach	https://ucsd.zoom.us/meeting/register/tJModuqpqzMtGtaSfvbGmhqPsumuEXQdOLPr
	City Heights	https://ucsd.zoom.us/meeting/register/tJMucuyhpz4uGNbqthOZVwIa7UYEUbiZkbnB
	Point Loma	https://ucsd.zoom.us/meeting/register/tJIud-GhrTIoGt0xoEIYTq4Zk3fImDb60mWm
	Barrio Logan	https://ucsd.zoom.us/meeting/register/tJwsfumgpj0vGtE5MwAXXMmXq5NjBikR-_dI
	Imperial Beach	https://ucsd.zoom.us/meeting/register/tJwrceqhrjoiH91UBYt6V-0GxjdzqqS708l7
Throwback Thursday Groove Session		https://ucsd.zoom.us/meeting/register/tJcvd-utqzwvHtQ8bOcUzqmbf1ldfnZEPKRX

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

Zoom Room Registration Links – Friday

Friday Zoom Rooms		Registration Link
Opening Remarks		https://ucsd.zoom.us/meeting/register/tJwof-GrrT4qHt1gy86L8POj1RUC_ytQe4y1
Student Panel Rooms	University City	https://ucsd.zoom.us/meeting/register/tJwtduiprTIoH9A8I3xQtDmkJqwC_WSiii-0
	Pacific Beach	https://ucsd.zoom.us/meeting/register/tJwvd-6oqTgvHNS2xx19IeeB4VWzXJlDpjtk
	Mission Hills	https://ucsd.zoom.us/meeting/register/tJAkcuCqpzwiG9B3Elhi2RLdV_-HLmAYjfR_
	Kensington	https://ucsd.zoom.us/meeting/register/tJwodOCpqTkvGtRwDD3eKx5GEed7YszPFgXe
	North Park	https://ucsd.zoom.us/meeting/register/tJwpduGrqT4sGdXbhwPsNsAK8liDbaR25YJT
	Hillcrest	https://ucsd.zoom.us/meeting/register/tJApfuGspj0iGdHPIAQySqI6HMsT-aRgHurH
	Little Italy	https://ucsd.zoom.us/meeting/register/tJwofumrqDkrHtd6pqI8YxV9vYIqqtsUBnNg
	Ocean Beach	https://ucsd.zoom.us/meeting/register/tJYkc-Gppz0tHdTwH13C6pEO60iaxA910fzh
	City Heights	https://ucsd.zoom.us/meeting/register/tJArf-uvpzspGtWg-4r5jrJLUNygU5Rpbyk1
	Point Loma	https://ucsd.zoom.us/meeting/register/tJwvcO6vpjIpE9bHqFA9GBSDzIT57kGvq4fC
	Barrio Logan	https://ucsd.zoom.us/meeting/register/tJApdeqtpj8pH9R-AMXtgIaWMS9O9iTyAzsr
	Imperial Beach	https://ucsd.zoom.us/meeting/register/tJEvcuysrzMpHdSkHpw3tv4-_XWTjDP35Peh
Closing Remarks		https://ucsd.zoom.us/meeting/register/tJYlcOGrrjIuGdzbZscUywGWAFfzs4Qram4T
Fiesta Friday Groove Session		See Closing Remarks link above

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

Presentation FAQs

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. 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 broadcasting this material via a Zoom screen share.

What should I wear?

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

What should I do while I'm not presenting?

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

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

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

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

Why wasn't I grouped in a panel with my labmates 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 either don't know the answer or only partially know the answer?

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

How do I ask good questions at a conference?

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

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

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

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

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

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

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

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

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

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

Panel Presentation Schedule

Thursday: Morning Session I, 9:10AM

Panel #	Panel Name	Location
01	Bioinformatics	University City
02	Inorganic Chemistry & Nanotechnology	Pacific Beach
03	Bacteria	Mission Hills
04	Linguistics & Literature	Kensington
05	Medical Applications of Electrical and Computer Engineering	North Park
06	Diverse Topics in Biological Sciences	Hillcrest
07	ADHD, Autism, and Memory	Little Italy
08	Psychology	Ocean Beach
09	Diverse Topics in Science & Engineering	City Heights
10	Therapeutic Applications of Chemistry and Biochemistry	Point Loma
11	Neuroscience 1	Barrio Logan
12	Health and Cancer	Imperial Beach

Thursday: Morning Session II, 10:35AM

Panel #	Panel Name	Location
13	Data Science, Computing, and Machine Learning	University City
14	Bioengineering and Medicine 1	Pacific Beach
15	Machine Learning in Computer Science	Mission Hills
16	Music, Film, & Narratives	Kensington
17	Chemistry and Biochemistry	North Park
18	The Gut	Hillcrest
19	Ecology	Little Italy
20	Science Education	Ocean Beach
21	Computer Vision, Object Detection, and Sensor Perception	City Heights
22	Nanoengineering and Chemistry	Point Loma
23	Neuroscience 2	Barrio Logan
24	T-Cells	Imperial Beach

Thursday: Afternoon Session I, 1:00PM

Panel #	Panel Name	Location
25	Perception, Bias, and Reporting	University City
26	Biochemistry and Cell Biology	Pacific Beach
27	Genetics 1	Mission Hills
28	Biomed 1	Kensington
29	Medical Disparities 1	North Park
30	Computer Science 1	Hillcrest
31	Mechanical Engineering	Little Italy
32	Data Science and Mathematics	Ocean Beach
33	Interdisciplinary Mother Earth	City Heights
34	Neuroscience, Genetics, and Reward Processing	Point Loma
35	Psychology and Development	Barrio Logan
36	Social Behavior and Decision-Making	Imperial Beach

Thursday: Afternoon Session II, 2:25PM

Panel #	Panel Name	Location
37	Computer Science 2	University City
38	Badly Behaving Bacteria	Pacific Beach
39	Genetics 2	Mission Hills
40	Botany 1	Kensington
41	Medical Applications of Nanoengineering	North Park
42	Ecology: Critters	Hillcrest
43	Medical Disparities 2	Little Italy
44	Biomed 2	Ocean Beach
45	Electrical and Computer Engineering	City Heights
46	Neurodegeneration	Point Loma
47	Critical Race Theory	Barrio Logan
48	Emotions, Arousal, and Social Interactions	Imperial Beach

Friday: Morning Session I, 9:10AM

Panel #	Panel Name	Location
49	Robotics and Autonomous Vehicle Controls	University City
50	Bioengineering and Medicine 2	Pacific Beach
51	Housing and Homelessness	Mission Hills
52	Botany 2	Kensington
53	Medical Disparities 3	North Park
54	Materials Science and Nanoengineering 1	Hillcrest
55	Physics	Little Italy
56	Misfolded Proteins	Ocean Beach
57	Mechanical Engineering, Robotics, and Controls	City Heights
58	Chemistry and Environmental Ecology	Point Loma
59	Cancer Treatment	Barrio Logan
60	Neuroscience 3	Imperial Beach

Friday: Morning Session II, 10:35AM

Panel #	Panel Name	Location
61	Nanoengineering	University City
62	Electrical and Computer Engineering and the Environmental Ecology	Pacific Beach
63	Education and Work	Mission Hills
64	Memory	Kensington
65	Medical Disparities 4	North Park
66	Materials Science and Nanoengineering 2	Hillcrest
67	Astrophysics	Little Italy
68	Ecology: Extreme Water Conditions	Ocean Beach
69	Glucose	City Heights
70	Cellular Biology	Point Loma
71	Lungs	Barrio Logan
72	Oceanographic Sciences and Climate Change	Imperial Beach

Student Spotlights

Ava Bayley

Research Programs: Undergraduate Research Scholarships (URS)
Class Standing/College: Sophomore, Sixth College
Major: Human Biology and Sociology
Field of Research: LGBTQ+ Public Health
Presentation Title: *Transgender and Gender Non-Binary Youths' Perspectives on the Use of Telemedicine in Gender-Affirming Healthcare*
Mentor: Dr. Samantha Hurst

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

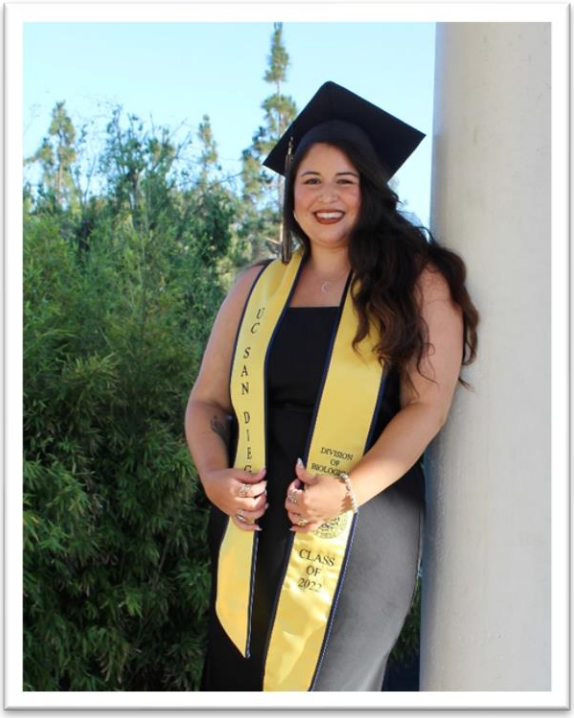
My personal and academic growth during this experience has been nothing short of incredible, but my most meaningful experience during the Summer Research Program stems from knowing my work is finally giving a voice to many in my community. To not just analyze barriers to healthcare access for the LGBTQ+ community, but to really delve into a concrete solution, is invaluable work I'm proud to be a part of. I'm also honored to get to work alongside and be mentored by many talented individuals who share in this passion for the health of my community as a whole.

Blake Estefan

Research Programs: CAMP
Class Standing/College: Sophomore, Revelle College
Major: Bioengineering
Field of Research: Bioinformatics/Pediatrics
Presentation Title: *An Updated Metabolic Model of the Photosynthetic Bacterium Synechocystis*
Mentor: Rodrigo Santibañez

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

The most meaningful experience I've had during the Summer Research Program has been working so closely and being around all the members of my lab.



Lauren Huey

Research Programs: Genentech
Class Standing/College: Senior, Marshall College
Major: General Biology
Field of Research: Plant Biology
Presentation Title*: Beta-Selinene Derived Metabolites Produced by Maize Roots Alter Soil Microbiome*
Mentor: Dr. Huffaker

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

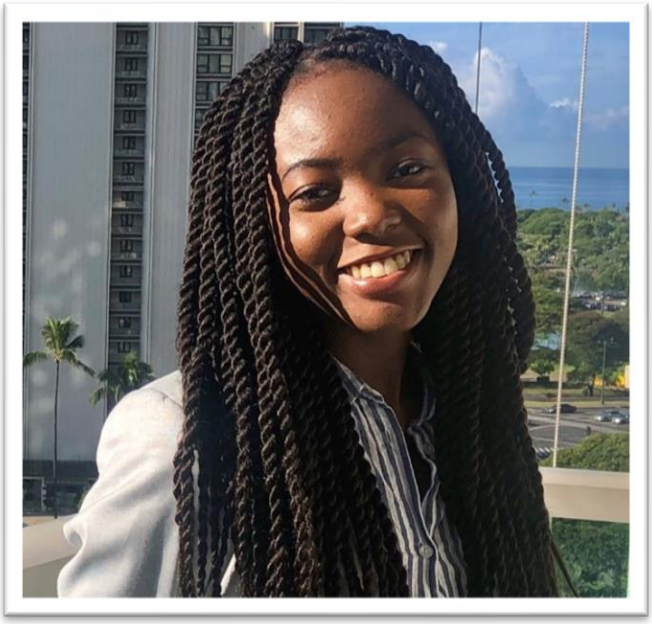
The most meaningful experience I've had during the Summer Research Program is connecting with other students from all different backgrounds and getting to share our academic and career goals. Everyone I've met has different inspirations for pursuing research but what I've found is that we are all eager to learn and we are all excited for where our academic journeys might take us. The SRP has provided me with so many resources in this short time and I am truly grateful for this experience.

Brooke Johnson

Research Programs: McNair
Class Standing/College: Junior, ERC
Major: Global Health
Field of Research: Molecular Biology, Host-Microbe Systems & Therapeutics
Presentation Title: *Phage susceptibility of Vibrio Cholerae under cholera toxin-inducing conditions*
Mentor: Dr. Fabian Rivera-Chávez

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

My most meaningful experience this summer was working under Dr. Fabian Rivera-Chávez. I have learned so much under his mentorship. He allowed me to construct my research question and challenged me to figure out ways to test the hypothesis, allowing me to start to create a new research methodology. He has pushed me beyond my comfort zone, teaching me how to think critically as a scientist. I will forever be grateful for his guidance and dedication to providing me with the tools I will need to succeed in my future goals as an aspiring scientist.

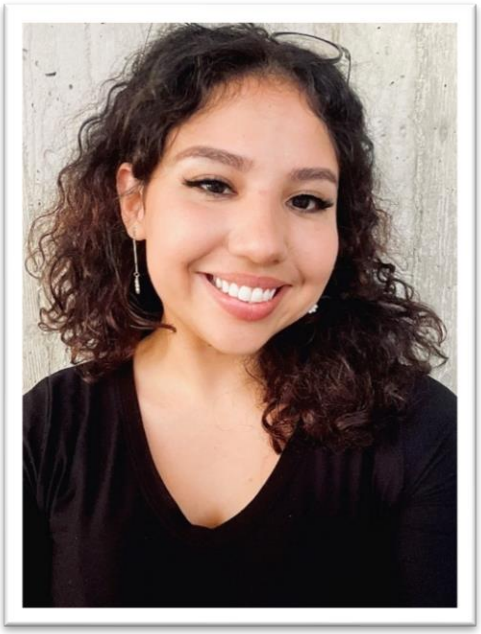


Paula Kirya

Research Programs: McNair Scholars Program
Class Standing/College: Junior, John Muir College
Major: Bioengineering
Field of research: Bioengineering
Presentation Title: Naturally Derived Nano-Optical Metasurfaces for On-Chip Breast Cancer Diagnostics and Drug Discovery
Mentor: Dr. Lisa Poulikakos

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

Transferring in Fall 2020 I had little opportunity to conduct laboratory research and connect with my peers. This summer I was able to fully immerse myself in both experiences, which has been very fulfilling. Having to navigate optimizing experiments and appropriately interpreting data has allowed me to grow so much as a researcher over this short amount of time, especially under my exceptional mentorship. I also had a lot of fun with many of the other SRP students this summer and through them, I gained a greater appreciation for the many different types of research.



Zaira Leal

Research Programs: UC Scholars
Class Standing/College: Senior, ERC
Major: Biological Anthropology
Field of Research: Health Disparities
Presentation Title: *Examining the preterm birth rates by race/ethnicity before and during the COVID-19 pandemic*
Mentor: Amy L. Non

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

I had the pleasure of meeting incredibly accomplished and eager students this summer. I met Louie on the elevator as I was moving in. When I asked him about his research, he fully embodied what I can only explain as a mad scientist. He spoke fast, with grand hand gestures, rapid hair flips, and the occasional pause to allow his audience a second to embrace the feeling of awe as he explained what it's like to be an indigenous person in STEM. Louie is loud, funny, unapologetic, and painfully aware of the historical events that led to the genocide of his community. He is fighting for affordable cancer screening technology that will disperse treatment beyond the scope of private health care. Then I met Briana who wants to teach literature from the perspective of historically marginalized people. She revives literary text in a way that makes you hear the perspectives of missing voices in our history. Then there is David who is breaking cycles of generational trauma as we speak. He interviews men who have been neglected a space to sit and feel the emotions and experiences that plague their hearts and sometimes work to perpetuate generations of trauma. We are all fighting the same battle from different angles. Meeting them and seeing how they turned their perspectives into opportunities to heal was a surreal experience. In their research, I see the faces of my family and friends. In their research, I can exist in a space of compassion and hope.

Jesus Peng Zhao

Research Programs: Genentech
Class Standing/College: Sophomore, Revelle College
Major: Biochemistry
Field of research: Plant Biology
Presentation Title: *Characterization of a novel role of citrate mediated root development in Arabidopsis thaliana*
Mentor: Jazz Dickinson and Tao Zhang

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

The most meaningful aspect of this program has been the wonderful scientific community I was able to get immersed in. Through working closely together with my mentors to comb through existing literature for clues, designing experiments and discussing the results and their implications, I feel better equipped and excited to continue developing and exploring the questions yet unsolved in my field of interest. In addition to all the knowledge and experience I have gained, the connections I was able to develop with my peers, fellow undergraduate students, and graduate students has left me with a broader perspective on how research is conducted and what science can do.

Marysol Valdez

Research Programs: TRELS
Class Standing/College: Sophomore, Muir College
Major: Ethnic Studies and Public Policy
Field of research: Ethnic Studies: Critical Race Theory and Decolonial Praxis
Presentation Title: *Decolonizing San Diego: How Colonialism and Tourism Impact America's "Finest City"*
Mentor: Luis Alvarez, PhD

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

My most meaningful experience in the Summer Research Program was having the opportunity to both investigate the current body of history in San Diego and cultivate storytelling opportunities that have been silenced for generations. Across the United States, historical monuments along with American primary and secondary education curricula minimally discuss or even acknowledge the effects of colonization, slavery and racial discrimination. The absence of diverse storytelling amplifies the wide array of systemic issues which racially marginalized groups in the United States have generationally experienced and still face today. This research experience allowed me to share the diverse perspectives that energize our understanding of San Diego history and to remind individuals to ask questions about historical policies and legal barriers that influence our lives. With this research experience, I will continue to analyze established historical, legal, and political systems with a critical lens to change and strengthen the future of our communities.

This research is dedicated to the Kumeyaay people who continue to maintain cultural traditions and political sovereignty as integral members of San Diego. I would also like to dedicate my research to my family, friends, and mentor Dr. Luis Alvarez who have all been supportive during this experience.

Leslie Vallejo-Avila

Research Programs: Undergraduate Research Scholarships (URS)
Class Standing/College: Sophomore, Warren College
Major: Political Science; International relations with Business Minor
Field of research: Urban Geography, Gentrification
Presentation Title: *Analyzing gentrification: its impact on the Latinx experience in San Francisco's Mission district*
Mentor: Gerardo Arellano, PhD

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

The experience from being part of this Summer Research Program has been overall meaningful to me because I never imagined myself having access to the opportunity to conduct research. Being able to study about a social issue that impacts my hometown, San Francisco, while being able to conduct the study in-person has been very meaningful to me. Having the privilege to be engaged with my community and immerse myself in a new one through URS has been heart-warming to undergo as a first-generation Latinx college student. During my research I realized how gentrification intersects with other social issues that impact SF. It solidified the idea that URS had constantly reiterated to us in our weekly seminars, if we had all the answers we wouldn't be doing research. I find determination to continue engaging myself in research knowing that there is more to discover. This being my first time conducting a study of my own, I'm grateful to have had the support of the URS team (Sophia Tsai and more) and my mentor (Gerardo Arellano) as they've been as dedicated to my success as I have in this new endeavor. Thank you to my interviewees, my parents, and everyone who contributed to making my first summer research project possible.

Allie Williams

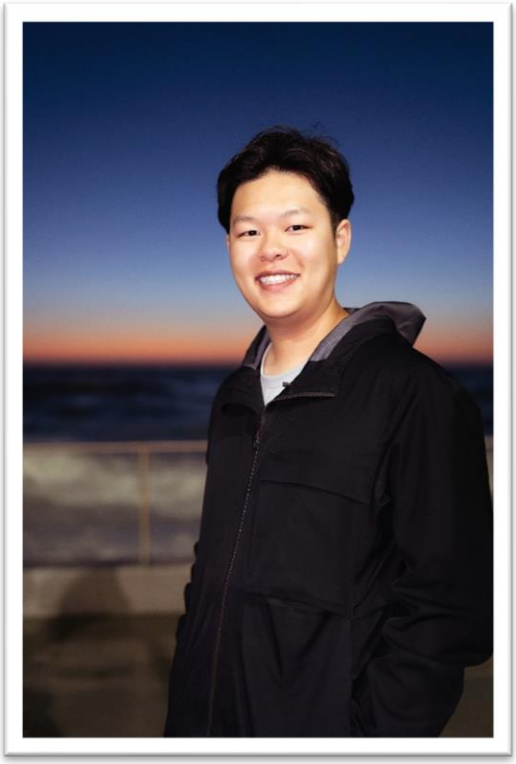
Research Programs: CAMP
Class Standing/College: Junior, Muir College
Major: Neurobiology
Field of research: Neurobiology
Presentation Title: *Neuromodulatory Impact of Protein-rich Diet on the Behaviors of Female Drosophila*
Mentor: Chih-Ying Su

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

On top of learning new transferrable skills, I had the privilege to further challenge myself and watch myself grow as I take on a new experience. As a mother and wife to an active-duty service member, being a full-time student can be a challenge within itself, but as someone who plans on pursuing higher education, I want to keep challenging myself to become a better student and researcher as it will help me become more resilient and be better prepared for future challenges.

Scott Yang

Research Programs: UC Scholars
Class Standing/College: Senior, Sixth College
Major: Data Science & Cognitive Science
Field of research: Cognitive Science Memory Formation
Presentation Title: *Independent Electroencephalography Data Reveals Memory Formation by Controlling Confidence*
Mentor: Jason G Fleischer



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

Collaborating extensively with people from various technical and cultural backgrounds has been the most invaluable experience throughout the summer research program. More importantly, I learned much about the significance of keeping the communication channel open between researchers. Throughout the research experience, I have encountered countless obstacles that hinder our research project. Nevertheless, by actively collaborating and always keeping an open mind, my fantastic research team was able to manage to overcome waves of barriers. After all endurances and countless hours of frustration, I learned how to cope with the natural process of conducting research and gradually fell in love with it. Summer Research Program enables me a chance to snip into a brand new world where I can apply the bits of knowledge I learned from the classroom to solve a real-world problem. The urge to continue conducting research, and the insatiable sense of accomplishment, are among the most priceless experience I gained.

Panel Details

Thursday: Morning Session I

Panel 01: Bioinformatics

Zoom Room: University City
Thursday 9:15 AM – 10:25 AM
Moderator: Celeste Allaband

Joelle Faybishenko - UC San Diego
Mentor: Dr. Justin Shaffer
Classifying the human gut microbiome with animal gut microbiomes

Kyra Fetter - UC San Diego
Mentor: Dr. Ferhat Ay
Developing a comprehensive database of high-resolution protein-centric chromatin conformation capture (HiChIP) datasets curated from the literature

Angela Ng - Baruch College
Mentor: Dr. Tsung-Ting Kuo
Blockchain Technology in Nursing Informatics: A systematic review

Jay Golden - UC San Diego
Mentor: Dr. Marco Mravic
Engineering Membrane Spanning Proteins Using Statistical Methods

Gabriel Alfredo Siguenza - CSU San Marcos
Mentor: Dr. Graham McVicker
Predicting the effects of genetic risk variants on open chromatin and gene expression using allele specific open chromatin accessibility measures from quantitative trait loci studies

Panel 02: Inorganic Chemistry and Nanotechnology

Zoom Room: Pacific Beach
Thursday 9:15 AM – 10:25 AM
Moderator: Michael Sailor

Eleanor Stewart-Jones - Yale University
Mentor: Professor Michael Sailor
Fabrication of Deuteride-terminated Porous Silicon

Sydnee Farnsworth - Phoenix College
Mentor: Reagan Beer
pH Dependent Dye Release experiments of TiO2 coated nanoparticles

Abhi Bagchi - UC San Diego
Mentor: Dr. Francesco Paesani
Catalytic Versatility of Phosphinines

Michelle Luces - University of Guam
Mentor: Dr. Zheng Chen
Metal-organic Frameworks as Ion Conductors for Solid-State Batteries

Lanie Guerrero and Sophia Da Silva - CSU Long Beach, Fluminense Federal University
Mentor: Michael Sailor
pH-Dependent Study of Calcium Silicate Coated Nanoparticles for Drug Delivery

Panel 03: Bacteria

Zoom Room: Mission Hills
Thursday 9:15 AM – 10:25 AM
Moderator: Toheeb Balogun

Ramina Amino - UC San Diego
Mentor: Gurol Süel
Investigation of B. subtilis spore and other bacterial species cell

Blake Estefan - UC San Diego
Mentor: Karsten Zengler
Curation of a computational model of the cyanobacterium Synechocystis sp. PCC 6803

Angel Sarabia - UC San Diego
Mentor: Dr. Rachel Dutton
Unearthing The Molecular Mechanisms Underlying Host-Phage Co-Evolution In Cheese Microbial Communities

Xinran Shi - UC San Diego
Mentor: Andrew Chisholm
Collagen Expression in the Larval Cuticle

Matthew Uzelac - UC San Diego
Mentor: Dr. Weg Ongkeko
Archaea Microbial Landscape as an Indicator of Lung Adenocarcinoma and Squamous Cell Carcinoma

Panel 04: Linguistics & Literature

Zoom Room: Kensington
Thursday 9:15 AM – 10:25 AM
Moderator: Jessica Lizarraga

Kiara Summers - University of San Diego
Mentor: Dr. Clara Azevedo
Spanglish: the creative expression of intercultural Latinx identity

Briana Thang - UC San Diego
Mentor: Dr. Marc Garellek
Register in Austroasiatic Languages

Briana Parker - UC San Diego
Mentor: Seth Lerer
Crossing Brooklyn Ferry: A Socially Activated Pedagogical Experiment in the Literary Mapping of Poetic Landscapes, Boarders, and the Imagination

Miriam Castanon - University of San Diego
Mentor: Dr. Ivan Ortiz
Madness and Mothering in Gothic Fiction

Alyssa Mugavero - University of San Diego
Mentor: Dr. Marilynn Johnson
Criticism of Scalia's Thesis: The Statutory Interpretation of Textualism

Panel 05: Medical Applications of Electrical and Computer Engineering

Zoom Room: North Park
Thursday 9:15 AM – 10:25 AM
Moderator: Yatish Turakhia

Faris Alkhalifah - UC San Diego
Mentor: Dr. Karcher Morris
Design of a surface electromyography-enabled device for capturing a surgeon's ergonomic performance

Zhangwen Wan - UC San Diego
Mentor: Professor Sujit Dey
Virtual Physical Therapy

Abby Hackbarth - UC San Diego
Mentor: Dr. Karcher Morris
Inertial and Optical Non-invasive Wearable Device for Recording Surgeon Ergonomics

Neelay Joglekar - UC San Diego
Mentor: Professor Michael Yip
Suture Thread Reconstruction with Physical Constraints

Yichen Yang - UC San Diego
Mentor: DR. Imanuel Lerman
Respiration monitoring and classification through a non-invasive method using inertial measurement units

Panel 06: Diverse Topics in Biological Sciences

Zoom Room: Hillcrest
Thursday 9:15 AM – 10:25 AM
Moderator: Ayse Sahan

Bridget Boyle - UC San Diego
Mentor: Dr. Pinar Yoldas
Dark Botany

Leonardo Gonzalez - UC San Diego
Mentor: Yury Miller
ABCA1 and ABCG1 cholesterol transporters effect in nociceptive signaling in Chemotherapy-Induced Peripheral Neuropathy (CIPN) mice

Steven Ocón - UC San Diego
Mentor: Dr. Tony L. Yaksh
The Behavioral Effects of TAK-242 on LPS-Induced Mice

Celina Shen - UC San Diego
Mentor: Professor Christina Towers
Investigating Mechanisms of Mitochondrial-Derived Vesicle Formation

Taylor Rytlewski - UC San Diego
Mentor: Dr. Suckjoon Jun
Understanding growth rate control in Bacillus subtilis

Panel 07: ADHD, Autism, and Memory

Zoom Room: Little Italy
Thursday 9:15 AM – 10:25 AM
Moderator: Oliva Mota Segura

Jaden Huynh - UC San Diego
Mentor: Dr. Georgia Sadler
ADHD and ADHD Symptomology Care in Pediatric Brain Tumor Survivors

Hyoser Jo - UC San Diego
Mentor: Professor Deanna Greene
Functional Network Organization of Comorbid Tourette Syndrome

Turley Duque - University of San Diego
Mentor: Dr. Jena Hales
Memory deficits and pro-inflammatory cytokines in the hippocampus in a rat model of ADHD

Viviana Castro - University of San Diego
Mentor: Dr. Jena Hales
Examining the Role of the Endocannabinoid System in Elapsed Time Memory in Rats

Jessica Brunner - Spelman College
Mentor: Dr. Leslie Carver
HMET (Neurotypical vs. ASD) & Joint Attention: Developmental Neuroscience Lab

Panel 08: Psychology

Zoom Room: Ocean Beach
Thursday 9:15 AM – 10:25 AM
Moderator: Emma Geller

Tiffany Widjaja - UC San Diego
Mentor: Dr. Emma Geller
Effects of Combining Refutation and Self-Explanation on Belief Revision in Emotionally Charged Misconceptions

Zoe Tait - UC San Diego
Mentor: Dr. Judith Fan
How well do self-beliefs and engagement predict learning outcomes in an introductory statistics course?

Josephine Cabrera - California State University San Bernardino
Mentor: Dr. Gail Heyman
Students' Intuitive Reasoning About Grading Systems

Cathy Quach - California State University Northridge
Mentor: Dr. Gail Heyman
The Essence of Being American

Denise Picazo - University of San Diego
Mentor: Laura Getz
Speech Perception in Bilinguals

Panel 09: Diverse Topics in Science and Engineering

Zoom Room: City Heights
Thursday 9:15 AM – 10:25 AM
Moderator: Radhika Anish Mathuria

Qiaolin Li - UC Davis
Mentor: Dr.Tara Hutchinson
Prefabricated steel stairs to be tested as part of 10-story mass timber building

Peter Nguyen - UC Riverside
Mentor: Dr. Ken Loh
Bio-Inspired Active Skins for Passive Temperature Sensors

Yuliza Venegas - San Diego city college
Mentor: Oscar Vasquez
Quantum Dots as light sensitizers for Graphene

Clara Medina - UC Merced
Mentor: Dr. Morgan Levy
Coastal Climate and Groundwater Systems Analysis in the California Pajaro Valley from 1957-2020

Hannah Chen - UC Berkeley
Mentor: Dr. Michael Sailor
Blow spinning of silicon-embedded carbon nanofibers as Li ion battery anodes

Panel 10: Therapeutic Applications of Chemistry and Biochemistry

Zoom Room: Point Loma
Thursday 9:15 AM – 10:25 AM
Moderator: Gosia Murawska

Logan Tucker - University of San Diego
Mentor: Dr. Joan Schellinger
Microwave-Assisted Reversible Addition-Fragmentation Chain Transfer Polymerization of Cationic Monomers for the Development of Antimicrobial Polymers

Aman Shihora - UC San Diego
Mentor: Dr. Lalit Deshmukh
Investigation of the Proline Rich Domain of Annexin A11

Jake Anderson - UC San Diego
Mentor: Dr. Michael K. Gilson
Improving the Generalized--Born Implicit Solvent Model

Hennie Marie Johnsen - University of Oslo
Mentor: Professor Michael Sailor
Targeted delivery of anti-cancer drug by albumin-coated porous silicon nanoparticles

Juliet Anawalt and Astrid Pratt - University of San Diego
Mentor: Dr. Joan Schellinger
Amino Acid-Derived Polymethacrylamides: A Potential Alternative Treatment of Multi-Drug Resistant Bacteria?

Panel 11: Neuroscience 1

Zoom Room: Barrio Logan
Thursday 9:15 AM – 10:25 AM
Moderator: Tania Delgado

Anqi Wang - UC San Diego
Mentor: DR. Stacey Glasgow
Effect of NUAK2 Kinase-dead Mutation on Glioma Tumorigenesis

Isabel Smith - UC San Diego
Mentor: Dr. Nicola Allen
Is astrocyte c-fos expression dependent on store-mediated Ca2+ release?

Jose Samano Catalan - University of California, Davis
Mentor: Dr. Thomas L. Beaumont
Chromatin Remodelers in Brain Tumor Oncogenesis

Trinity Dawoodtabar - UC San Diego
Mentor: Dr. Nicola Allen
Investigating Astrocyte-Secreted Proteins in Conjunction with Visual Critical Period Plasticity in Mice

Elan Ortiz - San Diego Mesa College
Mentor: Dr. Miguel Lopez-Ramirez
An Analysis on the Localization of Cerebral Cavernous Malformations through in Situ Hybridization

Panel 12: Health and Cancer

Zoom Room: Imperial Beach
Thursday 9:15 AM – 10:25 AM
Moderator: Helen Wedegaertner

Jordan Gomez-Padilla - UC San Diego
Mentor: Dr. Georgia Sadler
Cancer and Dementia; Who Cares?

Amaya Mendez-Molina - UC San Diego
Mentor: Georgia Sadler
Addressing Adenoid Cystic Carcinoma of the Salivary Glands

Andrea Contreras - UC San Diego
Mentor: Dr. Georgia Sadler
Does Sexual Trauma Predict Lower Rates of Cervical Cancer Screening?

Jocelyn Quiroz - UC San Diego
Mentor: Georgia R Sadler
Exploring Body Image Interventions for Patients with Breast Cancer: A Review of the Literature

Thursday: Morning Session II

Panel 13: Data Science, Computing, and Machine Learning

Zoom Room: University City
Thursday 10:35 AM – 11:50 AM
Moderator: Cong Dinh

Aaron Simon - University of the Pacifc Stockton Campus
Mentor: Philip Myint
Simulation of Multiphase, Multicomponent Mixtures

Leon Zhang - UC Irvine
Mentor: Professor Darren Lipomi
Open-source tool for accurate modeling and simulation of conjugated polymers

Ziheng Huang - UC San Diego
Mentor: Michael Yip
Endoscopic scene semantic segmentation

Yuanjia Yang - UC San Diego
Mentor: Dr. Jason Fleischer
EEG reveals memory formation processes

Panel 14: Bioengineering and Medicine 1

Zoom Room: Pacific Beach
Thursday 10:35 AM – 11:50 AM
Moderator: Michael Sailor

Cassandra Pheiffer - UC San Diego
Mentor: Laura Vasquez-Bolanos
Using FIJI to streamline analysis of immunofluorescence stained tissue samples

Paula Kirya - UC San Diego
Mentor: Dr. Lisa Poulikakos
Naturally Derived Nano-Optical Metasurfaces for On-Chip Breast Cancer Diagnostics and Drug Discovery

Matthew Plazola - CSU Long Beach
Mentor: Dr. Jon Pokorski
Development of a biocomposite PCL patch for accelerated wound healing

Kaitlyn Strandberg - UC San Diego
Mentor: Dr. Robert Sah
Dose-Dependence of EdU for Localization and Tracking of Proliferating Chondrocytes

Azeh Ndifor and Andrew Finebaum - Georgia Institute of Technology, Boston University
Mentor: Bryan Bishe
Cyanobacterial Strain Development in Alginate Hydrogel Matrices

Panel 15: Machine Learning in Computer Science

Zoom Room: Mission Hills
Thursday 10:35 AM – 11:50 AM
Moderator: Debalina Chowdhury

Junyi Xu - UC San Diego
Mentor: Jianrong Chen
Driver's State of Mind and Intent Detection using Multiple Sensors and Machine Learning

Viren Abhyankar - UC San Diego
Mentor: Associate Professor Yiying Zhang
Memory-Constrained ML Optimizations

Daniel Tran - University of San Diego
Mentor: Dr. Siavash Mirarab
Sequence Embedding for Phylogenetics

Chengjing Yuan - UC San Diego
Mentor: Professor Michael Yip
Pointcloud based collision detection

Jicang Cai - UC San Diego
Mentor: Professor Lin, Bill
Meta-Learning by Routing in Deep Neural Networks

Panel 16: Music, Film, & Narratives

Zoom Room: Kensington
Thursday 10:35 AM – 11:50 AM
Moderator: Betty Ramirez

Zerui Pan - UC San Diego
Mentor: Professor Géraldine A. Fiss
Treading on the Tiger's Tail: Chinese and Japanese Action Cinema Reacting to State Censorship

Joseph Ceballos - University of San Diego
Mentor: Jeffery Malecki
Latin Pop Influence in Classical Music

Quinn Picard - UC San Diego
Mentor: Dr. Alex Frano
Deep Learning for Music Analysis

Marysol Valdez - UC San Diego
Mentor: Luis Alvarez
Decolonizing San Diego: How Colonialism and Tourism Impact America's "Finest City"

Valeria Castro Abril - UC San Diego
Mentor: Dr. Ariana Ruiz
An Exceptional Commute: Transborder Students at the U.S.-Mexico Border

Panel 17: Chemistry and Biochemistry

Zoom Room: North Park
Thursday 10:35 AM – 11:50 AM
Moderator: Sharon Lin

Adriana Siordia - UC San Diego
Mentor: Dr. Itay Budin
Dissecting the contribution of sterol structure to GUV phase separation

Clarisa Bautista - UC San Diego
Mentor: Dr. Tatiana Mishanina
Cysteine Oxidation of Mitochondrial Transcription Factor A

Ivan Martin Del Campo - University of California, Irvine
Mentor: Dr. Nathan Romero
Sulfonium ions as intermediate used to synthesize Conjugated Polymers

Emily Huang - UC San Diego
Mentor: Dr. William Fenical
Discovering Inhibitors of the SARS-COV-2 Protein in Natural Products from Marine Bacteria

Joe Avalos - University of San Diego
Mentor: Dr. Lauren Benz
Ball-milling to Promote Post-Synthetic Ligand Exchange in UiO-66

Panel 18: The Gut

Zoom Room: Hillcrest
Thursday 10:35 AM – 11:50 AM
Moderator: Ayse Sahan

TzuTung Lin - UC San Diego
Mentor: Dr. Yoshitake Cho
The Role of Perm1 in Cardiomyocytes and Metabolism

Tammy-Nhu Nguyen - UC San Diego
Mentor: Dr. Bichen Zhang
The NOX4 Isoform is the Major Contributor to the Production of ROS in Adipocytes and its Inhibition Decreases the Expression of UCP1

Mina Perez - Winston-Salem State University
Mentor: Dr. Dionicio Siegel
The Synthesis of Novel Compounds to combat Binge Eating Disorder

Kevin Wei - UC San Diego
Mentor: Arianna Brevi
Dissecting the role of bacterial bile acid metabolism in colorectal cancer

Emily Zhang - UC San Diego
Mentor: Dr. Reuben Shaw
AMPK Mediated Proliferation of Intestinal Stem Cell Derived Organoids

Panel 19: Ecology

Zoom Room: Little Italy
Thursday 10:35 AM – 11:50 AM
Moderator: Jess Mullins

Laurel Wagner - University of Nebraska - Lincoln
Mentor: Dr. Stephen Mayfield
Purifying and Testing Potential Polyurethanases

Qianqian Tao - UC San Diego
Mentor: Professor Martin Tresguerres
Manipulating culture conditions to trick free-living algae into a state that mimics the coral-algae symbiosis

Yan Zhe Liu - UC San Diego
Mentor: Dr. Bradley Moore
Establishing genomic, transcriptomic, and metabolomic libraries for a Xenia octocoral and using the libraries to investigate potentially bioactive terpenoids and their biosynthetic pathways.

Maria Angst - University of San Diego
Mentor: Dr. Drew Talley
Interannual Variation of Ichthyofaunal Utilization of a Man-Made Salt Marsh Creek in Mission Bay, California

Ashley Miller - UC San Diego
Mentor: Dr. Jonathan Shurin
Influence of Selective Pressures on The Fitness and Growth of Microalgae Nannochloropsis sp.

Panel 20: Science Education

Zoom Room: Ocean Beach
Thursday 10:35 AM – 11:50 AM
Moderator: Oliva Mota Segura

Lilyan Mendez - UC San Diego
Mentor: Dr. Claire Meaders and Dr. Melinda Owens
Factors Influencing Introductory Biology Students Attitudes Towards Chemistry

Yalila Vega - UC San Diego
Mentor: Dr. Claire Meaders
Have you heard about this? An exploration of faculty communication about campus resources to students in biology courses

Saya Shahoy - UC San Diego
Mentor: Dr. Melinda T. Owens
Student understanding of COVID-19 vaccines and central dogma

Khoa Nguyen - UC San Diego
Mentor: Professor Karcher Morris
Bringing electrical engineering into high schools: Reinventing a hands-on introduction to electrical engineering through analogies and creativity

Panel 21: Computer Vision, Object Detection, and Sensor Perception

Zoom Room: City Heights
Thursday 10:35 AM – 11:50 AM
Moderator: Radhika Anish Mathuria

Joydeep Dutta - UC San Diego
Mentor: Professor Pengtao Xie
Automatic Annotation of Objects Based on Image Captions

Yucheng Huang - UC San Diego
Mentor: Dr. Dinesh Bharadia
improving lidar auto-labeling with camera detection for radar model training

Girish Krishnan - UC San Diego
Mentor: Professor Truong Nguyen
Lightweight Human Digitization System

Schuyler Diaz - Arizona State University
Mentor: Yeshaiahu Fainman
Computer Vision Aided Automatic Waveguide Alignment and Optimization System

Vincent Tu - UC San Diego
Mentor: Dr. Talmo Pereira
Contrastive Self-Supervised Re-Identification in Tracking

Panel 22: Nanoengineering and Chemistry

Zoom Room: Point Loma
Thursday 10:35 AM – 11:50 AM
Moderator: Johannes Schoeneberg

Snigdha Jagarlapudi - University of California, Berkeley
Mentor: Andrea Tao
PPS Driven Ligand Exchange to Facilitate the Removal of CTAB on the Surface of Gold Nano Cubes

Megan Salek - UC San Diego
Mentor: Dr. Michael J. Sailor
Synthesis of Titanium Dioxide-coated Silicon Nanoparticles and Characterization via X-Ray Diffraction

Ryan Jones - UC San Diego
Mentor: Dr. Nisarg Shah
Nanoparticle Size

Yutong She - UC San Diego
Mentor: Professor Michale J. Sailor
Loading and Releasing of Lysozyme on Partially and Fully Oxidized Porous Silicon Nanoparticles

Zhiqi Zhang - UC San Diego
Mentor: Helen Zhang, Professor Michael J. Sailor
Mesoporous silicon nanoparticles as a delivery system to help understand the biological function of Erucamide

Panel 23: Neuroscience 2

Zoom Room: Barrio Logan
Thursday 10:35 AM – 11:50 AM
Moderator: Tania Delgado

Alejandro Cervantes-Medrano - UC San Diego
Mentor: Richard Daneman
Do endothelial cells within the hippocampus proliferate in the adult mouse?

Jessica Muojekwu - UC San Diego
Mentor: Tom Hnakso
Leveraging CRISPR-Cas9 tools to selectively disrupt glutamate or dopamine release from VTA glutamate projections.

Veronica Hernandez - UC San Diego
Mentor: Dr. Lara Rangel
Neurophysiological activity within the dentate gyrus of the hippocampus during vicarious trial and error and object-pushing

Luowen Yu - UC San Diego
Mentor: Dr. Lara Rangel
Investigating the Role of Dentate Gyrus in Pattern Separation

Panel 24: T-Cells

Zoom Room: Imperial Beach
Thursday 10:35 AM – 11:50 AM
Moderator: Daniel Cardenas

Allison Cafferata - UC San Diego
Mentor: Dr. Ananda Goldrath
Investigating Wsb1 for influence on Tissue Residency and T Cell Function in Cancer

Josiah Drakes - Xavier University of Louisiana
Mentor: Megan Young/Dr. Geoffrey Chang
HIV Reverse Transcriptase

Andrea Farrell - UC San Diego
Mentor: Dr. Wei Ying
The role of regulatory T cells in the development of non-alcoholic steatohepatitis

Emi Sanchez - UC San Diego
Mentor: Dr. Anjana Rao
Improving anti-tumor functioning by degrading transcription factors involved in T cell exhaustion

Thursday: Afternoon Session II

Panel 25: Perception, Bias, and Reporting

Zoom Room: University City
Thursday 1:00 PM – 2:15 PM
Moderator: Ece Bayram

Alfredo Santiago - California State University, Northridge
Mentor: Dr. John Wixted
Photo Lineups: Which one is better?

Belinda Avalos - CSU Northridge
Mentor: Dr. John Wixted
Confidence and Accuracy in Eyewitness Testimonies

Jiayi Zhao - UC San Diego
Mentor: Dr. Jason Fleischer
Advanced Analysis of Racial Equity in San Diego Criminal Justice System

Christian Flores - UC San Diego
Mentor: Sean Kross
Reevaluating Artificial Intelligence Applications: Public Perception and Ethical Governance

Oshin Wilson - University of the District of Columbia
Mentor: Dr. Hyoduk Shin
Standard for Sustainability Disclosure

Panel 26: Biochemistry and Cell Biology

Zoom Room: Pacific Beach
Thursday 1:00 PM – 2:15 PM
Moderator: Colleen McHugh

Ethan Ashley - UC San Diego
Mentor: Dr. Christian Metallo
Developing a Platform for Studying the Effects of Altering Metabolism on the Function of Cellular Receptors

Noura Yassir - UC San Diego
Mentor: Dr. Johannes Schöneberg
Effects of the Ketogenic Diet on Mitochondria Morphology in Epilepsy-Associated Mutations in Human Stem Cells

Michelle Israel - Miramar College
Mentor: Dr. Lalit Deshmukh
Identification of the Motif within ALIX Responsible for Phase Separation

Ananya Bharath - UC San Diego
Mentor: Dr. Jin Zhang
Dynamic Interplay between cAMP/PKA and ERK Signaling in PC12 Cells

Khoa Tran - UC San Diego
Mentor: Dr. Colleen McHugh
Identifying binding region(s) of the long non-coding RNA DUBR to NuRD complex proteins and DNMT1

Panel 27: Genetics 1

Zoom Room: Mission Hills
Thursday 1:00 PM – 2:15 PM
Moderator: Lakshmi Batachari

Ithan Cano - California State University, Northridge
Mentor: Dr. Colleen Mchugh
Long non-coding RNAs

Valerie Gonzalez - UC San Diego
Mentor: Dr. Gene Yeo
Developing an RNA-targeted therapeutic for microsatellite repeat expansion disorders using catalytically dead Cas13d

Allison Li - UC San Diego
Mentor: Dr. Gene Yeo
CIRTS Constructs are Effective in Targeting Microsatellite Repeat Expansion Disorders

Ashai Williams - Xavier University of Louisiana
Mentor: Alon Goren
Mitotic H3K9ac is controlled by phase-specific activity of HDAC2, HDAC3 and SIRT1

Sophia Xu - UC San Diego
Mentor: Professor Scott Rifkin
Developing an in vivo System to Decipher Effects of Mutations in Transcription Regulation

Panel 28: Biomedical Science 1

Zoom Room: Kensington
Thursday 1:00 PM – 2:15 PM
Moderator: Toheeb Balogun

Mohnish Alishala - UC San Diego
Mentor: Dr. Christopher Glass
Loss of DNMT3A or TET2 leads to exacerbated inflammatory response in macrophages treated with uric acid crystals

Arianna Girmai - UC San Diego
Mentor: Michael Croft
Psoriasis and Atopic Dermatitis

Elise Kim - UC San Diego
Mentor: Dr. Robert Rissman
Identifying Blood-Based Biomarkers of Alzheimer's Disease in Down Syndrome Patients

Isaac Rodriguez - UC San Diego
Mentor: Dr. Bryan Ru
The Comparisons of Nicotinamide Riboside Treatments for Osteoarthritis

Panel 29: Medical Disparities 1

Zoom Room: North Park
Thursday 1:00 PM – 2:15 PM
Moderator: Nicole Scharping

Ashley Gonzalez - University of San Diego
Mentor: Drew Talley, PhD
The Interconnection between Health Disparities and Junkyards in East Los Angeles County

Daniela Dreifke - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Impact of Public Umbilical Cord Blood Banks' Lack of Donor Diversity

Sabrina Chang Liao - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Increasing Colorectal Cancer Screening Rates in the Asian American Community

Helen Hernandez - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Interface between Genomic Variation and Immunotherapy

Anthony Cirilo - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Human Papillomavirus (HPV) and Gender Beyond the Binary: Correlates to HPV Knowledge and Awareness in a Gender Diverse Population

Panel 30: Computer Science 1

Zoom Room: Hillcrest
Thursday 1:00 PM – 2:15 PM
Moderator: Alma Santana

Andrew Oabel - UC San Diego
Mentor: Professor Mai ElSherief
Detecting Risk Levels in Problem Gamblers Through Online Communities on Reddit

Alan Diaz - UC San Diego
Mentor: Dr. Rodeny Gabriel
Improving

Ryan Kosta - UC San Diego
Mentor: Professor Yiying Zhang
dataflOwS: an Exploration of Disaggregated Heterogeneous Accelerators

Carol Bao - UC San Diego
Mentor: Yatish Turakhia
Large-scale COVID-19 Phylogenetics

Xuan Wang - UC San Diego
Mentor: Professor Yatish Turakhia
Tiling Technique for large Dynamic Programming (DP) Matrices

Panel 31: Mechanical Engineering

Zoom Room: Little Italy
Thursday 1:00 PM – 2:15 PM
Moderator: Edgar Beas

Anna Nguyen - UC San Diego
Mentor: Professor Lisa Poulikakos
Amyloid-Beta (Aβ) Plaque Deposition in the Human Eye for AD Diagnosis

Gabrielle Scott - UC San Diego
Mentor: Dr. Frank Talke
Analysis of Novel Silicone Composite Vaginal Tissue Analogs Using Digital Image Correlation

Ali Kattee - UC San Diego
Mentor: DR. John Hwang
Continuous scale battery modeling for cube-sat design optimization

Martin Beshara - University of California, Berkeley
Mentor: Dr. Sutanu Sarkar
Modeling the Upper Ocean's Mixed Layer

Jessica De La Torre - UC San Diego
Mentor: Dr. Jeremy Orosco
Surface Acoustic Wave and Thickness Mode Device Design

Panel 32: Data Science and Mathematics

Zoom Room: Ocean Beach
Thursday 1:00 PM – 2:15 PM
Moderator: Daniel Diaz

Goldar Luu - UC San Diego
Mentor: Danna Zhang
Transforming the Black-Scholes Equation to the Heat EQuation

Czarlyn Camba - California State University Northridge
Mentor: Dr. Tsung-Ting Kuo
Recording Biomedical Compliance Training Certificates using Blockchain Technology

Myleah Avant - Howard University
Mentor: Dr. Rodney Gabriel
Depression and Anxiety in Relation to Persistent Opioid Use

Zhengyun Nie - UC San Diego
Mentor: Professor Lutz Warnke
Costas array

Carlos Monterosa - UC San Diego
Mentor: Huiwen Lu
Graph Neural Networks and Directed Graphs

Panel 33: Interdisciplinary Mother Earth

Zoom Room: City Heights
Thursday 1:00 PM – 2:15 PM
Moderator: Adit Chaudhary

Jared Hoffart - UC San Diego
Mentor: Pinar Yoldas
Artificial Reef Art Installation

Kate Zegans - UC San Diego
Mentor: Alihan Polat
Climate Migration and Density in New Hampshire

Marie Vaughan - UC San Diego
Mentor: Juli Hinds
Food Swamps and Adolescent Obesity Rates In San Diego County

Valerie Lee - UC San Diego
Mentor: Dr. Amy Lerner
Effects of Reducing Beef on Carbon Emissions at UCSD Dining Halls

Ethan Olson - UC San Diego
Mentor: Dr. Amy Lerner
What to Do about the Eucalyptus?: A Speculative Design Proposal for UC San Diego's Largest Eucalyptus Grove

Panel 34: Neuroscience, Genetics, and Reward Processing

Zoom Room: Point Loma
Thursday 1:00 PM – 2:15 PM
Moderator: Deryl LeDuke

Marissa Franco - University of San Diego
Mentor: Jennifer Wenzel
Adolescent cannabinoid exposure alters cocaine conditioned reward and attenuates cocaine-induced activation of the prefrontal cortex in adulthood

Hannah Kim - UC San Diego
Mentor: Professor Nicholas Spitzer
Validating a Chemogenetic and Optogenetic approach to study Neurotransmitter Switching

Gordon Ye - UC San Diego
Mentor: Dr. Eric Zorrilla
A Genome-Wide Association Study of Problematic Alcohol Use using Whole-Genome Sequencing Data from the National Institutes of Health All of Us Research Program and UK Biobank

Sevim Bianchi - UC San Diego
Mentor: Dr. Sandra Sanchez-Roige
CADM2 is Implicated in Impulsive Personality and Numerous Other Traits by Genome- And Phenome-Wide Association Studies in a multi-ancestral cohort comprising up to 3 million individuals

Hailey Adney - San Diego State University
Mentor: Dr. Jillian Wiggins
Childhood Adversity as a Moderator for Irritability-Related Reward Processing

Panel 35: Psychology and Development

Zoom Room: Barrio Logan
Thursday 1:00 PM – 2:15 PM
Moderator: Ramiro Frausto

Angie Gross - UC San Diego
Mentor: Dr. Lindsey Powell
Examining the role of utility in ownership judgments

Victoria Fawcette - University of California Northridge
Mentor: Dr. Powell
Infants Understanding and Expectations of Ownership

Isabel Herrera Guevara - UC San Diego
Mentor: Dr. Lindsey J. Powell
Emotion responses following failed goals

Rosalba Bonilla - University of San Diego
Mentor: Dr. Kristen McCabe
Parents' Opinions About Behavior Parent Training Techniques Designed to Improve Child Behavior

Kelly Rodriguez - California State University Northridge
Mentor: Dr. Prashant Bharadwaj
Mental Health Service Utilization by Race: A Examination of Household Income, Emotional Care, and Family Involvement Factors

Panel 36: Social Behavior and Decision-Making

Zoom Room: Imperial Beach
Thursday 1:00 PM – 2:15 PM
Moderator: Samantha Ayoub

Srushti Naik - UC San Diego
Mentor: Dr. Andrea Chiba
Do rats priviledge neediness or familiarity in prosocial decision making?

Alexandra Garcia - UC San Diego
Mentor: Professor Kay Tye
Investigating the impact of social homeostasis on social rank representations in the medial prefrontal cortex

Faith Aloboudi - UC San Diego
Mentor: Dr. Kay Tye
Social Exclusion Modifies Behavioral Responses to and Neural Representations of Physical Pain

Jennifer Alvarez - UC San Diego
Mentor: Christina Gremel
The role of Experience on Decision-making

Thursday: Afternoon Session II

Panel 37: Computer Science 2

Zoom Room: University City
Thursday 2:25 PM – 3:40 PM
Moderator: Mai ElSherief

Jenelle Truong - UC San Diego
Mentor: Professor Mai ElSherief
Detection of Mental Burnout Risk Factors Across Reddit Online Communities

Karrisa Lee - UC San Diego
Mentor: Professor Niema Moshiri
Accelerating Microbiome Sequencing & Analysis

Amandeep Kaur Singh - University of Massachusetts Amherst
Mentor: Dr. Debashis Sahoo
OrgaTuring: AI Deciphers Organoids Towards Futuristic Healthcare

Wanting Mao and Cindy Wang - UC San Diego
Mentor: Dr. Imani N. S. Munyaka
The Impact of Security-Related Chatbot on User's Mental Model

Panel 38: Badly Behaving Bacteria

Zoom Room: Pacific Beach
Thursday 2:25 PM – 3:40 PM
Moderator: Colleen McHugh

Kit Fong Cheung - CSU Northridge
Mentor: David Gonzalez
Understanding the conserved role of S protein across pathogenic streptococcal species

Brooke Johnson - UC San Diego
Mentor: Dr. Fabian Rivera-Chávez
Phage susceptibility of Vibrio Cholerae under cholera toxin-inducing conditions

Jina Lee - UC San Diego
Mentor: Dr. Joseph Pogliano
Optimization of a Nucleus-Forming Phage for Molecular Applications

Michelle Nacayama - UC San Diego
Mentor: Soumita Das
The Interactions of Endosomal Proteins and ELMO1 Play a Role in the Internalization of Salmonella

India Robinson - Southern University at New Orleans
Mentor: Conor Caffrey
How potential drug candidates/compounds can kill parasites

Panel 39: Genetics 2

Zoom Room: Mission Hills
Thursday 2:25 PM – 3:40 PM
Moderator: Lakshmi Batachari

Cherish Alex-Wele - Xavier University of Louisiana
Mentor: Shanna Newton Lavalle
Causal Genetic Variants Associated with Type 1 Diabetes Susceptibility

Abdullah Ashiq - UC San Diego
Mentor: Dr. Xin Jin
In vivo genetic screening to uncover molecular mechanisms of ASD

Allison Delehoy - UC San Diego
Mentor: Dr. Bryan Sun
The Genetic Causes of Glomuvenous Malformations

Yuqi Wang - UC San Diego
Mentor: Amit Majithia
Identifying NAFLD associated genes by genomic characterization through hepatic steatosis simulation

Panel 40: Botany 1

Zoom Room: Kensington
Thursday 2:25 PM – 3:40 PM
Moderator: VinSché Gray

Shoreh Ketabian - Mesa College
Mentor: Dr. Alisa Huffaker
Phosphorylation of Asparaginase modifies the innate immune responses in Arabidopsis thaliana

Kristal Lam - UC San Diego
Mentor: Professor Elsa Cleland
Tradeoff of Photosynthetic Rate and Water Use Efficiency of Native Plants

Jesus Peng Zhao - UC San Diego
Mentor: Dr. Jazz Dickinson
Characterization of a novel role of citrate mediated root development in Arabidopsis thaliana.

Siena Schumaker - UC San Diego
Mentor: Dr. Eric Schmelz
Defining complex interactions between maize growth and defense pathways

Evinn Shelton - Xavier University of Louisiana
Mentor: Dr. Alisa Huffaker
What metabolites do maize plants produce to defend itself from microbes

Panel 41: Medical Applications of Nanoengineering

Zoom Room: North Park
Thursday 2:25 PM – 3:40 PM
Moderator: Jessica Affonso de Oliveira

Emmie Yao - UC San Diego
Mentor: Dr. Shaochen Chen
3D Bioprinted Ovarian Cancer Model for Investigation on CPMV Reconditioned Tumor Microenvironment

Gilda Castellanos - CSU San Marcos
Mentor: Shaochen Chen
CPMV Induced Phagocytosis in Ovarian Cancer (OvCa) Tumor-Associated Macrophage (TAM) Spheroids.

Christine Oh and James Gow - UC San Diego
Mentor: Dr. Michael Sailor
Development and Characterization of Fusogenic Porous Silicon Nanoparticles for siRNA Delivery for the Treatment of Retinal Neovascularization

Alessia lucrezia Fenaroli, Viola Bertolotti, and Alessia Sambugaro - University of Milan "la statale", Università degli studi di Milano, University of Verona
Mentor: Dr. Michael J Sailor
Porous silicon nanoparticles coated with hyaluronic acid for targeted cancer therapy

Panel 42: Ecology: Critters

Zoom Room: Hillcrest
Thursday 2:25 PM – 3:40 PM
Moderator: Stephanie Nehasil

Christine Frazier - UC San Diego
Mentor: Diana Rennison
Exploring morphology and gut microbiota diversity across threespine stickleback populations showing repeated shifts in trophic ecology

Oscar Partida - UC San Diego
Mentor: Terence Hwa
Bacterial Sensation and Aggregation; Deciphering Chemical Language of Particle Associated Marine Bacteria

Hope Romero - University of San Diego
Mentor: Kate Boersma
Macrophytes in the Anza Borrego Desert State Park

Alejandra Williams - UC San Diego
Mentor: Professor Chih-Ying Su
Neuromodulatory impact of protein-rich diet on the behaviors of female Drosophila

Tristie Le - UC San Diego
Mentor: David Holway/Jess Mullins
Pollination Services: Is it really a native vs non-native competition?

Panel 43: Medical Disparities 2

Zoom Room: Little Italy
Thursday 2:25 PM – 3:40 PM
Moderator: Amy Non

Anna Rapp - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Cancer Disparities Exacerbated by Inaccessible Scientific Literature

Victoria Herrera - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Neglected Endemics: How the Lack of Worm Research and Education has Contributed to Disparities in Bladder Cancer in Areas Endemic for Schistosomiasis

Zaira Leal Hernandez - UC San Diego
Mentor: Dr. Amy Non
Examining Preterm Birth Rates by Race/Ethnicity Before and During the COVID-19 Pandemic

Duncan Hong - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Disparities in Multiple Myeloma Treatment and Research in African Americans

Brenda Ochoa - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Calling the Shots: Mechanisms Behind Alcohol-Induced Breast Cancer to Explore Disparities Concerning Sexual Minority Women

Panel 44: Biomedical Science 2

Zoom Room: Ocean Beach
Thursday 2:25 PM – 3:40 PM
Moderator: Nicole Scharping

Farah Haleem - UC San Diego
Mentor: Dr. Tracy Harrison
Role of Testosterone on Luteinizing Hormone Level and Menstrual Cycle in Transgender Men

Sharon Lee - UC San Diego
Mentor: Dr. Xi Fang
Mitochondrial stress induces an HRI-eIF2a pathway protective for cardiomyopathy

David Ma - UC San Diego
Mentor: Dr. Daniel Hollern
Investigation into Autoantibody Response against Gene X in Triple Negative Breast Cancer

Albert Nguyen - UC San Diego
Mentor: Dr. Priyadarshini Pantham
Placental extracellular vesicles and small RNA expression profiling in pregnancy and preeclampsia

Jessica Jang - UC San Diego
Mentor: Dr. Kellie Breen Church
Brainstem and Hypothalamic Neuronal Activation during Immune Stress-Induced Hyperglycemia

Panel 45: Electrical and Computer Engineering

Zoom Room: City Heights
Thursday 2:25 PM – 3:40 PM
Moderator: Rohan Pote

Satvik Singh - UC San Diego
Mentor: Tse Nga Ng
Developing High Energy Super Capacitor for Wide temperature Range

YIZHANG LIU - UC San Diego
Mentor: Ke Sun, Professor Xinyu Zhang
Self-Supervised Egocentric Ambient Intelligence

Rahul Sahjwani - UC San Diego
Mentor: Dr. Piya Pal
Machine Learning for Inverse Problems

Hua Chai and Sky Hung - UC San Diego
Mentor: Professor Duygu Kuzum
Nonvolatile Memory Devices For Neuromorphic Computing

Panel 46: Neurodegeneration

Zoom Room: Point Loma
Thursday 2:25 PM – 3:40 PM
Moderator: Deryl LeDuke

Mayra Mendiola - UC San Diego
Mentor: Dr. Susan Ackerman
Epistatic interaction between SNPs on nTr22 and nTr20 mutants leads to enhanced neurodegeneration

Samantha Mak - UC San Diego
Mentor: Dr. Nicole Coufal
Role of Microglia in Neurodegenerative Langerhans Cell Histiocytosis

Gabriela Ramirez - CSU San Marcos
Mentor: Nicole Coufal
Creating neurodegenerative disease models from iPSC-derived microglia

Ethan Williams and Shannon Lopez - Xavier University of New Orleans, California State University San Bernardino
Mentor: Dr. Chengbiao Wu
Identifying Abnormalities Present in Neurodegenerative Lysosomes and Mitochondria

Panel 47: Critical Race Theory

Zoom Room: Barrio Logan
Thursday 2:25 PM – 3:40 PM
Moderator: Amy Bintliff

Kyleen Martin - UC San Diego
Mentor: Dr. Lilly Irani and Dr. Stuart Geiger
Data as Property

Fatima Maciel - UC San Diego
Mentor: Dr. Gerardo Arellano
Constitutionality of Critical Race Studies in K-12 Education

Katherine Cobos - UC San Diego
Mentor: Dr. Gerardo Arellano
Latinx Cuentos: An Archival Community Project From Coast to Coast

Amaya Parks - Spelman College
Mentor: Dr. Mary Blair-Loy
Perspectives on Diversity and Inclusion Practices in Universities– A Case Study

Lisa Phung - UC San Diego
Mentor: Dr. Amy Bintliff
Responding to Injustice: Can Strategic Implementation Create Social Change?

Panel 48: Emotions, Arousal, and Social Interactions

Zoom Room: Imperial Beach
Thursday 2:25 PM – 3:40 PM
Moderator: Tom Brown

Jonah Bryan - UC San Diego
Mentor: Dr. Elizabeth Eikey
Understanding Social Media Addiction and Interaction Patterns: A Qualitative Study

Tatiyana Kazlova - UC San Diego
Mentor: Dr. Gail Heyman
Understanding the Psychological and Social Dynamics of Disappointing Gifts

Julie Eitzen - UC San Diego
Mentor: Dr. Cassandra Vieten
Exploring Awe's Outcomes: A Retrospective Qualitative Thematic Analysis

Francesca Massa - UC San Diego
Mentor: Dr. Kay Tye
Delineating the acute effects of psilocybin on behavior amid conflicting cues of reward and punishment

Roman Figueroa - UC San Diego
Mentor: Thomas Brown
Attentional States and Their Influence on Sexual Arousal in Transgender, Nonbinary, and Gender Expansive Populations

Friday: Morning Session I

Panel 49: Robotics and Autonomous Vehicle Controls

Zoom Room: University City
Friday 9:10 AM – 10:25 AM
Moderator: Ruchita Reddy

Albert Miao - UC San Diego
Mentor: Associate Professor Michael Yip
A Semantic-aware Surgical Perception Framework for Robotic Tissue Manipulation

Anish Kulkarni - UC San Diego
Mentor: Dr. Yang Zheng
Smoothing Traffic Flow via Autonomous Vehicles: Python Implementation and Numerical Experiments

Jim Solomon - UC Los Angeles
Mentor: Nikolay Atanasov
Autonomous Car Path Tracking with PID Control

Adin Ackerman, Jiawen Yu, and Anthony Tseng - UC San Diego
Mentor: Professor Nikolay Atanasov
Hardware Design and Software Setup for Autonomous Quadrotor Robots

Panel 50: Bioengineering and Medicine 2

Zoom Room: Pacific Beach
Friday 9:10 AM – 10:25 AM
Moderator: Jainish Chauhan

Queenie Lin - UC Riverside
Mentor: Ester J. Kwon
Severity- and Sex-Dependent Biodistribution of an Activity-Based Nanosensor for Traumatic Brain Injury

Alison Lao - UC San Diego
Mentor: Dr. Shaochen Chen
3D printing elastomer-based biomaterial for volumetric muscle loss

Errysteinn Frondarina - Southwestern College
Mentor: Dr. Ester Kwon
Formulating Lipid Nanoparticles with Targeting Peptides

Laura Charria - UC San Diego
Mentor: Professor Michael J. Sailor
Hybrid Porous Silicon Microparticle and Polycaprolactone Drug Delivery System for Revascularization of the Anterior Cruciate Ligament Post Surgically

Nathaniel Cabral and Cindy Lai - UC San Diego, California State University Long Beach
Mentor: Dr. Michael Sailor
Hybrid Porous Silicon Nanoparticle and Polycaprolactone Drug Delivery System for Revascularization of the Anterior Cruciate Ligament Post Surgically

Panel 51: Housing and Homelessness

Zoom Room: Mission Hills
Friday 9:10 AM – 10:25 AM
Moderator: Michel Estefan

Leslie Vallejo-Avila - UC San Diego
Mentor: Gerardo Arellano
Analyzing gentrification: its impact on the Latinx experience in San Francisco's Mission district

Gabriella Flores - University of San Diego
Mentor: Dr. Melissa James
Not finalized, will submit with the abstract!!

Ruijie Zhong - UC San Diego
Mentor: Juan Herreño
Comparison of Change in Housing Market After Covid-19

Jean Jeremie - University of San Diego
Mentor: Dr. Juliana Maxim
Haitian Migrant Housing Stability in San Diego

Panel 52: Botany 2

Zoom Room: Kensington
Friday 9:10 AM – 10:25 AM
Moderator: Stephanie Nehasil

Connor Davies - UC San Diego
Mentor: Eric Schmelz
Discovering core regulators of plant specialized metabolism

Haoyang Hu - UC San Diego
Mentor: Dr. Julian Schroeder
Exploring Potential Mutant Candidate T-DNA Lines of Cadmium-Induced Arabidopsis thaliana's genes

Lauren Huey - UC San Diego
Mentor: Dr. Alisa Huffaker
Beta-selinene derived metabolites produced by maize roots alter soil microbiome

Daniella Tu - UC San Diego
Mentor: Dr. Carlisle Bascom Jr.
Determining the role of auxin-activated transcription factors in development and drought response of Physcomitrium patens

Ethan Young - UC San Diego
Mentor: Professor Yunde Zhao
The Role of ESR Transcription Factors in Plant Growth and Development

Panel 53: Medical Disparities 3

Zoom Room: North Park
Friday 9:10 AM – 10:25 AM
Moderator: Kellie Church

Joshua Hartman - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Importance of Screening and Potential Biomarkers for Multiple Myeloma

Diane Thai - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Exploring the Pain Experience of Asian American Cancer Patients

Paola Anguiano Quiroz - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Latina Women and Cervical Cancer Disparities

David Castillo - UC San Diego
Mentor: Abigail, Andrews
Intergenerational Trauma Within Young Latino Men

Xiomara Gaeta Agreda - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Exploring Social Media and Influencers' Impact on Breast Cancer Awareness

Panel 54: Materials Science and Nanoengineering 1

Zoom Room: Hillcrest
Friday 9:10 AM – 10:25 AM
Moderator: Manas Likhit Holekevi Chandrappa

Keying Deng - UC San Diego
Mentor: Professor Jonathan K Pokorski
Understanding complex phenotypes generated by 3D Printed Biocomposite Hydrogels with diverse functional cyanobacterial species

Karla Leon Zuñiga - CIDETEQ
Mentor: Professor Michael Sailor
Catalytic hydrolysis performance of enzyme-loaded porous Silicon nanoparticles in a hydrogel system

Jordan Bunch - UC San Diego
Mentor: DR. DARREN J. LIPOMI
The Influence of Crosslinking Semiconducting Polymers on the Mechanical Properties and Performance in Organic Photovoltaics

Alexander Yang Yang - UC San Diego
Mentor: Professor Prabhakar Bandaru
Measurement of Thermal Conductivity of Films and Novel Materials through the Three-Omega Method

Ian Douglas and Han Chi - University of Rochester, UC San Diego
Mentor: Dr. Michael Sailor
Hydrogel Contact Lenses Loaded with Zirconium (oxo) Cluster Catalysts for Protection from Chemical Warfare Agents

Panel 55: Physics

Zoom Room: Little Italy
Friday 9:10 AM – 10:25 AM
Moderator: Dr. Adam Burgasser

David Imig - UC San Diego
Mentor: Professor Daniel Green
Imprints of Massive Neutrinos in the Phase of the Cosmic Microwave Background

Emily Pan - UC San Diego
Mentor: Dr. Liang Yang
The Search for Neutrinoless Double Beta Decay: Development of a Cryoprobe for Barium-tagging R&D

Mohammedali Mohamed - University of San Diego
Mentor: Gregory Severn
Does presheath ion flow affect electron density mea- surements for Langmuir probes near boundaries?

Adrian Woodley - University of San Diego
Mentor: Dr. Greg Severn
Does sheath expansion around Langmuir probes used near material boundaries depend only on the presheath ion flow affect electron density measurements for Langmuir probes near boundaries?

Panel 56: Misfolded Proteins

Zoom Room: Ocean Beach
Friday 9:10 AM – 10:25 AM
Moderator: Ximena Garcia Arceo

Raghad Albawab - UC San Diego
Mentor: Dr. Sonya Neal
Characterization of Rhomboid Protease RHBDL4

Casey Horn - UC San Diego
Mentor: Dr. Sonya Neal
Rhomboid Protease Dfm1: Its Role in the Mitigation of Cytotoxic Membrane Stress

Jasmine Jung - UC San Diego
Mentor: Dr. Sonya Neal
Determining the Mechanism of Chaperone Function for the Yeast Derlin Dfm1

Vikash Muruhathasan - UC San Diego
Mentor: Dr. Hemal Patel
Using Nano-pillars to Probe Membrane Repair Kinetics as a Function of Caveolin Proteins

Jennifer Rodriguez - UC San Diego
Mentor: Dr. Samara Reck-Peterson
Understanding the mechanism by which Lis 1 activates dynein

Panel 57: Mechanical Engineering, Robotics, and Controls

Zoom Room: City Heights
Friday 9:10 AM – 10:25 AM
Moderator: Michael Ishida

Jose Mercado - UC San Diego
Mentor: Ralph Keeling
Creation and Evaluation of the Viability of an Air Pressure Driven Affordable Water Flow Rate Control System

Allyson Chen - UC San Diego
Mentor: Professor Michael T. Tolley
Hydraulic Control Board for Untethered Underwater Soft Robots

Judy Mohamad - UC San Diego
Mentor: Dr. Sylvia Herbert
Residual Dynamics Learning Using Bayesian Uncertainty

Jayden Wood - UC San Diego
Mentor: Dr. Michael Tolley
Soft nozzle for steering for a cephalopod-inspired swimming robot

Panel 58: Chemistry and Environmental Ecology

Zoom Room: Point Loma
Friday 9:10 AM – 10:25 AM
Moderator: Qi Su

Sachel Jetly - UC San Diego
Mentor: Professor Michael Sailor
Optimizing Electrochemical Etching Parameters of Silicon for Preparation of Polypyrrole-Coated Silicon Core-Shell Microparticles in Lithium-Ion Coin Cell Battery Anodes

Thuy Khanh Nguyen - Santa Ana College
Mentor: Dr. Michael D. Burkart, Dr. Stephen Mayfield
3D printing filaments from renewable and biodegradable thermoplastic polyurethanes (TPUs)

Allison McKenzie - CWRU
Mentor: Dr. Steinmetz
Complementary binding domains allow for loading of agrochemicals onto VNPs

Ruby Gamboa - UC San Diego
Mentor: Dr. Michael Burkart
Protein Purification and Analysis of Pseudomonas Bacteria

Justin Han - UC San Diego
Mentor: Dr. Sarah Aarons
Column Chemistry Calibration

Panel 59: Cancer Treatment

Zoom Room: Barrio Logan
Friday 9:10 AM – 10:25 AM
Moderator: Helen Wedegaertner

Varsha Beldona - UC San Diego
Mentor: Dr. Weg Ongkeko
Small nucleolar RNAs in the diagnosis of head and neck cancer

Philip Emmanuele - UC San Diego
Mentor: Professor Jeff Hasty
Adaptive Laboratory Evolution and Synchronized Lysis as tools for cancer therapy

Daniel John - UC San Diego
Mentor: Dr. Weg Ongkeko
Characterization of the intratumoral microbiome in Papillary Thyroid Carcinoma

Joshua Tran - UC San Diego
Mentor: Dr. Georgia Sadler
Exploring the Interface Between Cancer and the Microbiome

Panel 60: Neuroscience 3

Zoom Room: Imperial Beach
Friday 9:10 AM – 10:25 AM
Moderator: Jennifer Castro Garcia

Romona Dong - UC San Diego
Mentor: Professor Nicholas Spitzer
Analysis of the Effects of Corticosterone on Neurotransmitter Switching and Sustained Fear in Mice

Jason Yang - UC San Diego
Mentor: Professor Alexander Kauffman
Investigation of the Necessity of RP3V Kiss1 Neurons during the preovulatory for GnRH/LH Surge in Female Mice

Yunjae Hur - UC San Diego
Mentor: Dr. Matthew Shtrahman
rAAV-induced Toxicity in Neural Progenitor Cells

Edwin Ruiz - UC San Diego
Mentor: Alysson Muotri
Strategies that analyze networks in brain organoids to promote the growth of more complex neural tissue

Rogelio Castro - UC San Diego
Mentor: Dr. Kay Tye
Neurotensin and Rabies Tracing

Friday: Morning Session II

Panel 61: Nanoengineering

Zoom Room: University City
Friday 10:35 AM – 11:50 AM
Moderator: Ruchita Reddy

Christina Vialva - San Diego State University
Mentor: Dr. Maurice Retout/Dr. Jesse Jokerst
SARS-CoV-2 enzyme detection with a matrix insensitive nanoplasmonic platform

Daniel Esterkin - The Pennsylvania State University
Mentor: Professor Jinhye Bae
Programmable shape deformation of temperature-actuated Graphene Oxide poly(N – isopropylacrylamide) composite hydrogels

Jaden Cramlet - UC San Diego
Mentor: Dr. Darren Lipomi
Solid Phase Deposition of Hole Transport Layers in Perovskite-Silicon Tandem Photovoltaics

Diego Contreras Mora - Texas A&M University
Mentor: Andrea Tao
Investigation of the effects of solvents on silver nanocube stability over time

Emily Infante-Guzman and James Young - UC San Diego
Mentor: Dr. Tod Pascal
Programmable Assembly of Binary Sized Gold Nanoparticles

Panel 62: Electrical and Computer Engineering and the Environmental Ecology

Zoom Room: Pacific Beach
Friday 10:35 AM – 11:50 AM
Moderator: Mahdi Morafah

Chenxing Qiu - UC San Diego
Mentor: Hanh-Phuc Le
A battery charger converter circuit with charge measurement (Coulomb counter) and maximum power point tracking for solar energy system.

Kai-Wen Cheng - UC San Diego
Mentor: DR. YUANYUAN SHI
Carbon Aware EV Charging

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

Melina Dimitropoulou Kapsogeorgou - UC San Diego
Mentor: Professor Curt Schurgers
Radio Telemetry Tracking

Frank Chaqueco - UC San Diego
Mentor: Dr. Curt Schurgers
Radio Telemetry Tracking

Panel 63: Education and Work

Zoom Room: Mission Hills
Friday 10:35 AM – 11:50 AM
Moderator: Michel Estefan

Brienneth Durazo - UC San Diego
Mentor: Dr. Amy Bintliff
Reframing School Discipline: A Trauma-Informed Approach

Samantha Harmer - UC San Diego
Mentor: Harvey Goldmen
The Effects of Mentoring on Former Foster Youth

Rita Ewaz - UC San Diego
Mentor: Amy Bintliff
Socioeconomic Status and Student Academic Resilience in Higher Education During The COVID-19 Pandemic

Kaia Godsey - Spelman College
Mentor: Dr. Mary Blair-Loy
Career Trajectories of Women CEOs

Kamen Redfield and Sukham Sidhu - UC San Diego
Mentor: Dr. Christine Alvarado
Early Research Scholars Program: Analyzing Correlation with Academic Outcomes in Computer Science Students

Panel 64: Memory

Zoom Room: Kensington
Friday 10:35 AM – 11:50 AM
Moderator: Jennifer Castro Garcia

Farah Farouq - UC San Diego
Mentor: Dr. Stefan Leutgeb
Assessing the properties and potential mechanisms of time cells in working memory

Luke Sztajnkrycer - UC San Diego
Mentor: Dr. Marcelo Mattar
Investigating the effect of structured repetition on prediction and recall

Armine Barsegyan - California State University, Northridge
Mentor: DR. Anastasia Kiyonaga
Working Memory and Distractors

Sharai Barrera - UC San Diego
Mentor: Dr. Anastasia Kiyonaga
Exploring Prioritization and Distraction in Working Memory

Mary Ellen Garcia - California State University, San Bernardino
Mentor: Dr. Kelsey Thomas
Associations of memory self-awareness and external locus of control in unimpaired and MCI older adults

Panel 65: Medical Disparities 4

Zoom Room: North Park
Friday 10:35 AM – 11:50 AM
Moderator: Georgia Sadler

Amy Loeber - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Pediatric Cancers and Microplastic Levels in Community Water Sources

Ida Nikjeh - UC San Diego
Mentor: Dr. Georgia Robins Sadler
How Marginalizing the SWANA Community Can Be Damaging to Their Health Disparities and Clinical Studies

Sara Gonzalez - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Telehealth exacerbates disparities in breast cancer care and education among Hispanic women

Bettina Suarez Davila - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Higher Rates of Prostate Cancer Observed in Latino Men in the United States than Latino Men in Mexico

Ava Bayley - UC San Diego
Mentor: Dr. Samantha Hurst
Transgender and Gender Non-Binary Youths' Perspectives on the Use of Telemedicine in Gender-Affirming Healthcare

Panel 66: Materials Science and Nanoengineering 2

Zoom Room: Hillcrest
Friday 10:35 AM – 11:50 AM
Moderator: Truong Nguyen

Steven Meikle - University of Florida
Mentor: Dr. Ping Liu
Solid-State Synthesis of Iron Fluoride Nanocomposites as Cathode Materials for Lithium Ion Batteries

Serena Geroe - Smith College
Mentor: Professor Michael Sailor
Detoxification of Chemical Warfare Nerve Agents via Zirconium Cluster Catalysis

Paola Méndez González - University of Puerto Rico at Mayagüez
Mentor: Jonathan Pokorski
Coupling of derived-norbornene polymer to lignin as a model for plant cell wall modification

Joeun Kim, William Chan, and Kara Lui - UC San Diego, UC San Diego, Northeastern University
Mentor: Dr. Michael Sailor
Investigating Effective Solutions for Homogenous Nanoparticles by Freeze Fracturing of Perforated Silicon

Panel 67: Astrophysics

Zoom Room: Little Italy
Friday 10:35 AM – 11:50 AM
Moderator: Dr. Adam Burgasser

Sonata Simonaitis-Boyd - UC San Diego
Mentor: Dr Shelley Wright
"They Grow Up So Fast!": Studying Galaxy Evolution Over Cosmic Timescales

Angelica Whisnant - California State Polytechnic University, Pomona
Mentor: Dr. Adam Burgasser
Atmosphere and Evolutionary Models for Stellar Populations in 47 Tuc

Alison McAnally - UC San Diego
Mentor: Dr. Kaixuan Ni
Investigating Electron Bursts and S2 Signal Rates

Malina Desai - UC San Diego
Mentor: Dr. Adam Burgasser
Investigating Ultracool Binary Systems Using Random Forests

Julissa Villalobos Valencia - UC San Diego
Mentor: Dr. Adam J. Burgasser
Using Infrared Spectral Analysis Tools to Study an Ultra-cool Dwarf Benchmark Companion

Panel 68: Ecology: Extreme Water Conditions

Zoom Room: Ocean Beach
Friday 10:35 AM – 11:50 AM
Moderator: Stephanie Nehasil

Sandy Nguyenphuoc - UC San Diego
Mentor: Dr. Jeff Bowman
The effect of heterotrophic prokaryotes on the growth rates of halophilic algae Dunaliella salina in varying salinities

Claire Wellenkamp - UC San Diego
Mentor: Carolyn Kurle
Counting Calories: California Current Ecosystem Prey Fish Quality through the Marine Heat Wave

Imanol Ulloa - UC Santa Barbara
Mentor: Jeff Bowman
Possible effects of pH on Alkaline Phosphatase Activity in the coastal waters of Southern California

Wenbo Ding - UC San Diego
Mentor: Dr. Sara Jackrel
Assaying expression of Heat Shock Proteins in the harmful cyanobacterium Microcystis aeruginosa under heat stress associated with climate change

Ria Bhabu - UC San Diego
Mentor: Professor Martin Tresguerres
Warmer temperatures accelerate developmental and yolk sac consumption rates of larval white seabass

Panel 69: Glucose

Zoom Room: City Heights
Friday 10:35 AM – 11:50 AM
Moderator: Kellie Church

Hayelin Jung - UC San Diego
Mentor: Dr. Kellie Church
How Stress Affects Blood Glucose Levels

Laura Long - UC San Diego
Mentor: Dr. Simon Schenk
Effects of Formin 2 Inhibition on Insulin-Stimulated Glucose Uptake in Skeletal Muscle.

Sharanya Sriram - UC San Diego
Mentor: Dr. Maike Sander
Characterizing the islet cellular landscape during diet-induced progression towards type 2 diabetes

Timothy Yuan - UC San Diego
Mentor: Dr. Alan Saltiel
AMPK Mediates TORC-2 Dephosphorylation and Migration into Nucleus in Response to cAMP

Andrew Zhang - UC San Diego
Mentor: Dr. Gulcin Pekkurnaz
O-GlcNAcylation Flux's Effect on Glucose-6-phosphate Dehydrogenase Activity

Panel 70: Cellular Biology

Zoom Room: Point Loma
Friday 10:35 AM – 11:50 AM
Moderator: Maximilian Heeg

Laura Biggs - UC San Diego
Mentor: Dr. Ananda Goldrath
Investigating the Role of Retinoic Acid in Small Intestine Tissue Resident Memory CD8 T Cell Formation

Vicky Chen - UC San Diego
Mentor: Dr. Gene Yeo
Increasing Protein Expression Through mRNA Localization to the Mitochondria in Mammalian Cells

Katelyn Raney - UC San Diego
Mentor: Dr. Suresh Subramani
Investigating novel players impacting cellular peroxisome homeostasis.

Tessa Sterns - San Diego Miramar College
Mentor: Dr. Yu-Hwa Lo
Cell Protein Analysis Utilizing Capillary Array

Annika Sy - UC San Diego
Mentor: Dr. Joseph Pogliano
The subcellular organization of N4-like virus vB_EamP_Frozen infections

Panel 71: Lungs

Zoom Room: Barrio Logan
Friday 10:35 AM – 11:50 AM
Moderator: Julia Gauberg

Ailyn Alicea - UC San Diego
Mentor: Dr. Georgia Sadler
Does Reduced Lung Function decrease cancer survival rates?

Daniela Carrillo - UC San Diego
Mentor: Dr. Weg Ongkeko
Metastasis driven by snoRNA in non-small cell lung cancer

Shruti Magesh - UC San Diego
Mentor: Dr. Weg Ongkeko
The effect of behavioral and demographic risk factors on the infectivity and prevalence of the COVID-19 variants

Natalie Pok - UC San Diego
Mentor: Michelle Solomon
Expression of mast cell inflammatory mediators in the bronchoalveolar lavage of asthma patients

Kameswari Vedula - UC San Diego
Mentor: Dr. Weg Ongkeko
Analyzing clinical and genomic data from smoking-related HNSCC patients to examine smoking-influenced changes in tRNA expression

Panel 72: Oceanographic Sciences and Climate Change

Zoom Room: Imperial Beach
Friday 10:35 AM – 11:50 AM
Moderator: Zhe Jia

Diana Oliva Najarro - UC San Diego
Mentor: Dr. Sarah Purkey
Understanding the Equatorial Pacific Ocean Biogeochemistry and their Connection to El Niño and La Niña Events

Anshul Garde - UC San Diego
Mentor: Professor Curt Schurgers
Accelerometer and Magnetometer Calibration of an Oceanic Data Collection Platform

Elisa Prohroff - UC San Diego
Mentor: Dr. Jennifer Taylor
Mechanical integrity of Pandalus gurneyi exoskeleton in response to ocean acidification and ocean warming conditions.

Vine Blankenship - UC San Diego
Mentor: DR. AMATO EVAN
Characterizing Dust Size Distributions in the Surface Atmospheric Boundary Layer around the Salton Sea

Abstracts

Viren Abhyankar

Computer Science, UC San Diego
Undergraduate Research Scholarships
Mentored by Associate Professor Yiying Zhang

Memory-Constrained ML Optimizations

Parallelism of machine learning training is critical to improve throughput for large models in a distributed setting. While popular models may have expert-designed parallel execution plans, this does not scale. Previous work has focused on automatically generating a parallel execution plan given a model's computational graph and a corresponding device topology. These take advantage of algebraic transformations on operators and existing parallelism strategies such as data parallelism or model parallelism. However, these optimizations are semantic preserving; they do not affect the accuracy of the model. In this work, we explore parallelism with semantic non-preserving optimizations, such as quantization and sparsity. Semantic non-preserving optimizations can affect final model accuracy but represent significant savings in memory. There are two main challenges we tackle. First, these optimizations are model-specific but may not be operator-specific i.e. sparsity in layer 1 may have a different effect on accuracy than sparsity in layer 5. Second, accuracy must be taken into account when selecting a parallel execution plan, which can create an additional training bottleneck. To solve these problems, we present a novel algorithm guided by heuristics to narrow the search space and select a parallel execution plan that marginally sacrifices accuracy for substantial speedup in training and memory usage.

Adin Ackerman, Anthony Tseng, and Jiawen Yu

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Nikolay Atanasov

Hardware Design and Software Setup for Autonomous Quadrotor Robots

This project focuses on building and upgrading a fully functioning autonomous quadrotor robot.

The hardware used consists of sensors such as cameras and an inertial measurement unit (IMU) for visual-inertial odometry (VIO), a PX4 flight controller, an Intel NUC computer, motors, and a LiPo battery. Custom parts were designed and 3D-printed, such as a mount for the VIO hardware that allows the angle of the cameras to be adjusted, as

well as as a box to house the computer. Several connectors and a PCB were also made to simplify the wiring process and to power the entire assembly.

As for the software, this consists of installation of the robot operating system (ROS) and relevant drivers on the onboard computer to enable communication with the sensors and flight controller. Calibration of the flight controller and cameras, along with synchronization between the cameras and IMU were also done.

With the completion of these tasks, the quadrotor will be able to carry out simultaneous localization and mapping (SLAM), where the data collected from the sensors can be used for further research and experimentation in the fields of planning and controls.

Hailey Adney

Psychology, San Diego State University
IMSD
Mentored by Dr. Jillian Wiggins

Childhood Adversity as a Moderator for Irritability-Related Reward Processing

Due to proprietary information this abstract has been redacted.

Raghad Albawab

General Biology, UC San Diego
STARS
Mentored by Dr. Sonya Neal/Dr. Satarupa Bhaduri

Characterization of Rhomboid Protease RHBDL4

Rhomboid proteases are ubiquitous intramembrane serine proteases that directly cleave misfolded membrane substrates within the lipid bilayer. They have vast functions in growth factor signaling, mitochondrial homeostasis, protein quality control and parasite invasion. RHBDL4 is an essential mammalian rhomboid protease that is responsible for cleaving misfolded proteins in the membrane, implicated in several diseases such as cancer and Alzheimer's disease. However, Rhbdl4’s catalytic properties and substrate specificity hasn’t been characterized. Knowing the substrate and sequence preference for RHBDL4 activity could help find treatments for those diseases. To do so, we purified RHBDL4 both in active and inactive forms and identified a soluble fluoregenic peptide substrate. We further characterized various enzymatic properties of RHBDL4 with the final aim to identify the natural substrate specificity of RHBDL4 using multiplex substrate profiling by mass spectrometry. 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 for future drug targeting of this rhomboid protease.

Cherish Alex-Wele

Biology, Xavier University of Lousiana
STARS
Mentored by Shanna Newton Lavalle

Causal Genetic Variants Associated with Type 1 Diabetes Susceptibility

More than 122 million Americans are living with diabetes, the 7th leading cause of death in the United States. 1 in 3 adults have prediabetes and 1 in 5 adults do not know they have diabetes. There is currently no cure available and patients depend on lifelong insulin therapy to regulate sugar levels. Medical costs and lost work and wages for people with diagnosed diabetes total $327 billion yearly and are twice as high as for people who don't have diabetes. There are three main types of diabetes: type 1 diabetes, type 2 diabetes, and gestational diabetes- that is, while pregnant. This work focuses on type 1 diabetes mellitus (T1DM). The goal of this work is to delve into the genetic factors at play in the etiology of the disease. While we know the genetic variants associated with type 1 diabetes, we do not know which ones are causal. However, we know that a majority of these variants are located in non-coding regions of the DNA. Our hypothesis is that genetic variants located within cis-regulatory elements contribute to stress-mediated T1D susceptibility. Our methods will include star sequencing, plasmids, and electroporation transfections. The results of this research will help to further develop novel approaches to the current treatment of diabetes. As well, major research efforts are needed to achieve early diagnosis, prevent beta cell loss, and develop better treatment options to improve the quality of life and prognosis of those affected.

Ailyn Alicea

Public Health, UC San Diego
Multidisciplinary Approach to Reduce Cancer Disparat
Mentored by Dr. Georgia Sadler

Does Reduced Lung Function decrease cancer survival rates?

Coping with cancer and a second life-limiting severe disease usually results in a poorer prognosis for the cancer outcome. The treatment plans designed to manage two diseases are often complex and cumbersome. Diseases that reduce lung capacity have a particularly high risk of reducing cancer survival rates. The presence of chronic respiratory illness in cancer patients has been associated with increased mortality rates. Studies suggest that patients with respiratory diseases experienced an increase in vascular endothelial growth factors and transforming growth factors, and both promoted tumor growth and metastasis. This has been observed in patients with comorbidities such as asthma, Chronic Obstructive Pulmonary Disease, and bronchitis. Survival rates for lung cancer patients with COPD had lower outcomes and 54.5% survival compared to lung cancer patients without COPD of 69%. However, one study showed decreased mortality

rates among patients with small squamous lung cancer and asthma, raising the possibility of benefits from asthma drugs. Reducing the odds of developing comorbid illnesses for which there is potential to reduce their risk, is important. This review of the literature focused on the various triggers of lung inflammation experienced by adults and children living in California's Imperial Valley as a way to reduce that source of co-morbidity. Research articles between 2017 and 2022 related to Imperial Valley and surrounding areas were identified using PubMed, Google Scholar, and CINAHL databases. Search terms included Imperial Valley, asthma, and air quality. Additional information was identified through the research articles and clinical studies' reference lists.

Mohnish Alishala

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Christopher Glass

Loss of DNMT3A or TET2 leads to exacerbated inflammatory response in macrophages treated with uric acid crystals

Gout is the most common form of arthritis with increasing incidence in both developed and underdeveloped countries. The risk factors for increased gout predispose to higher serum urate levels which leads to monosodium urate crystals (MSUc) deposition in joints. This causes the activation of inflammasome in macrophages and acute episodes of gout flare. Recent epidemiological studies have pointed out that somatic mutations in DNMT3A or TET2 exacerbated damage induced by MSUc during gout flares. Our preliminary data indicates that DNMT3A and TET2 are deregulated during the response of macrophages to MSUc. However, even though some studies have yielded mechanistic insights into how MSUc regulate the response of macrophages during gout flares, the detailed mechanism of gouty cytokine production by innate immune cells remains unclear. In my project, I aim to characterize how DNMT3A and TET2 regulate the epigenetic landscape and transcriptomic profile of macrophages in response to MSUc. CRISPR/Cas9 gene editing will be used to generate loss of function alleles for each factor. FACS sorting will be used to isolate single cells with homozygous mutations resulting in complete loss of function. Then, through bioinformatic means, I will be able to predict which signaling pathways and transcription factors are most likely to be activated in macrophages by MSUc. The proposed project will unravel the mechanism of more severe gout flares in individuals with DNMT3A or TET2 somatic mutations.

Faris Alkhalifah

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Karcher Morris

Design of a surface electromyography-enabled device for capturing a surgeon's ergonomic performance

As a result of prolonged poor postures during procedures, musculoskeletal disorders pose a significant problem to the surgical community. A survey conducted by Voss et al. (2016) showed that 90% of surgeons had previously experienced musculoskeletal symptoms during an operation. If not corrected, poor ergonomics during surgery can lead to future injury in the surgeon's career, forcing the surgeon into an early retirement.

Dong et al. (2014) developed a model based on surface electromyograms (sEMG) for obtaining a generalized muscular fatigue level by fusing the fatigue levels of muscles in a target area. In our study, the methods found in the literature are adapted to capture neck muscle fatigue. Using a cost-effective wearable sEMG, electrical muscle activity is captured over time. First, the potential difference between the two electrodes placed on the target muscle is amplified. The signal is then passed through a band-pass filter after which it is rectified. Finally, the signal is passed to a microcontroller and a connected computer for post-processing. MATLAB is used to show the general and localized relative drops in muscle activity. This data, if captured in a surgical setting, can inform the surgeon if their muscles are experiencing fatigue, i.e., that they are in a poor ergonomic position.

The design of the device and the methods of analyzing the signals will be further elaborated on during the presentation. In addition, we will discuss the pending clinical studies using our device and the improvements needed for that translational effort.

Faith Aloboudi

Neurobiology, UC San Diego
Colors of the Brain
Mentored by Dr. Kay Tye

Social Exclusion Modifies Behavioral Responses to and Neural Representations of Physical Pain

Social pain, the emotional pain caused by aversive experiences with one's social group, can have deleterious effects on both mental and physical health. However, we do not know the specific neural substrates where social and physical pain overlap in circuitry and how social pain is processed within the brain. Our project aims to understand how the anterior insular cortex (aIC), an area of the brain that has been shown to process social behavior and pain, processes experiences of social exclusion and how this process can be

affected by neuromodulators such as dopamine (DA) and endocannabinoids. To study social pain, we have established a novel social exclusion paradigm, which we refer to as the “FOMO” (Fear of Missing Out) Task and are using In vivo fiber photometry and biosensor imaging to investigate neuromodulatory signaling in the aIC during social exclusion. Lastly, to test how social pain can modulate physical pain, we are using different both mechanical and thermal nociceptive stimuli to assess pain behaviors after social exclusion. Altogether, our project hopes to understand how social exclusion is represented within the brain, and how social pain can modulate physical pain in order to increase efforts towards effective treatments relieving social pain.

Jennifer Alvarez

Psychology, UC San Diego
McNair Scholars Program
Mentored by Christina Gremel

Examining foraging-based decision-making under a naturalistic setting

Due to proprietary information this abstract has been redacted.

Ramina Amino

Biochemistry and biophysics, UC San Diego
STARS
Mentored by Gurol Süel

Investigation of B. subtilis spore and other bacterial species cell

Due to proprietary information this abstract has been redacted.

Juliet Anawalt and Astrid Pratt

Biology / Biochemisty, University of San Diego
USD Alice B Hayes Scholarship
Mentored by Dr. Joan Schellinger

Amino Acid-Derived Polymethacrylamides: A Potential Alternative Treatment of Multi-Drug Resistant Bacteria?

The growing epidemic of multidrug resistance (MDR) in bacteria poses a severe public health threat ranging from limiting treatment options to prolonging the process of approving new antibiotics. Possible substitutes for traditional antibiotics were antimicrobial peptides (AMPs) because of their low tendency to induce antibiotic resistance. While AMPs exhibit high selectivity and low cytotoxicity, these compounds are highly susceptible to proteolytic degradation and involve challenging synthesis. AMP-mimicking polymers were then developed which offer additional advantages such as lower cost and ease of chemical modification. The overarching goal of our lab is to

prepare a library of AMP-mimicking, lysine-derived polymers that allows for systematic structure-antimicrobial activity relationship studies. We will study the effects of altering the hydrophobic to hydrophilic ratio (benzyl versus acetyl, varying cationic densities and linker lengths), an important parameter in developing and evaluating antimicrobial agents. Specifically, our current work is focused on the preparation of the monomers via a two-step synthesis consisting of amide coupling via nucleophilic acyl substitution followed by the removal of the protecting groups. Results indicate that the coupling agents EDC and Oxyma provide moderate to high yield of the coupled products. Future work involves large scale reactions and polymerization of the synthesized monomers for antimicrobial evaluation.

Jake Anderson

Chemistry, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Michael K. Gilson

Improving the Generalized--Born Implicit Solvent Model

Estimating the binding free energy of protein--ligand systems is an integral part of modern drug discovery. To perform these computations quickly, water molecules are often represented implicitly by a single mathematical model. A popular implementation of implicit solvation is the Generalized--Born (GB) model. The GB model is computationally efficient but lacks accuracy against experimental hydration and binding data. To increase the accuracy of the model and help accelerate drug discovery, a new kernel function for the dielectric screening of implicit waters is developed. The pAPRika, OpenFF--Evaluator, OpenMM, and ForceBalance frameworks are employed to optimize and validate proposed kernel functions against experimental hydration and host--guest binding data.

Maria Angst

Environmental and Ocean Science, University of San Diego
McNair Scholars Program
Mentored by Dr. Drew Talley

Interannual Variation of Ichthyofaunal Utilization of a Man-Made Salt Marsh Creek in Mission Bay, California

Southern California's wetlands are drastically declining due to human activities. Increasingly, marsh restoration and creation are being used to mitigate such losses. This study used minnow traps to resample the ichthyofauna of a created marsh (Crown Point Mitigation Site; CPMS) and an adjacent natural marsh (Kendall Frost) in Mission Bay, California, 26 years following the marsh creation. These data were compared to data collected from 1995-1998, immediately after marsh creation, and data from 2021. Fishes captured included Fundulus parvipinnis, Gillichthys mirabilis, Acanthagobius

flavimanus, Ctenogobius sagittula, and Mugil cephalus. Species richness and dominance measures were higher in the natural relative to the created marsh. The size-structure of F. parvipinnis populations in the natural marsh were skewed towards larger sizes relative to those in the created marsh. These size differences were similar to 2021, but were opposite of those noted in the years immediately following marsh creation, suggesting that these represent long-term changes and not inter-annual variability. The changes in size structure appear to arise from differences in creek morphology between the created and natural systems, with the created marsh having become shallower through time. The differences in ichthyofaunal communities between the created and natural systems suggest that marsh and creek geomorphology may be affecting the suitability of habitat for resident fishes, and so should be more carefully considered when designing marsh restoration projects.

Paola Anguiano Quiroz

Pharmacological Chemistry, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Georgia Sadler

Latina Women and Cervical Cancer Disparities

Cervical cancer, most commonly caused by one of four variations of Human papillomavirus (HPV), is sexually transmitted. Despite the long-term availability of the Papanicolaou test, a method for identifying pre-cancer cervical cell changes, Latinas have higher cervical cancer incidence and mortality rates than other groups in the United States. This narrative review explored factors influencing Latinas' cervical cancer morbidity and mortality rates. Articles published in English and Spanish between 2014 and 2022 were identified using PubMed, CINAHL, EBSCOhost, and Google Scholar databases, using such keywords as: Latinas, women, cervical cancer, HPV, screening, morbidity, mortality, incidence, vaccines, Paps smear, and attitudes. Citations in eligible articles were evaluated for inclusion. Studies suggest that this ethnic disparity is correlated with low health literacy, limited access to readily available medical information, inadequate medical facilities, and cultural differences diminishing participation in preventive services and discouraging procedures requiring disrobing. The slow uptake of HPV vaccine for children within the Latino community, foreshadows an increase in future cervical cancer disparities within the Latino community, as previously non-vaccinated children become sexually active. By identifying and addressing these disparities, educational and behavioral interventions can be implemented, and their impact evaluated. Education specifically focused on continuing the uptake of HPV vaccine is critical to future reduction of cervical cancer, while promotion of the adherence to guidelines related to Paps smears can reduce evolving cancers.

Abdullah Ashiq

Molecular and Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by DR. XIN JIN

In vivo genetic screening to uncover molecular mechanisms of ASD

In recent years, human genetic studies on neurodevelopmental disorders, such as autism spectrum disorders (ASD), have tied these disorders to 'risk genes.' These inherited or de novo genetic variants significantly increase one's likelihood for developing these disorders. Several ASD-risk genes have been identified, yet the molecular mechanisms that lead to ASD-related changes across different brain cell types are still unclear. In vivo Perturb-seq, which Dr. Jin developed previously, allows us to clarify these mechanisms. Via CRISPR Cas-9, we can knock out a panel of genes simultaneously in prenatal forebrain progenitors and individually sequence postnatal, developed cells. As a result, we can discover the role of each gene in cell development, thus providing greater insight into the molecular mechanisms they regulate. However, ideal gRNAs must first be designed for each risk gene and be tested for its efficiency in gene editing. My project aims to discover efficient gRNAs to allow in vivo Perturb-seq for future genetic studies of ASD-risk genes. We will choose six pilot ASD-risk genes, according to recent literature in human genetics, and design three gRNAs to target each gene. These gRNAs will be cloned into lentiviral vectors and transfected into Neuro-2a cells. These cells will undergo library preparation and next generation genomic sequencing to test their frameshift mutation rate for each gRNA. Overall, our project will identify the gRNAs for in vivo Perturb-seq in investigating molecular changes related to ASD, providing a more comprehensive toolkit for future genetic studies.

Ethan Ashley

Bioengineering: Biotechnology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Christian Metallo

Developing a Platform for Studying the Effects of Altering Metabolism on the Function of Cellular Receptors

Metabolism encompasses all the chemical processes which are needed for a living organism to stay alive. Cellular receptors have many diverse roles in the cell ranging from physical sensation to controlling gene expression. Alterations in metabolic activity often correspond with diseased states such as cancers, diabetes, and neuropathies. The overarching goal is to establish a platform for altering cellular metabolism and determining how it affects cellular receptor function. TRPV1 is a well-studied ion channel that is responsible for pain and temperature sensation. TRPV1 opens in response to binding by capsaicin, as well as exposure to high temperatures and low pH, allowing

calcium ions to flow into the cell and leading to the sensation of pain. Abnormal TRPV1 expression and function is associated with neuropathy and many types of cancer.

We can study the altered function of cellular receptors, like TRPV1, by measuring the levels of ions in the cell. To achieve this, a cell culture system of the human colon cancer cell line, HCT 116, was established. Both wildtype cells and cells with TRPV1 knocked out were cultured to compare results between normal and reduced levels of the receptor respectively. Cells were then cultured with varying levels of nutrients like glucose, amino acids, and lipids. The effect of these conditions on ion channel activity were characterized using a fluorescence-based imaging technique that measures intra-cellular ion concentration. The goal is to identify conditions that affect activity in nutrient-metabolite ion channels and correlate these to ongoing in vivo studies of metabolism.

Belinda Avalos

Psychology, CSU Northridge
STARS
Mentored by Dr. John Wixted

Confidence and Accuracy in Eyewitness Testimonies

Eyewitness memory is widely believed to be unreliable because high-confidence eyewitness misidentifications played a role in 70% of more than 375 DNA exonerations of wrongfully convicted men and women. In addition, laboratory studies have often reported a weak relationship between eyewitness confidence and accuracy even when memory is tested under ideal conditions. This means that eyewitnesses make many errors whether they identify a suspect with low confidence or high confidence. The relationship was thought to be weak, even under ideal (low stress) conditions in the laboratory because the data showed that the correlation between confidence and accuracy was close to zero in many studies. However, in recent years, the field realized that the correlation is the wrong measure to use because it can mask a strong confidence-accuracy relationship. A recent reanalysis of the data using a more appropriate statistical approach shows that (1) confidence is instead strongly related to accuracy and (2) high-confidence IDs are highly reliable. These conclusions apply only to an initial test of memory using a proper lineup. Unfortunately, testing a witness's memory with a lineup unavoidably contaminates it. The fact that many eyewitnesses are known to have made high-confidence misidentifications in the courtroom (i.e., on the last test of memory instead of the first) has created the almost universal impression that eyewitness memory is unreliable. A new understanding in the field is that it is important to test a witness's memory of a suspect only once because eyewitness memory is reliable on that first test only.

Joe Avalos

Chemistry, University of San Diego
McNair Scholars Program
Mentored by Dr. Lauren Benz

Ball-milling to Promote Post-Synthetic Ligand Exchange in UiO-66

Metal-Organic Frameworks (MOFs) are highly porous crystalline solids composed of inorganic, secondary building units (SBUs) and organic ligands. MOFs have many applications, including gas capture, storage, drug delivery, and catalysis. Post-Synthetic Exchange (PSE) is a method of modifying the organic or metal components of preformed MOF nanoparticles following synthesis to incorporate additional functionality or to control surface chemistry. Typically, PSE occurs in a solution of chemically distinct but related ligand, and PSE time and temperature are adjusted to achieve the desired degree of incoming ligand incorporation. Herein, we utilize ball-milling as a physical means to achieve PSE, measuring bulk levels of ligand using energy-dispersive X-ray spectroscopy (EDX). The exchange amount varied depending on ball-milling conditions such as energy. The surface exchange was also explored as a function of ball-milling energy using X-ray photoelectron spectroscopy (XPS). These findings also demonstrate the feasibility of using ball-milling as a more environmentally friendly method of PSE when compared to traditional methods.

Myleah Avant

Psychology, Howard University
STARS
Mentored by Dr. Rodney Gabriel

Depression and Anxiety in Relation to Persistent Opioid Use

Opioids, while effective in relieving postoperative pain, can potentially be addictive. The U.S. Department of Health reported that 40% of opioid overdose deaths in 2016 involved a prescription opioid. The opioid epidemic poses a large caution for healthcare providers. In major spine surgery, specifically, opioids are prescribed for pain both preoperatively and postoperatively. Preoperative opioid use and other factors contribute to the possibility of chronic opioid use following surgery. Obtaining knowledge of patient factors that are predictive of chronic opioid use after spine surgery is essential. The objective of this study was to determine if there was an association between depression and/or anxiety with persistent opioid use (defined as ongoing opioid use more than 3 months after surgery) following major spine surgery. Data were collected from 551 patients at a single institution. Multivariable logistic regression was performed, which controlled for various confounders, to estimate the association. We reported the odds ratio (OR) and the 95% confidence interval (CI). This study found that depression was predictive of persistent opioid use after spine surgery in patients who were chronic opioid users before surgery,

(OR 2.13, 95% CI 1.040 - 4.069, P = 0.02). There was no association between anxiety and persistent opioid use. This study will help medical professionals better understand the specific factors - such as depression - that are predictive of persistent opioid use in patients with a chronic opioid use history undergoing major spine surgery.

Abhi Bagchi

Molecular Synthesis, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Francesco Paesani

Catalytic Versatility of Phosphorines

This research provides a comprehensive investigation in the synthesis and coordination chemistry of Phosphorines. The utility for a variety of organometallic complexes containing these ligands are analyzed through a range of catalytic transformations. Efforts were concentrated at better understanding substituent effects of Ortho-Phosphorines, since they can provide substantial effects on enhancing the chelate effect; therefore, experimental analysis of substituent variations were imposed to elucidate an optimal ligand design for each respective catalytic transformation. The results presented provide strategies that were implemented to expand the donor functionalization of new mono- & bis-Phosphorines. Additionally, their catalytic activity was compared to conventionally used P-donors for reference.

Only within the last decade has further examination of this niche class of molecules been taken, thus the primary objective was to contribute useful data to better understand efficient applications for this type of ligand. Herein, the mechanism for catalytically selective Phosphorine ligands as viable options for CO2 oligomerization and nitrogenase functionality are reported. Using Molecular Orbital representations for interpreting the fundamental basis for the reactivity of Phosphorines, Crystallographic and infrared spectroscopic data was employed as further insight on our key compounds. Additionally, computation of various theoretical analogues were studied using a P,P-donor Ligand Knowledge Base and were implemented to further aid this analysis. By contributing competitive ligands, capable of converting harmful exhaust into fuels, Phosphorine ligands provide an interesting solution for decreasing our carbon footprints.

Carol Bao

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Yatish Turakhia

Large-scale COVID-19 Phylogenetics

Due to proprietary information this abstract has been redacted.

Sharai Barrera

Cognitive Science, UC San Diego
Colors of the Brain
Mentored by Dr. Anastasia Kiyonaga

Neural Signatures for Prioritization in Working Memory

Accomplishing everyday goals requires the temporary maintenance of information in mind even after it is no longer available in the environment; this process is described as working memory. Carrying out these goals consist of performing multiple tasks throughout the day which involves prioritizing certain information over another depending on the task at hand. Information that is prioritized in working memory is more easily detectable in neural signals from neuroimaging methods such as an electroencephalography (EEG); however, it is uncertain how prioritization influences the neural activity. In the present study, subjects will complete a working memory task with varying priority cues while undergoing EEG. EEG is a method that uses a head cap with 64 electrodes spread throughout the head. Each electrode records electrical activity in its given spot on the head as well as timing of neural activity. As the subject performs a task, the activity is recorded as brain waves by the EEG which are analyzed by observing the difference in frequency and wavelength. The anticipated results will examine brain waves in the beta frequency and whether the strength of that signal will vary with the priority level of the working memory content. This research aims to examine how items in working memory are assigned importance which is crucial to understanding how humans handle their day to day goals.

Armine Barsegyan

Psychology, California State University, Northridge
STARS
Mentored by DR. Anastasia Kiyonaga

Utilizing EEG to Understand Working Memory and Distractibility

Working memory (WM) is a critical cognitive function which holds information in mind for a short period of time after it is no longer available in the environment. Information held in WM can be vulnerable to distracting input, but it remains unclear how distraction affects behavior and the neural components involved in WM. Studies using electroencephalography (EEG) have found that distraction influences the amount and quality of information that is maintained in WM, but these findings are inconsistent across studies. EEG is a technique that records electrical activity on the scalp and allows researchers to investigate the precise timing of neural activity. The EEG signal can be analyzed in several different ways, such as neural oscillations. Here, we will measure EEG signals in the alpha and theta frequency bands, to ask how WM content is influenced by distracting perceptual input. To do this, participants were presented a task

which asks them to remember multiple items in their WM and then were shown distracting information. Though the task typically helps a participant's WM, distractors can disturb WM as it gets in the way of the original task. We hypothesize that distractors will have different effects on WM depending on the similarity and task relevance. Critically, we expect alpha oscillations to hold information about the distractor similarity, and theta oscillations to hold information about the WM task relevance. These findings can help explain inconsistent findings about the effects of distraction, and how neural activity supports distractor resistant WM.

Clarisa Bautista

Chemistry, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Tatiana Mishanina

Cysteine Oxidation of Mitochondrial Transcription Factor A

Human mitochondria have maintained a small circular genome that contains 13 protein coding genes. These genes encode proteins that are essential components of mitochondrial oxidative phosphorylation (OXPHOS) complexes that supply most cellular energy. Mitochondrial transcription factor A (TFAM) is a nuclear-encoded protein that is responsible for binding and compacting mitochondrial DNA and functions as a necessary transcription initiation factor. Regulation of TFAM's DNA binding is thought to be essential for regulating mitochondrial transcription because higher levels of TFAM can halt transcription. Local regulation of TFAM function is thought to be achieved through post-translational modifications (PTMs) such as phosphorylation and acetylation, but here we will investigate reversible protein oxidation of the amino acid cysteine as a novel PTM for TFAM regulation. This oxidation is accomplished by hydrogen peroxide (H2O2), a molecule produced in abundance by OXPHOS complexes. Previous studies conducted in vivo have established reversible oxidation as an emerging field for protein regulation. The mtDNA's proximity to the source of H2O2 means that TFAM is a prime candidate. I will be examining the oxidation of TFAM in-vitro using western blot analysis and then assessing TFAM's functional changes as both a compaction protein and a transcription factor using electrophoretic mobility shift assays (EMSA) and in vitro transcription reactions. Ultimately, this work will determine if TFAM oxidation is a consequential modification in regulation of mitochondrial DNA compaction and transcription.

Ava Bayley

Human Biology and Sociology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Samantha Hurst

Transgender and Gender Non-Binary Youths' Perspectives on the Use of Telemedicine in Gender-Affirming Healthcare

Due to proprietary information this abstract has been redacted.

Varsha Beldona

Molecular and Cellular Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Rutherford Ongkeko

Small nucleolar RNAs in the diagnosis of head and neck cancer

Head and neck cancer, or head and neck squamous cell carcinoma (HNSCC), mostly originates in the pharynx, larynx, and oral cavity [1]. Human papillomavirus (HPV) is associated with pharynx cancers, while oral cavity and larynx cancers are associated with alcohol abuse or tobacco consumption [1]. Thus, HNSCCs can be separated into HPV-negative or HPV-positive. It is unknown why HPV-positive patients respond to treatment better and demonstrate higher survival rates than their HPV-negative counterparts [2]. Head and neck cancers account for hundreds of thousands of deaths every year [1]. HNSCC patients' survival rates greatly increase when there is early detection of a tumor. However, few predictive markers exist that allow for the early diagnosis of HNSCCs [3]. Increasing evidence shows that small nucleolar RNAs (snoRNAs) are involved in the carcinogenesis of certain tumors [3]. There are two classes of snoRNA which contribute to post-transcriptional modification [4]. The exact mechanism through which snoRNAs contribute to carcinogenesis is unknown, but they may be dysregulated in cancer [5]. Despite the connection of snoRNAs to carcinogenesis and, potentially, cancer diagnosis, they have not been widely studied as potential therapeutic targets or biomarkers for HNSCC diagnosis specifically. Computational analysis of The Cancer Genome Atlas (TCGA) patients was used to understand how snoRNA dysregulation can identify HNSCCs and if a difference exists between dysregulation associated with HPV-positive and smoking-associated HNSCCs.

Viola Bertolotti, Alessia lucrezia Fenaroli, and Alessia Sambugaro

Pharmaceutical Chemistry and Technology, Università degli studi di Milano / Univeristy of Milan “La Statale” / University of Verano
MRSEC REU or RIMSE
Mentored by Dr. Michael J Sailor

Porous Silicon Nanoparticles Coated with Hyaluronic Acid for Targeted Cancer Therapy

In the past century, cancer has been one of the most challenging diseases to resulting in one of the top ten causes of death worldwide.1 The challenges in the treatment of this pathology are related not only to the discovery of an effective drug, but also to find the need of a suitable way of administration.

The aim of this project is to coat porous silicon nanoparticles (pSiNPs) with hyaluronic acid (HA) allowing to target cancer cells (i.e. prostate, triple-negative breast, lung and pancreatic cancer) that overexpress CD44,2 a receptor that is able to interact with HA.3 Moreover, the coating will improve the stability the nanoparticles in aqueous media.

pSiNPs were obtained through sonication of silicon flakes and modified with surface amine groups to allow the bonding with HA. The thickness of HA was optimized by studying the coating of pSiNPs with different concentrations of acid and measuring Z-potential and size by means of dynamic light scattering (DLS) and scanned electron microscopy (SEM).

Once the coating will be optimized, the next step will be to encapsulate small interfering RNA (siRNA) into pSiNPs to obtain a system able to deliver in a selective way the molecule. siRNA is extremely promising due to its ability of limiting the proliferation of cancer cells but it showed several critical points (i.e. fast renal clearance, degradation and inefficient endocytosis)4 thus the need to protect it through the loading into a carrier.

Martin Beshara

Mechanical Engineering, University of California, Berkeley
STARS
Mentored by Dr. Sutanu Sarkar

Modeling the Upper Ocean’s Mixed Layer

The ocean surface mixed layer (ML) plays an important role in global climate due to the complex air-sea interaction occurring within the layer. The vertical transport of mass, momentum, and heat due to atmospheric forcings such as winds, diurnal heat fluxes, precipitation, and evaporation from the surface to the ocean interior is influenced by turbulent processes in the ML. Large-scale climate models often utilize one-dimensional (1D) turbulent mixing parameterizations to represent the effects of turbulence. Two well-known schemes are the K-profile parameterization (KPP) and Price-Weller-Pinkel (PWP)

models. In a previous study, Pham and Sarkar (2017) used high-resolution, turbulent-resolving large-eddy simulations (LES) to show the acceptable performance of the KPP parameterization in modeling the ML in the Bay of Bengal, where the stratification is uniquely strong. In the present study, we aim to use the same LES database to evaluate the performance of the PWP model and compare the result with the KPP model. Seven simulations at a wide range of the non-dimensional stratification parameter N0/f, where N0 is the buoyancy frequency and f is the Coriolis parameter, are performed using the PWP model. The results will be contrasted with the LES and KPP model. A comparative analysis of the turbulent entrainment rate inside the ML will highlight the differences between the KPP and PWP models.

Ria Bhabu

Marine Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Martin Tresguerres

Warmer temperatures accelerate developmental and yolk sac consumption rates of larval white seabass

In the California Current System, ocean temperature is predicted to rise by ~3-5°C by the year 2100. In this study, we examined early development and yolk sac conversion efficiency of larval white seabass (Atractoscion nobilis). Larval white seabass reared at 18°C or 23°C were sampled throughout development from 0 to 6 days old at matching accumulated thermal units (ATUs) to differentiate the contributions of temperature and time. Z-stacked images of larval fishes were obtained under a light microscope, and their morphometrics were measured using FIJI software. To estimate yolk sac consumption, lipids were stained with nile red, imaged using a confocal microscope, and the immunofluorescent signal quantified using IMARIS software. Our results show that despite experiencing comparable ATUs, larval white seabass reared at 23°C experienced higher mortalities, faster development, and consumed their yolk sac more quickly compared to those reared at 18°C. Consistent with other studies, our findings suggest larval fishes in warmer oceans will grow faster and consume the energy stored in their yolk sac less efficiently. More efficient yolk sac energy conversion in cooler temperatures could give them more time to master predation techniques. On the other hand, faster growth during warmer conditions could enhance feeding success and improve predator avoidance. Altogether, our results suggest that fish recruitment could swing to either extremity due to ocean warming. All experiments were approved by the SIO-UCSD animal care committee (protocol no. S10320) in compliance with the IACUC guidelines for the care and use of experimental animals.

Ananya Bharath

Chemical Engineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Jin Zhang

Dynamic Interplay between cAMP/PKA and ERK Signaling in PC12 Cells

Previous studies have identified the concurrent activation of the Extracellular-Signal Regulated Kinase (ERK) pathway and the cyclic AMP (cAMP) / Protein Kinase A (PKA) pathway in pancreatic cancer. This project aims to investigate the complex crosstalk between these two key signaling pathways that both play important roles in tumorigenesis. Using a genetically encoded fluorescent biosensor that reports ERK activity with a FRET readout, we showed that PKA regulates plasma membrane ERK activity in PC12 cells either positively or negatively, depending on whether these cells were stimulated with growth factor. We hypothesize that PKA regulates ERK activity at the plasma membrane via PKA phosphorylation of Rap1. To test this hypothesis, we plan to employ genetically encodable fluorescent biosensors to visualize the spatiotemporal dynamics of ERK, PKA, and Rap1 activities. We plan to engineer a series of PKA and Rap1 biosensors that can be expressed and imaged simultaneously with the ERK activity biosensor in live cells. This multiplexed imaging approach should allow us to determine the precise temporal relationship between these signaling activities. Negative Rap1 biosensor controls, which can no longer be phosphorylated by PKA, will be used to verify our results. The data collected from these experiments will be used to elucidate the mechanism of this complex crosstalk. A better understanding of these signaling pathways should facilitate the development of new therapeutic strategies for cancer.

Sevim Bianchi

Human Biology with a minor in Global Health, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Sandra Sanchez-Roige

CADM2 is Implicated in Impulsive Personality and Numerous Other Traits by Genome-And Phenome-Wide Association Studies in a multi-ancestral cohort comprising up to 3 million individuals

Impulsivity is a multidimensional, heritable phenotype that broadly refers to the tendency to act prematurely and is associated with multiple forms of psychopathology, including substance use disorders. Several large-scale genome-wide association studies (GWAS) of impulsivity and risk-related traits have robustly established an association between the gene CADM2 and risk behaviors. Additional GWAS studies have also implicated the role of this gene in multiple other traits, including cognitive function and body mass index, clearly establishing the importance of CADM2 in human health. However, it is not yet known whether this gene acts on these behaviors through its association with impulsivity

or via independent mechanisms. The project aims to further characterize the role of CADM2 via a phenome-wide association study (PheWAS) of five of the implicated variants in CADM2 - rs993137, rs62263923, rs11708632, rs818219, rs6803322 - and thousands of traits available from the 23andMe cohort. A unique feature of this project is its inclusion of multiple ancestries - European (N≤3,229,317), Latin American (N≤579,623), and African American (N≤199,663) - to evaluate the role of ancestral-specific effects of CADM2. This project will leverage access to an unprecedented database of up to 1,300 phenotypes across multiple categories, including cognitive, autoimmune, and psychiatric, to uncover additional non-medical and medical phenotypes that are associated with genetic risk for impulsivity in multi-ethnic populations. It will also serve to provide novel insights into the far-reaching role of CADM2 on human health.

Laura Biggs

Molecular & Cellular Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Ananda Goldrath

Investigating the Role of Retinoic Acid in Small Intestine Tissue Resident Memory CD8 T Cell Formation

CD8+ T cells are a critical component of the immune response to intracellular infections and malignancies. Tissue resident memory CD8+ T cells (TRM) have been shown to provide a first line defense upon reinfection at barrier sites. Studies indicate the transcriptional repressor, Hic1, plays an important role in mediating intestinal homeostasis among diverse immune cell populations, including TRM. Furthermore, Hic1 overexpression leads to enhanced TRM accumulation in the small intestine and protection from viral infection. Hic1 is induced by retinoic acid signaling through its nuclear receptor, retinoic acid receptor.

Vine Blankenship

Oceanic and Atmospheric Science, UC San Diego
Undergraduate Research Scholarships
Mentored by DR. AMATO EVAN

Characterizing Dust Size Distributions in the Surface Atmospheric Boundary Layer around the Salton Sea

As California’s Salton Sea evaporates at increasing rates due to lacking water supplies and global warming, playa surfaces are increasing along with other dust sources in the region. Playa erosion is expected to cause dust storms to worsen with time. Because the lake has previously been polluted by agricultural runoff, potentially toxic dust raises concern for people living and working in surrounding communities. To predict changes

in dust flux as the Salton Sea recedes, accurate models that simulate dust emission and transport are needed. Initial measurements indicate that the WRF-Chem weather and forecasting model, often utilized to study this region, underestimates the net flux of dust emitted during dust storms. Specifically, the model overpredicts small dust particles (diameters < 1 micron) and underpredicts large particles (diameters > 10 microns). To improve the representation of dust emission fluxes in WRF-Chem, a tower will be assembled this summer, equipped with two sonic anemometers (measuring wind speed), and two cloud droplet probes (measuring dust particle size and flux). Two crossarms will be attached to the tower at 1 and 3 meters above ground level. One cloud droplet probe and one anemometer will be mounted at opposing ends of each crossarm. A computer program will be written to process anemometer data. The tower will be deployed during dust storms and measurement analysis will allow for accurate estimates of surface dust flux and sizes. These estimates will be used to modify representations of dust in the model, and improve predictions of future dust in the region.

Rosalba Bonilla

Psychology and Sociology, University of San Diego
McNair Scholars Program
Mentored by Dr. Kristen McCabe

The Relation of Parenting Style to Behavioral Parent Training Treatment Acceptability Using Tailored Treatment Rationales

Current research demonstrates that behavioral parent training programs (BPTs) are effective in treating young children with disruptive behavior disorders, but many ethnic minority families do not fully benefit from these programs. It has been noted that some parenting styles are incompatible with the skills taught in BPTs. For example, BPTs reflect an authoritative parenting style in teaching parents to increase both warmth and consistent limit setting with their children. However, authoritarian and permissive parenting styles contrast this and may have conflicting parenting strategies to therapy, therefore making it difficult for parents to implement BPT techniques. Parental engagement with therapy may be improved by tailoring therapists' explanations of techniques to better fit with parental beliefs. Currently, little research examines how manipulating treatment rationales may impact parent's treatment acceptability. This study will examine in a sample of 160 parents whether tailored authoritarian or permissive treatment rationales influence parent acceptability of BPT interventions. We hypothesize that parents who are presented with materials that are tailored to their parenting style (i.e. an authoritarian parent receiving "authoritarian" materials) will rate the acceptability of BPT techniques significantly higher than parents endorsing the same parenting style who are given mismatched materials. We also hypothesize that potential differences in acceptability of BPT techniques across different ethnic groups may be influenced by degree of acculturation and related cultural beliefs. Participants will be recruited through

the online participant recruitment system Prolific.co, will be balanced across ethnicity, and will have a child between the ages of 2 and 7.

Bridget Boyle

Muir Special Projects - Biodesign, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Pinar Yoldas

Dark Botany

The anthropological reality of humanity's climate crisis has caused a growing reliance on and hope in the premise of a technofix; a technological solution to climate change. Dark Botany is a speculative ecology installation that explores the tension between technophobia and technophilia through the lens of our proposed climate technofix: a plant world altered to facilitate a great oxygenation event through faster carbon capture, via highly efficient photosynthetic pigments that are dark in color. In turn, these pigments give plants a soft black color, birthing lush dark landscapes out of the genetic modification of plants.

One foundational layer of this project is the researcher's journey of determining the biological feasibility of genetically modifying the savior super-efficient plant cell, stemming from the question: can black plants exist?

The current exploration of this question and the larger (im)possibility of this technofix has begun by examining the abiotic and biotic factors that contribute to and can impact a plant's observed color. Essential internal factors such as a plant's photosynthetic mechanisms, light harvesting complexes, and the biological pigments present can all be manipulated and altered via environmental stressors, such as our climate crisis. These pieces allow us to understand the necessary conditions to create a black pigmented plant, as well as determine whether an evolutionary journey towards black plants has already begun.

Jessica Brunner

Psychology (Neuroscience conc.), Spelman College
STARS
Mentored by Dr. Leslie Carver

HMET (Neurotypical vs. ASD) & Joint Attention: Developmental Neuroscience Lab

The present study will investigate the relationship between the development of joint attention amongst neurotypical (NT) infants and infants who have an older sibling diagnosed with Autism Spectrum Disorder (ASD). As of right now, the study is in the preliminary stages, however, the head-mounted eye-tracking (HMET) project is set to start piloting in the Fall 2022, with infants (ages from 9 -12 months) and their parents.

Participants and their parents will each be placed under a HMET device, which will track their eye movements, as well as the actual scene/environment in which they are interacting in, in order to study the attention of the infants in coordination with their parents' attention and hand gestures. It is hypothesized that a statistically significant difference will be found as NT infants will coordinate their hand-eye movements in conjunction with their parents' more often and for longer periods of time in order to elicit joint play than infants with a sibling with ASD. HMET research has shown that children with ASD show no coordination differences when compared to NT kids. Further, HMET research on 9–12-month NT babies show how important coordination is for joint play and later joint attention. This project will be the first to use the HMET in infants with an older sibling with ASD to assess early risk-level developmental differences that contribute to later joint attention impairments.

Jonah Bryan

Cognitive Science, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Elizabeth Eikey

Understanding Social Media Addiction and Interaction Patterns: A Qualitative Study

The brain's reward circuitry has been implicated in processing socially relevant information online. Receiving "likes", which are paralinguistic digital affordances (PDAs), on social media content is associated with increased activation of the brain's reward circuitry (Sherman et al., 2018). Given the effects of PDAs on the developing brain's reward network, we believe receiving PDAs on social media could become addictive. We identified a gap in the understanding of users' interaction patterns with PDAs and their connection to current definitions of social media addiction. In an attempt to bridge this gap, we developed the following research question: Which interaction patterns on Instagram, if any, suggest an addiction to receiving PDAs? We chose Instagram over other social media platforms given the prominent role "likes" play in motivating use of the platform (Sherman). We will conduct semi-structured interviews with 20 Instagram users to better understand how interaction patterns with PDAs relate to their perception of social media addiction. To develop this interview protocol, we utilized the "Gratifications from Receiving PDAs" framework (Shabahang et al., 2022) and mapped it onto the "Substance Use Motives Measure" (Biolcati et al., 2019). We plan to conduct a deductive thematic analysis using the "habit stacking" framework (Bayer et al., 2022) to outline which patterns of interaction might suggest a users' addiction to social media while also allowing for emergent themes. Findings will be shared with social media and mental health experts to inform the ethical development of future interventions that more accurately can assess social media addiction.

Jordan Bunch

Nanoengineering, UC San Diego
McNair Scholars Program
Mentored by DR. DARREN J. LIPOMI

The Influence of Crosslinking Semiconducting Polymers on the Mechanical Properties and Performance in Organic Photovoltaics

Semiconducting (π-conjugated) polymers have conjugated backbones that enable electron delocalization and give rise to their electronic properties. One advantage of polymeric semiconductors, as opposed to conventional electronic materials, is the tunability of their mechanical properties for applications in mechanically robust electronics. These favorable mechanical properties can enable large-area energy harvesting for the incorporation of organic solar cells (OSC) onto human-transformed surfaces (e.g., rooftops and painted surfaces). My research focuses on understanding structure-property relationships in crosslinked conjugated polymers for the purpose of improving the mechanical properties of organic solar cells. After crosslinking a conjugated polymer film using a small molecule crosslinker ("4Bx"), we use a pseudo-free standing tensile test ("film-on-water") to understand how crosslinker affects the tensile properties of semiconducting polymer films. In doing so, we show that low loadings of 4Bx can be used to improve the mechanical robustness (e.g., toughness, fracture strain, strength) of all-polymer bulk heterojunctions (BHJ). For application in organic photovoltaics, we fabricate OSC with a liquid metal top electrode ("EGaIn") to determine the effect of the crosslinker on the photovoltaic properties of the bulk heterojunction. We find that crosslinking the BHJ freezes the morphology of the film, thus improving the survivability (e.g., solvent resistance, abrasion resistance) and lifespan of the solar cell. Overall, we show that (1) the mechanical properties of semiconducting polymer films can be tuned by crosslinking, and (2) crosslinking the BHJ of an OSC can improve both the mechanical robustness and photovoltaic performance of the device.

Nathaniel Cabral and Cindy Lai

Chemistry / Biochemistry, UC San Diego / California State University, Long Beach
MRSEC REU or RIMSE
Mentored by Dr. Michael Sailor

Hybrid Porous Silicon Nanoparticle and Polycaprolactone Drug Delivery System for Revascularization of the Anterior Cruciate Ligament Post Surgically

The Anterior Cruciate Ligament (ACL) is a commonly torn ligament in the knee through sports injury that requires reconstruction surgery to be healed. It serves a critical role as one of the main ligaments that connects the femur and tibia to control pivotal movement and to provide stability to the knee. Roughly 100,000 ACL reconstruction surgeries are performed yearly in the U.S. with remarkable success. However, the current standard of

ACL repair utilizes surgical grafts which lack direct vascularization, subjecting patients to endure a lengthy recovery period with no assurance of regaining full athletic abilities post-surgery. Therefore, this study seeks to improve and expedite the post-surgical recovery of the ACL injury by promoting revascularization of the damaged ligament via the proposed drug delivery system which administers vascular endothelial growth factor (VEGF); a drug to promote revascularization. The drug delivery system is composed of Si nanoparticles that encapsulate VEGF and a polycaprolactone (PCL) "patch" with trapped, VEGF-loaded Si nanoparticles. The patch is intended to be placed in the knee post-surgery, where we hypothesize a slow release of VEGF into the ACL will significantly enhance its recovery time and efficiency. We have demonstrated a drug-releasing profile that matched the need for a slow, continuous release in the ACL recovery application, suggesting it is promising for the treatment of said injuries. Hence, we are currently focused on replicating release measurements (spanning a 2-week time period) via ELISA assays as well as improving encapsulation efficiency.

Josephine Cabrera

Psychology, California State University San Bernardino
STARS
Mentored by Dr. Gail Heyman

Students' Intuitive Reasoning About Grading Systems

Properly developing fair and effective grading policy concerns educators and policymakers. In practice, teachers use various grading systems to assess students, focusing on effort, ability, or improvement – all of which play a key role in a student's outcomes. Previous research has examined the effect of different grading systems on students' academic performance, but little research has explored how students perceive these grading systems. To explore this question, this developing study aims to examine how elementary-age students perceive the effect of different grading systems on students' motivation, mental health, academic integrity, and interpersonal relationships. We will be specifically looking at students' perceptions of an effort-based, ability-based (non-zero-sum and zero-sum), and improvement-based grading system. In a pilot study, we will be using a relative measure to obtain information on college students' perspectives. Following this study, we will make any necessary adjustments and collect data from elementary-age students through recruitment events at schools, parks, and childcare programs. Our long-term goal is to investigate this topic from both developmental and cross-cultural perspectives. This study has theoretical implications for academic motivation theory and practical insights into education policies.

Allison Cafferata

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

Investigating Wsb1 for influence on Tissue Residency and T Cell Function in Cancer

A major barrier to the immune system's ability to kill tumor cells is the constant activation of CD8+ T cells that leads to a dysfunctional state known as T cell exhaustion. Tissue Resident Memory T cells (TRM) are a type of memory T cell that stay at the site of the pathogen rather than circulating throughout the body. TRM are beneficial because they have the ability to relaunch an immune response at the site of infection quickly and efficiently. Previous experiments have shown that treating tumor-bearing mice with T cells over-expressing a gene present in TRM T cells live longer or even clear their tumors altogether. Using retroviral transduction, we can induce over-expression of specific genes in T cells, such as E3 ubiquitin ligase Wsb1, and then observe their function in tumor-bearing mice compared to control T cells. This can help answer questions about the function of tissue resident memory T cells and hopefully translate to less invasive and more effective treatments for cancer patients.

Jicang Cai

Electrical and Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Lin, Bill

Meta-Learning by Routing in Deep Neural Networks

Meta-learning, also known as learning to learn, is a subfield of machine learning, where the focus is to optimize a model's ability to quickly learn and adapt to new tasks. The primary motivation behind meta-learning is that, conventional machine learning models do not perform well without a large amount of data to learn from, and hence we want to train a model with very few examples that is capable of generalizing to unfamiliar categories without extensive retraining.

In particular, Model-Agnostic Meta-Learning (MAML) is an algorithm that is compatible with any model trained with gradient descent and applicable to a variety of different learning problems (ex. classification, regression…). The key idea is to train the model's initial parameters such that the model has maximal performance on a new task after the parameters have been updated through one or more gradient steps computed with a small amount of data from that new task.

Our project proposed a meta-learning by routing technique. Motivated by the fact that humans learn new concepts upon already learned concepts in their mind, a meta-learning model could also make use of the already trained neurons, and only select a small

percentage of neurons for a new training task. Specifically, built upon the MAML algorithm, during training we apply a filter selection technique based on the magnitude of the batch normalization parameters to select certain CNN filters to update. By adding this technique, we've obtained better results compared to the original MAML algorithm.

Czarlyn Camba

Biotechnology, California State University Northridge
STARS
Mentored by Dr. Tsung-Ting Kuo

Recording Biomedical Compliance Training Certificates using Blockchain Technology

Due to proprietary information this abstract has been redacted.

Ithan Cano

Biotechnology, California State University, Northridge
STARS
Mentored by Dr. Colleen Mchugh

Long non-coding RNAs

Long non-coding RNAs (lncRNAs) are RNA transcripts larger than 200 nucleotides. Research concerning lncRNAs is still in its infancy and It is believed that they regulate important cellular processes. Recent studies reveal that the dysregulation of multiple lncRNAs are associated with cancer development and progression. Our lab has previously demonstrated that the cell viability of multiple cancer cell lines is diminished when a specific lncRNA known as GAS5 or growth arrest specific 5 is knocked down. This lncRNA is found in a number of growth arrested cell lines making GAS5 a prime target for further study regarding cancer survival. This study in particular focuses on investigating whether the effect of GAS5 knockdown can be rescued by overexpressing GAS5. GAS5 knockdown was achieved using locked nucleic acid gapmers, which bind to GAS5 and induce its degradation via RNase H. GAS5 constructs were cloned into pcDNA3 plasmid to obtain overexpression in mammalian cells. In order to prevent the transiently overexpressed transcripts to be targeted by gapmer, the gapmer targeting sequence in GAS5 was shuffled. GAS5 gapmer-resistant construct and GAS5 gapmer will be co-transfected in A549 lung cancer cells. Transfection efficiency will be assessed using qpcr, then cell viability assay will be performed. The specific construct we are currently working with is cDNA, it contains only exons, gDNA contains a number of introns known to be small non coding RNAs. sncRNAs regulate transcriptional and translational processes. by this, we hope to fully investigate the biological functions of gas5 and the snoRNAs in cancer.

Daniela Carrillo

Public Health, UC San Diego
Undergraduate Research Scholarships
Mentored by Weg Ongkeko

Metastasis driven by snoRNA in non-small cell lung cancer

Small nucleolar RNAs (snoRNA), a type of non-coding RNA, have been implicated in numerous pathological processes, including cancer. There have been prior studies reporting that snoRNA is implicated in oncogenic related functions in various cancers, but considerably less information is available on how snoRNA correlates to lung cancer development. Lung cancer is the third most common cancer in the United States. Non-small cell lung cancer (NSCLC) comprises approximately 85% of all lung cancers. NSCLC often has extremely poor prognosis, with an overall 5-year survival rate of only 18%. The 5-year survival rate for metastatic, Stage IV NSCLC could be as low as 1%. These poor survival rates underscore the importance of identifying new therapeutic targets for metastatic NSCLC. The objective of this project is to elucidate the potential role of snoRNA, small non-coding RNA molecules that have been reported to be involved in metastasis pathways, in smoking-associated NSCLC metastasis. This project will consist of computational components. For in silico analysis, RNA sequencing data from The Cancer Genome Atlas (TCGA) will be used to dissect the pathways interactions of snoRNAs in smoke-related NSCLC. Through this project, I will be able to illuminate a comprehensive profile of snoRNA's effects on metastasis of smoking-induced NSCLC.

Miriam Castanon

English, University of San Diego
McNair Scholars Program
Mentored by Dr. Ivan Ortiz

Mothering and Slavery in Gothic Fiction

This paper examines the significance behind Toni Morrison's adoption of the absent mother-trope in her book Beloved (1987). This trope is foundational to British Gothic fiction from the 19th century and was commonly used to have mother figures in stories be dead or missing from the family and leaving children behind. It is this absence left by the mother that often creates the perfect conditions for Gothic novel protagonists to have their encounters with monsters and the supernatural. Being well versed in the genre, Morrison not only brings this tradition into a new century but reivents it by placing the horror in the mother's presence rather than her absence. By making this transfer, Morrison calls on the effects of slavery in the United States on the sense of identity of black people and on motherhood as a source of horror as well. In this way, she extends criticism of the patriarchy present in early British Gothic fiction and brings it into a new context where one of the main struggles is ownership. Through Sethe's story ownership

of the self, over one's own history, and over children gets explored. Using critical reading theory and psychoanalytic criticism, I look at Morrison's text in the context of history and the Gothic literature tradition to extrapolate the importance of this choice. This inquiry will delve into the female identity as it intersects with motherhood, race, and sexuality in Morrison's characters Sethe, Denver, and Beloved.

Gilda Castellanos

Biotechnology, CSU San Marcos
STARS
Mentored by Shaochen Chen

CPMV Induced Phagocytosis in Ovarian Cancer (OvCa) Tumor-Associated Macrophage (TAM) Spheroids.

Due to proprietary information this abstract has been redacted.

David Castillo

Sociology, UC San Diego
McNair Scholars Program
Mentored by Abigail, Andrews

Intergenerational Trauma Within Young Latino Men

The emotional or psychological wounding that is passed down across generations is referred to as Intergenerational Trauma (IT), also known as transgenerational trauma or multigenerational trauma. Intergenerational Trauma occurs when the effects of traumatic experiences are passed down between generations, however, IT can also be the result of mass oppression such as war or genocide. Historically, Latinx in the United States, are particularly vulnerable to intergenerational trauma due to the legacies of colonialism, political violence, and migration-related stressors. More specifically, the immigration and carceral system are often forces of oppression that perpetuate the violent cycles of intergenerational trauma among Young Latino Men. This scoping review aims to cross-examine extensive literature on intergenerational trauma in Latinx populations, violence experienced in prison systems or deportation centers, and ways in which trauma impact masculinity. The research will follow up by conducting surveys and interviews with young Latino men and collecting qualitative data about their upbringings, direct or indirect experiences with policing, and identities.

Rogelio Castro

Neurobiology, UC San Diego
Colors of the Brain
Mentored by Dr. Kay Tye

Neurotensin and Rabies Tracing

Due to proprietary information this abstract has been redacted.

Viviana Castro

Behavioral Neuroscience, University of San Diego
McNair Scholars Program
Mentored by Dr. Jena Hales

Histological Analysis of the Role of the Endocannabinoid System in Elapsed Time Memory in Rats

Our sense of time is a fundamental ability that we use to judge the duration of events and temporally organize our experiences. Previous research suggests that the hippocampus is critical for estimating elapsed time duration. The hippocampus expresses cannabinoid type-1 (CB1) receptors, and neural signaling is regulated via CB1 binding of endogenous or exogenous cannabinoids. Interestingly, cannabis administration is shown to 'speed up' an organism's internal clock through a CB1- dependent mechanism, causing time intervals to be perceived as longer than they actually are. However, it is unclear how CB1 signaling within the hippocampus affect elapsed time discrimination. To investigate, we trained rats to perform a Time Duration Discrimination (TDD) task during which rats learn to discriminate between two time durations in order to perform a correct learned response. After learning the discrimination, rats underwent stereotaxic surgery to implant guide cannulae bilaterally into the dorsal hippocampus. Following recovery, rats continued daily testing on the TDD task, and on select days, they received intracranial infusions of a CB1 receptor agonist or antagonist. After testing, rats were perfused and their brains were sectioned, mounted, and stained for analysis. We performed immunohistochemical procedures to localize and measure the expression of the immediate early gene, cfos, within the hippocampus, dorsal striatum, medial entorhinal cortex, prefrontal cortex, substantia nigra, and ventral tegmental area. These histological and behavioral analyses will be combined to assess the role of the hippocampal endocannabinoid system in elapsed time processing in rats.

Valeria Castro Abril

Literature/Writing, UC San Diego
McNair Scholars Program
Mentored by Dr. Ariana Ruiz

An Exceptional Commute: Transborder Students at the U.S.-Mexico Border

The U.S.-Mexico border is often discussed as a barrier which forcefully and discriminatorily keeps people out. While this description is indeed representative of the experiences of many migrants and travelers at the border, it excludes the experiences of a population of inhabitants who create a life in the cross-border region where both nations meet. This transborder population is able to cross between nations, and as such, is able to exist on both sides of the border. The portion of this population that this project is specifically focused on is transborder students. Transborder students commute across the U.S.-Mexico border daily in order to attain their education–they live and continually "journey between two cultures, two languages and two nations" (Brown, 2012 qtd. Orraca et al. 2019). This presentation delves into the experiences of transborder students as they navigate through the highly militarized and potentially violent space of the pedestrian ports of entry, where constitutional rights lose priority over the interests of the United States. Through an ethnographic examination of the border, a study of its laws, and testimonios from transborder students and individuals, I articulate that these students undergo exceptional circumstances as they strive for their education and must be acknowledged within our academic institutions.

Joseph Ceballos

Music Theory, University of San Diego
McNair Scholars Program
Mentored by Jeffery Malecki

Latin Pop Influence in Classical Music

In recent decades, popular Latin musical styles (particularly Reggaeton), have seen an explosion in popularity to the extent that mainstream pop artists have "piggybacked" off that popularity by using elements of these genres within their own music, despite how seemingly disparate they may be. There is decidedly varied discussion among both amateur and professional Latin artists about the use of these elements by non-Latin people. This cultural appropriation of sound both amplifies the quality and worthiness of it among mainstream consumption, yet has also shadowed over the cultures that they were born out of. This research seeks to define and underscore the many fundamentals of these genres and their histories, summing up to explore the use of these components within select pieces from the Western Art Music tradition. It seeks as well to sift through what other components may justify or null these uses and some of the ramifications within this predominantly white institutional art form — both affirming and undignified

— examining some potential questions it poses for contemporary classical composers and conductors. Finally, I will present examples from an original composition in which I have used some of the elements discussed in considering authenticity.

Alejandro Cervantes-Medrano

Molecular and Cell Biology, UC San Diego
Colors of the Brain
Mentored by Richard Daneman

Do endothelial cells within the hippocampus proliferate in the adult mouse?

Adult neurogenesis is the process by which new neurons are formed and occurs exclusively within the olfactory bulb and the hippocampus. This process is important for learning and memory, and is altered in disease. Adult hippocampal neurogenesis occurs within a vascular niche, however, it is unknown how the hippocampal vasculature may regulate adult neurogenesis. Preliminary data gathered by single-cell RNA-sequencing on endothelial cells isolated from 9 different brain regions found that hippocampal endothelial cells exhibit the greatest number of gene expression differences compared to endothelial cells from each of the other brain regions examined. To further examine the unique properties of blood vessels in the hippocampus compared to other brain regions, I chose to focus on the proliferative capabilities of endothelial cells, as others have observed endothelial cell proliferation in the hippocampus. Here, we will compare endothelial cell proliferation between 3 different brain regions, specifically the hippocampus, cortex, and corpus callosum, of adult wildtype mice. We will utilize an EdU injection paradigm to label proliferating cells and immunohistochemistry to label blood vessels. I hypothesize that we will observe a greater number of proliferating endothelial cells in the hippocampus compared to the cortex and corpus callosum. Our findings will shed light on the unique properties of the hippocampal vasculature, and may inform future studies of vascular contributions to hippocampal function.

Hua Chai and Sky Hung

Electrical Engineering / Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Duygu Kuzum

Nonvolatile Memory Devices For Neuromorphic Computing

Due to proprietary information this abstract has been redacted.

William Chan, Kara Lui, and Joeun Kim

Chemical Engineering / Chemical Engineering / Chemistry, UC San Diego / Northeastern University / UC San Diego
MRSEC REU or RIMSE
Mentored by Dr. Michael Sailor

Investigating Effective Solutions for Homogenous Nanoparticles by Freeze Fracturing of Perforated Silicon

Porous silicon nanoparticles (pSiNPs) are an emerging nanostructured material with a wide variety of potential applications from drug delivery to batteries. Despite their promise, the synthesis of pSiNPs tends to suffer from long manufacturing times, low yields, and inhomogeneity. The electrochemical etching of silicon wafers offers researchers opportunities to improve upon factors influencing porosity, nanoparticle size distribution, and yields. Currently, one method uses a perforated etch which is achieved by alternating high and low current onto a silicon wafer, which creates layers of small and large pores that are then commonly fractured into pSiNPs by either 16 to 18 hours of sonication, ball-milling, or microfluidization. This presentation explores a new way of preparing nanoparticles through freeze fracturing. Since water confined in large nanopores has a higher freezing point than in smaller nanopores, we postulate that perforated etched silicon wafers can be broken into uniformly sized nanoparticles through temperature control. Specifically, we are investigating different water-based solvents and parameters such as freezing point and pore size to best expand and contract along the perforations in the hopes of decreasing the manufacturing time and increasing the yield. Results will be characterized using FTIR, DLS, and SLIM measurements.

Sabrina Chang Liao

Chemical engineering, UC San Diego
YES
Mentored by Dr Georgia Sadler

Increasing Colorectal Cancer Screening Rates in the Asian American Community

Asian Americans (AA) have lower screening rates for colorectal cancer (CRC), a leading cause of cancer-related deaths within this population. Major barriers to screening involve the lack of CRC awareness, embarrassment about the screening procedures, language and cultural barriers, and lack of healthcare insurance. Previous research showed that the fecal immunochemical at-home test kit (FIT), is effective for CRC screening. This narrative literature review explored AAs' CRC screening rates, barriers to screening, and early detection promotion programs' use of mailed at-home FIT testing kits within the AA community. The following databases used were: PubMed, CINAHL, Google Scholar, and Ethnic News. Articles published in English from 2013 to 2021 and accessible in full text were included. The keywords used to screen articles included CRC, screening, Asian,

American, barriers, and FIT. Of the 25 articles screened, seven studies determined the FIT option to increase CRC screening rates in the AA community. The literature revealed that consistent outreach through phone, mail, and mailed FIT kits increased CRC screening rates in the AA community to the target goal of 80%. This intervention was more effective for the uninsured, a cohort likely to derive the most benefit. Screening participation was higher for FIT than for colonoscopy. Further research needs to be done to evaluate whether the within AA communities benefit equally from evidence-based programs to increase the use of FIT and how to customize FIT and CRC screening education towards AA communities that continue to experience barriers to FIT uptake.

Frank Chaqueco

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

Radio Telemetry Tracking

In collaboration with the University of Central Arkansas, we aim to study how ectotherms deal with variations in environmental conditions and record the ecological and evolutionary effects of these variations. More specifically, we are studying how common collared lizards behave during the day and in the evening in relation to the temperature of the areas the lizards are located in. Current methods for tracking common collared lizards involve sending scientists out in the field with antenna probes to track the tagged lizards. This method is both labor intensive and inefficient as the lizards cannot be tracked continuously throughout the day. We constructed a network of receiver towers that can continuously and accurately monitor tagged lizards at all times of the day through the use of a sleep timer application which allows our network of towers to save power. This enables our tower network to remain operational for months, all while providing continuous positioning data of the lizards.

Laura Charria

Cognitive Science, UC San Diego
MRSEC REU or RIMSE
Mentored by Professor Michael J. Sailor

Hybrid Porous Silicon Microparticle and Polycaprolactone Drug Delivery System for Revascularization of the Anterior Cruciate Ligament Post Surgically

The Anterior Cruciate Ligament (ACL) is a ligament in the knee commonly torn through sports injury that requires a reconstruction surgery with a lengthy recovery time due to slow and improper neovasculature formation. Unlike other ligaments in the knee, the ACL cannot repair itself since it is surrounded by synovial fluids and lacks direct access to any exterior blood supply. Therefore, the experiment's main objective was to improve the post-surgical recovery of ACL by enhancing its revascularization via a drug delivery

system loaded with a vascular endothelial growth factor (VEGF). The drug delivery system is composed of VEGF - a drug to promote revascularization, Silicon nanoparticles that act as the delivery system by encapsulating VEGF, and a Polycaprolactone (PCL) "patch" with trapped, VEGF-loaded Silicon nanoparticles. The patch is intended to be placed in the knee post-surgery, where we hypothesize a slow release of VEGF into the ACL will significantly enhance its recovery time and efficiency. We have demonstrated a drug-releasing profile that matches the need for a slow, continuous release in the ACL recovery application, suggesting it is promising for the treatment of said injuries. Hence, we are currently focused on both replicating release measurements (spanning a 2-week time period) via ELISA assays as well as improving encapsulation efficiency.

Allyson Chen

Mechanical Engineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Michael T. Tolley

Hydraulic Control Board for Untethered Underwater Soft Robots

Soft robots have the potential to improve many engineering systems because they can be more versatile, safer, and provide more nuanced actuation than traditional, rigid robots. To control soft fluidic robots, pumps and valves are typically used to pressurize soft actuators with air or liquid. By manipulating the pressures and flow rates, these components can cause soft actuators to deform to perform a desired movement. In many soft robots, a control board is used to carry the pumps, valves, and electronics. Currently, there are pneumatic control boards that are modular and sufficiently compact to be housed onboard soft robots. However, pressurizing a soft actuator underwater with air affects the buoyancy, adding technical challenges and greatly restricting the operating depth of the robot. While there are other hydraulic control boards, these are typically large and must be housed outside the liquid environment, requiring long, restrictive tethers to the robot. To address these issues, we present a hydraulic control board that is modular and can be housed onboard robots while providing sufficient pressures and flow rates for soft actuators. The board utilizes a direct pump drive to achieve an overall smaller, lighter, and cheaper board by removing the need for valves. Once constructed, the board will be tested on multiple preexisting underwater soft robots to compare the performance capabilities with a preexisting tethered hydraulic control board. This control board has the potential to enable the control of current and future underwater soft robots, and to greatly accelerate the development of new designs.

Hannah Chen

Materials Science and Engineering, UC Berkeley
MRSEC REU or RIMSE
Mentored by Dr. Michael Sailor

Blow spinning of silicon-embedded carbon nanofibers as Li ion battery anodes

Silicon has recently presented itself as a promising anode material for lithium-ion batteries. As compared to the traditional graphite anode's energy capacity of 372 mAh/g, silicon possesses an extremely high energy capacity of 4,212 mAh/g. Exciting prospects for silicon-anode Li-ion batteries thus include increased cell efficiency, maximum output, and discharge/recharge rates. However, silicon anodes also suffer from low conductivity and high volumetric expansion, impairing the cell's cyclability. To address these problems, we investigate the use of solution blow spinning (SBS) to synthesize pSi-embedded carbon nanofibers for use in Li-ion battery anodes. Silicon nanoparticles (SiNPs) have been shown to resist volumetric changes; carbon nanofibers (CNFs) not only increase anodic conductivity and energy density, but also buffer further volumetric changes. A procedure for airbrushing nanofibers with polyacrylonitrile (PAN) polymer is outlined. Free-standing SiNP/CNF composites are then synthesized through pyrolysis of Si-embedded PAN nanofibers. Existence of nanofibers and distribution of silicon nanoparticles is verified through optical and fluorescence microscopy. Chemical composition of samples is examined through Raman spectroscopy. In collaboration with Professor Zheng Chen's lab, the conductivity and cyclability of pSiNP/CNF composites as anode materials is tested.

Vicky Chen

Biochemistry, UC San Diego
UC LEADS
Mentored by Gene Yeo

Increasing Protein Expression Through mRNA Localization to the Mitochondria in Mammalian Cells

Due to proprietary information this abstract has been redacted.

Kai-Wen Cheng

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by DR. YUANYUAN SHI

Carbon Aware EV Charging

Electric vehicles are an important factor to achieve the carbon neutrality goal since it replaces internal combustion engines and decreases the amount of carbon emission in the transportation sector. However, the electrification of the transportation fleet implies a higher load on the grid system during EV charging periods. Higher load can imply an increase in carbon emission since more power plants are required to generate the electricity needed to meet the demand. On top of that, the grid in certain areas also has very varying carbon intensity (high carbon intensity in the evenings and low carbon intensity during the day due to solar energy). With that in mind, the research is exploring the idea of developing a robust algorithm that can reduce the carbon footprint of a typical EV charging session given the constraint of the charging infrastructure as well as the time and energy required by the user. We applied constraint optimization methods to develop this algorithm. Throughout our research we were able to develop an algorithm that decreases carbon footprint by 4% while delivering the same total amount of energy required for the EV set by the user. Moreover, the reduction of carbon is more than 20% when sacrificing 10% of energy delivery. This is an important result if we apply the social cost of carbon onto the amount of carbon the algorithm reduced, then the algorithm could reduce more than 5 million dollars per year in California.

Kit Fong Cheung

Microbiology, CSU Northridge
STARS
Mentored by David Gonzalez

Understanding the conserved role of S protein across pathogenic streptococcal species

Due to proprietary information this abstract has been redacted.

Han Chi and Ian Douglas

Chemistry / Engineering Science, UC San Diego / University of Rochester
MRSEC REU or RIMSE
Mentored by Dr. Michael Sailor

Hydrogel Contact Lenses Loaded with Zirconium (oxo) Cluster Catalysts for Protection from Chemical Warfare Agents

Due to proprietary information this abstract has been redacted.

Anthony Cirilo

Public Health w/con Epidemiology, UC San Diego
Multidisciplinary Educational Approach to Reduced Cancer Disparities
Mentored by Georgia Sadler

Human Papillomavirus (HPV) and Gender Beyond the Binary: Correlates to HPV Knowledge and Awareness in a Gender Diverse Population

Human papillomavirus (HPV) is the most common sexually transmitted infection in the United States. Though most HPV infections clear on their own, certain strains are known to cause cancers, with an increased risk of certain cancer prognoses in sexual/gender minority populations. In studies comparing HPV knowledge and awareness among young cis-women and cis-men, the majority had some awareness of HPV, though HPV knowledge was subjectively reported as low. Interestingly, almost no studies had been published that looked at gender-diverse populations to measure HPV knowledge, awareness, or vaccination status. To a great detriment, current research on gender-based differences in HPV knowledge and vaccination behaviors focuses on the binary male/female view, lacking in gender-diverse populations. A narrow view on gender can be harmful to gender-diverse populations as oropharynx, anal, penile, vaginal, and cervical cancers have a high prevalence in the population and are linked to HPV. This paper aims to inform healthcare providers and researchers about gender-diverse persons and the population's correlates to HPV awareness. This paper uses data collected from the Can Prevent HPV Study (PI: Heather Corliss), a mixed-methods study aiming to understand the correlates of HPV vaccination in young LGBTQ+ adults from the San Diego region. Future studies should focus on HPV knowledge and awareness among gender-diverse persons, as these two factors may vary across the gender identity spectrum.

Katherine Cobos

Psychology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Gerardo Arellano

Latinx Cuentos: An Archival Community Project From Coast to Coast

The Critical Race Theory movement documents how law and state structures institutionalize white supremacy and privilege in the United States, therefore, disadvantaging those of other races, nationalities, and cultures. A form of resistance to the widespread dominant narratives grounded in whiteness that misconstrues history is counter storytelling, where the misrepresented share their own accounts to bring diversity to once silenced stories. This research project aims to utilize counter storytelling as a theoretical framework to center Latinx diasporic narratives collected via informal interviews with Latinx individuals from Miami and San Diego. The goal of this

photojournalism project is to share the stories from both the east and west coast to provide a unique perspective into the rich Latinx culture to those who would otherwise not have encountered these cultures and their stories. As an ongoing community archival project, these narratives will be distributed digitally by social media and physically in photobooks donated to the UCSD Library and the Raza Resource Centro.

Andrea Contreras

Human Developmental Sciences, UC San Diego
Multidiscplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Sadler

Does Sexual Trauma Predict Lower Rates of Cervical Cancer Screening?

Pre-cancerous cervical cell changes can easily be detected and removed, making adherence to routine cervical examinations of critical, life-saving importance. This review of the scientific literature explores whether there is evidence to suggest that women who have experienced sexual trauma are less likely to adhere to cervical cancer screening guidelines. This narrative literature review searched PubMed, CINAHL, and Google Scholar databases for articles published from 2010 to 2022, using such terms as sexual trauma, sexual abuse, sex workers, childhood sexual abuse, women, breast cancer, cervical cancer, and cancer screenings. It also searched databases focused on the lay literature: EBSCO, Proquest, and Women's Studies International. Only articles written in English and were full text accessible were eligible for inclusion. Information from the National Cancer Institute, American Cancer Society's websites and relevant articles' citations lists were also explored. Prior sexual trauma is more predictive of non-adherence than other cervical screening barriers. In countries without financial barriers to screening, prior sexual trauma remains the most predictive factor. Women who have undergone cervical screenings describe the perception of an imbalance of power between themselves and the performing physician. For women with sexual trauma, this power imbalance is likely to be reminiscent of their prior or on-going trauma, which they might be reluctant to disclose. Education to raise the health care and support staff's awareness of the signs of sexual trauma can help identify women whose well-being is endangered by the past emotional scars of trauma, as well as on-going trauma.

Diego Contreras Mora

Chemical Engineering, Texas A&M University
MRSEC REU or RIMSE
Mentored by Andrea Tao

Investigation of the effects of solvents on silver nanocube stability over time

The colloidal synthesis of silver nanocubes in various organic/aqueous systems is an area that has not been explored and limits the ability to create silver nanoparticles in other solvents. The cubes are coated with polyvinylpyrrolidone (PVP) to control the formation

of a cubic shape by stabilizing the crystal facets on the cube faces. The PVP coating on the cubes is then removed/replaced enabling the nanocubes to be dispersed in solvents via ligand exchange. While this process has been studied thoroughly, the procedure is highly sensitive and subject to deformations. Here, we report an approach to suspend PVP capped silver nanoparticles in a variety of aqueous and organic solvents. This work investigates solvents that share common chemical motifs but have significantly different physiochemical properties.

Jaden Cramlet

NanoEngineering, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Darren Lipomi

Solid Phase Deposition of Hole Transport Layers in Perovskite-Silicon Tandem Photovoltaics

Solid phase deposition (SPD) is a method of depositing thin films that can provide conformal coatings of complex pi-conjugated polymers on textured substrates. This presentation will discuss the ability of SPD to deposit thin film polymeric hole transport layers (HTL) on textured silicon and ITO for applications in perovskite-silicon tandem photovoltaic devices. The micron sized structures that these thin films are deposited on allows for light to be trapped within the absorber materials, giving multiple chances for absorption and resulting in a theoretical increase in efficiency. SPD is preferable over other deposition methods, because other methods of HTL deposition make sacrifices with respect to the texture or the choice of HTL material. We successfully formed conformal coatings of Poly-TPD HTL on textured silicon bottom cells in a batch process that allows for multiple cells to be coated in parallel.

Sophia Da Silva and Lanie Guerrero

Biomedicine / Biology, Fluminense Federal University / CSU Long Beach
MRSEC REU or RIMSE
Mentored by Michael Sailor

pH-Dependent Study of Calcium Silicate Coated Nanoparticles for Drug Delivery

pH-dependent drug delivery systems are attracting attention because they have the ability to deliver specific drugs at specific locations as the pathophysiological need of the disease, contributing to improved therapeutic efficacy. We used a self-sealing method to have Calcium-silicate coated on the porous silicon which helps to seal the pores and overall protect the payload. Using this technique we are going to study the pH-dependent properties of the drug delivery system that is anticipated to come from the calcium silicate coating and find the advantages and disadvantages of certain levels. In past research, to avoid the porous silicon from degrading too fast researchers have studied the core-shell structures which slowly release drug delivery formulas so that the drug can be

trapped in the nanostructure. We will study the dissolution rate of Calcium-silicate coated porous silicon nanoparticles (pSiNP-Ca) in pH4 and pH7 buffers. We will use the ICP-MS to help prepare the interval time point samples. We will also study the stability of the pSiNP-Ca by using dynamic light scattering to measure the size and Zeta potential to measure surface charge. The last part was to study the release behavior of the fluorescent dye, Calcein, loaded inside of the porous silicon nanoparticles using a fluorescence plate reader. The overall goal of the project is to test if the system had pH-dependent properties so we could use it in drug delivery platforms. In the future, technology like this could be used to release drugs in acidic environments like tumors and RNAi delivery.

Connor Davies

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Eric Schmelz

Discovering core regulators of plant specialized metabolism

Due to proprietary information this abstract has been redacted.

Trinity Dawoodtabar

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Nicola Allen

Investigating Astrocyte-Secreted Proteins in Conjunction with Visual Critical Period Plasticity in Mice

Due to proprietary information this abstract has been redacted.

Jessica De La Torre

Mechanical Engineering, UC San Diego
UC LEADS
Mentored by Dr. Jeremy Orosco

Surface Acoustic Wave and Thickness Mode Device Design For Improved Effectiveness

In acoustofluidics, thickness mode (TM) and surface acoustic wave (SAW) devices are used for a variety of purposes such as the atomization of fluids and characterizing surfaces for experiments. Such experiments are done using a Laser Doppler Vibrometer (LDV) or Digital Holographic Microscope (DHM), which work with very small dimensions. The design of the device that serves as the platform for both TM and SAW initially involved a steel plate that generated a current through pogo probe interactions with the plate and devices. This design generated factors such as noise from several wire connections, and lacked ease of use, which interfered with the reproducibility of

experiments. In the developed design, the main components are a printed circuit board, 3D printed base and insert. The insert accommodates both TM and SAW devices by having the appropriate setup for each that simply needs to be clipped into contact with copper tabs to function. This design is modular, as in the future, alterations to the design for other devices can be focused on the insert, rather than the entire structure of the device. In the future, such changes can continue to develop based on the progression of TM and SAW devices and expand the actions of the overall device. Throughout this research, reproducibility of experiments with this device, versatility, cost, and modularity are qualities that should be a priority as they define the accessibility and efficiency of the device.

Allison Delehoy

Molecular & Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Bryan Sun

The Genetic Causes of Glomuvenous Malformations

A glomuvenous malformation (GVM) is a venous anomaly that manifests due to the abnormal formation of blood vessels in the presence of glomus cells. GVMs are characterized by raised cobblestone-like blue-purple lesions on the skin, where dilated and thin-walled channels lined by endothelial cells permeate the outer membrane of blood vessels. GVMs have been found to be mainly inheritable; however, the genetic causes of this condition still remain unknown. In preliminary sequencing data, a mutation causing a change in the amino acid sequence of the CCM2L gene was found within GVM lesions. In this study, we aim to investigate whether an overexpression of this mutation affects human umbilical vein endothelial cell (HUVEC) proliferation and migration. According to past studies, CCM2L has been found to be linked to the enlargement of lesions in cerebral cavernous malformations (CCMs) within the brain and spinal cord, but CCM2L has yet to be studied in malformations of the skin. Through this study, we hope to better understand the genetic causes of GVMs and potentially contribute to future therapeutics and methods of diagnosis.

Keying Deng

Biology, UC San Diego
MRSEC REU or RIMSE
Mentored by Professor Jonathan K Pokorski

Understanding complex phenotypes generated by 3D Printed Biocomposite Hydrogels with diverse functional cyanobacterial species

Due to proprietary information this abstract has been redacted.

Malina Desai

Physics, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Adam Burgasser

Investigating Ultracool Binary Systems Using Random Forests

Binary star systems are used to find the mass of the individual stars of the system through their orbits. Identifying unresolved stellar binaries, which can be mistaken as single stars due to their close orbit, is important because it will better constrain luminosity and mass functions. Blended light spectra, which appear as the combination of two single-star spectra, can help find unresolved binaries. Differentiating them is challenging, especially if the two stars are close in spectral type. One approach is using machine learning methods, particularly random forest (RF) models that build decision trees to classify the unknown data. Here, we identify brown dwarf spectral binaries from low-resolution, near-infrared spectra using RF models. Our training data comes from the SpeX prism library consisting of 436 single stars ranging from spectral type M6-T9. We artificially created 42,008 binaries, with their respective synthetic blended light spectra. We explored variations in model architecture, spectral features used, and training set composition. We found that our RF model's accuracy ranges from 0.72 to 0.90 after adding noise and splitting the data according to spectral types. Single star precision rates vary from -0.12 less to 0.03 greater than the binary precision rates, with the RF misclassifying 2% to 5% of the objects. We also applied this model to a novel set of spectral data to search for new spectral blend binaries. Our results show that RF models can be effective in uncovering rare but physically interesting sub-populations in uniform spectral samples.

Alan Diaz

Computer Science, UC San Diego
STARS
Mentored by Dr. Rodeny Gabriel

Improving

Cybersecurity is a top priority among multiple health institutions, and phishing attacks are one of the threats that many health employees face. The objective of this research is to develop training programs in order to help health care employees better identify and report any phishing attacks. Different people react differently in certain situations, and understanding why certain people are less susceptible to phishing attacks, can help with the identification of phishing attacks. To do so, individuals who decide to participate in the research will be sent various emails that will simulate real phishing emails. By understanding how the participants respond, a program can be created that will provide proper guidance for health care employees to fend off phishing attacks.

Schuyler Diaz

Software Engineering, Arizona State University
NSF SDNI REU
Mentored by Yeshaiahu Fainman

Computer Vision Aided Automatic Waveguide Alignment and Optimization System

Precise alignment between an optical waveguide chip and an optical fiber array is crucial in the development of optical waveguide devices. Manual alignment of integrated photonic circuits with input fiber arrays is an intricate process that can take several hours. Furthermore, the components are delicate and can be damaged during the procedure. This places severe constraints on the type of devices that can be characterized by this method, which consequently limits their research potential. In order to overcome these limitations, it is necessary to develop a system for automated waveguide alignment. To this end, we construct an open source computer vision-based method for current position detection and propose a machine learning model for optimal position detection. The objective of the proposed method is to achieve precision levels better than 0.05° (angle detection), 0.1 μm (line detection), and 2 s (detection time). Finally, the optimization parameter of the method is customizable, and therefore it can be adapted to more general applications such as automated robotic alignment.

Melina Dimitropoulou Kapsogeorgou

Computer Science, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Professor Curt Schurgers

Radio Telemetry Tracking

Currently, one of the most prevalent animal-tracking methods for ecological study depend on tagging animals with radio transmitting devices. Typically, scientists must transverse the open habitat with large radio antennas, following the signal from the animal's tags. However, manually searching is both time consuming for ecologists conducting research. This is impractical or impossible in situations where frequent measurements are needed over long periods of time or in inaccessible habitat (such as sharp rocky cliff areas). This project aims to automate this tracking process to allow for reasonable and accurate estimation of radio tagged animal position in an area at intervals over a period of time. This will be accomplished in conjunction with UCSD's Engineers for Exploration program and a group of researchers from the University of Central Arkansas which aim to track common collared lizards over a relatively small area every 10 minutes, with less than one meter error. We will approach this problem by setting up multiple radio antenna towers along the perimeter of the area, which will detect the strength of the signal from the radio tags on ten minute intervals, and relay this information to the ground control station (GCS) server, where software will estimate and

display the locations of the tagged lizards. My focus is on the software for this system, including work on the communication protocol between multiple towers and the GCS, and the user interface display. The system is designed with flexibility of application, as a potential resource for similar ecological research.

Wenbo Ding

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Sara Jackrel

Assaying expression of Heat Shock Proteins in the harmful cyanobacterium Microcystis aeruginosa under heat stress associated with climate change

Global warming has become a critical problem in current day society. Scientists predict that to avoid the worst impacts of global warming, the emission of carbon must stop before 2050. However, even if that were done, the impact of global warming that has already occurred will still last for a while and this would affect many different organisms in different climates, ranging from large animals to small bacteria such as Microcystis. From previous research, it is known that a species of Microcystis, Microcystis aeruginosa, is the main cause of harmful algal blooms in freshwater. In our study, the main goal is to assess how the effects of global warming would impact the genetic variation within Microcystis and whether or not the survival of a certain genotype is preferred under global warming conditions. We have archived samples of Microcystis aeruginosa biomass from an earlier experimental test of how various genotypes of this cyanobacterium grow under global warming conditions. The next step in this study is to use qPCR analysis to assess gene expression patterns of genes associated with heat tolerance in order to understand why certain genotypes of these Microcystis bacteria survive under these different warming conditions. The results of this experiment could potentially be used to prevent and tackle the problem of harmful algal blooms in freshwater and help freshwater communities flourish.

Romona Dong

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Nicholas Spitzer

Analysis of the Effects of Corticosterone on Neurotransmitter Switching and Sustained Fear in Mice

Due to proprietary information this abstract has been redacted.

Josiah Drakes

Psychology Pre-Med, Xavier University of Lousiana
STARS
Mentored by Megan Young/Dr. Geoffrey Chang

HIV Reverse Transcriptase

HIV/AIDS claims millions of people's lives a year, and in several countries, it is even the leading cause of death. There are different drugs currently being produced to help manage the virus; however, because it is constantly adapting and mutating, it is necessary to develop more efficient drugs to help combat this evolving retrovirus. Many of the drugs being produced today target the HIV protease which prohibits the final step of viral replication. In this project, we target the protein HIV reverse transcriptase (HIV-RT), which plays a vital role in the transcription process of the virus. This protein is made up of the domains p66 and p51, and it reverse transcribes the virus's RNA into DNA thus causing the virus to become a part of a person's genetic makeup. The goal of this work aims to transform, grow, purify, and crystallize the HIV-RT protein to better understand its structure and function. Using a disrupter, we're able to lyse the cells and then purify the desired protein using a nickel column in preparation for crystallization. During the crystallization process, the distance and intensity of each individual atom is measured using x-ray crystallography. Ultimately, this process will allow us to expand our understanding of HIV-RT, thus creating a more effective HIV drug. The findings of this project will contribute to the scientific community's knowledge of HIV/AIDS and help to prevent and combat this ongoing epidemic.

Daniela Dreifke

Microbiology, UC San Diego
Creating Scientists to Address Cancer Disparities Program
Mentored by Dr. Georgia Sadler

Impact of Public Umbilical Cord Blood Banks' Lack of Donor Diversity

For the past 25 years umbilical cord blood stem cells (UBCs) have been used to validate regenerative stem cell treatments, advance HSC expansion, and test experimental drugs and cell therapies. Allogeneic UBC transplants require an external donor. Sibling matches are the most compatible since the HumanLeukocyte Antigens(HLA) are similar due to shared genetics. However, this is not possible for every patient, in which case they require a match from a donor volunteer registry. Minorities in the United States face challenges when matching with donors because of a lack of diversity in public UBC donor registries, which also impacts the research using these UBCs. Using keywords: cord blood, donor, ethnicity, race, research, and online databases: JSTOR, PubMed, Google Scholar, and ASH Publications, we identified articles between 2015 and 2022. Only English language articles with access to the full text were eligible for inclusion. Of

the 32 articles identified, eight were relevant. Our review of studies on the diversity of public donor registries suggests the underrepresentation of minority donors will negatively affect the accessibility of stem cell treatments for minority patients. Further, review of studies which investigated the types of UBCs being used in research to develop new cancer treatments, also revealed underrepresentation of minorities that will negatively impact the generalizability of new stem cell discoveries. Awareness of these disparities and educational intervention programs will be explored as possible solutions. Including ethnically/racially underrepresented donors would increase the robustness of UBC banks, facilitate donor matching, and improve representation in UBC research.

Turley Duque

Behavioral Neuroscience, University of San Diego
McNair Scholars Program
Mentored by Dr. Jena Hales

Elapsed Time Processing and Spatial Working Memory Deficit in a Rodent Model of Attention Deficit Hyperactivity Disorder (ADHD)

Due to proprietary information this abstract has been redacted.

Brienneth Durazo

Political Science/Education Studies, UC San Diego
McNair Scholars Program
Mentored by Dr. Amy Bintliff

Reframing School Discipline: A Trauma-Informed Approach

When we think of discipline in schools, most of us think of the traditional detention in which students are sitting in classrooms, sometimes not being allowed to speak or even do homework.. This traditional approach sends the message to students that they are "bad" students, simply because they made a bad choice. A lack of discipline can stem from many things in a student's life, but it is important for teachers and administrators to allow students to learn and correct their behavior. Schools are institutions for learning, not for punishing misbehavior. Approaches to discipline that only highlight student wrongdoings can exacerbate existing trauma, and take away the safe space that schools should be for students. A trauma-informed approach to discipline would explore alternative approaches to punitive discipline, focusing on positive reinforcement and praise, and would encompass many root causes for misconduct in a positive and productive manner. Punitive disciplinary approaches do little to help create these safe school environments, and instead contribute to pushing students further away from learning environments. This project will explore restorative practices to discipline and will provide suggestions for restorative practices that can be implemented.

Joydeep Dutta

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Pengtao Xie

Automatic Annotation of Objects Based on Image Captions

Due to proprietary information this abstract has been redacted.

Julie Eitzen

Psychology, UC San Diego
McNair Scholars Program
Mentored by Dr. Cassandra Vieten

Outcomes Associated with Experiences of Awe: A Qualitative Study of Open-Ended Survey Responses

While awe is a powerful and broadly recognized human experience, relatively little research has investigated this emotion. In particular, not much is known about how experiences of awe affect people's lives. Anecdotal descriptions and a review of the existing literature suggest that experiences of awe are generally associated with positive outcomes. The precise nature of these outcomes, however, has rarely been studied. Focusing on outcomes people associate with their own experiences of awe, this project was an exploratory retrospective qualitative analysis of responses to an open-ended survey question. In the context of a larger survey on experiences of awe, this question asked participants if an experience of awe had influenced their lives and, if so, how. Participants were recruited using a convenience sampling method and are not representative of the general population. Thematic analysis was performed on the dataset of 585 responses and resulted in several themes. The vast majority of participants described their experience of awe as positive and retrospectively attributed beneficial life changes to this experience. These included: 1) a sense of interconnectedness with the universe, the world, and others, 2) a decrease in rigidity, 3) changes in outlook, and 4) an increase in positive emotions. These findings generate hypotheses for future empirical experiments, inform an initial theoretical stance on the mechanisms by which awe might effect change, and lead to speculation about whether awe inductions could serve as a treatment intervention or personal development tool in the future.

Philip Emmanuele

Bioengineering: Biotechnology, UC San Diego
Biodynamics Laboratory
Mentored by Professor Jeff Hasty

Adaptive Laboratory Evolution, Synchronized Lysis, and Probiotic Bacteria as Tools for Cancer Therapy

Advances in synthetic biology have driven the development of genetically engineered microbes as therapeutic agents in cancer. E. coli Nissle, a probiotic bacterial species found in the gut, has been shown to selectively colonize tumors. In this work, we used adaptive laboratory evolution (ALE) and site directed mutagenesis to develop a strain of E. Coli Nissle with improved growth rate and genetic circuit behavior in the tumor microenvironment (TME). Using ALE, E. coli Nissle was evolved in media mimicking the TME, with characteristics such as reactive oxygen source (ROS) stress, low glucose, and high lactate levels. E. coli Nissle taken from later stages of ALE showed improved growth rates over the wildtype strain in continuous culture of the TME-mimicking media. We then used site directed mutagenesis to create a library of synchronized lysis circuits (SLC) of varying promoter strengths. The SLC is a previously developed genetic circuit that creates cycles of bacterial population growth and lysis, allowing for pulsatile delivery of cancer therapeutics inside of solid tumors. We identified a version of the SLC with consistent lysis dynamics in microfluidics, and found that evolved E. coli Nissle exhibited improved tolerance to ROS stress compared to wildtype when grown in Luria Bertani Broth. Further, evolved Nissle was able to consistently oscillate in TME-mimicking media whereas wildtype Nissle showed no oscillations.

Blake Estefan

Bioengineering, UC San Diego
Summer CAMP
Mentored by Karsten Zengler

Curation of a computational model of the cyanobacterium Synechocystis sp. PCC 6803

Cyanobacteria are photosynthetic organisms that play important roles in ecology and biogeochemistry supplying oxygen and biomass to aquatic trophic chains. They are natural sources of biologically active compounds, with varied activities, such as antiviral, antibacterial, antialgal, antifungal and anticancer. In addition, genetic manipulation has been successful to express heterologous proteins and enzymatic pathways in cyanobacteria to harness the photosynthesis and carbon fixation pathways. However, there is a need to understand the resource allocation within the cell in order to improve productivity. Novel computational models of metabolism and gene expression (ME-Model) are capable of making predictions of the amount of individual components that the cell must synthesize in order to grow optimally.

During this work, I will curate the iSyn936 ME-Model. ME-Models integrate organism-specific information, such as genomic sequence, gene function, complex stoichiometries and cofactors use. The model incorporates the function of 936 genes, although it is missing key metabolic functions. Enzymatic complex stoichiometry and cofactor use will be transferred manually from the Escherichia coli ME-Model, identifying homologous proteins using the NCBI BLASTp software. In the case of non-homologous proteins, I will retrieve the necessary information from scientific literature. The resulting model will be analyzed for gene essentiality and production strategies of biologically active compounds. I expect to obtain a functional ME-Model that can produce biotin and iron-sulfur clusters and estimate the biological cost to produce biomass under different culture conditions and genetic manipulations.

Daniel Esterkin

Physics, Pennsylvania State University
MRSEC REU or RIMSE
Mentored by Professor Jinhye Bae

Programmable shape deformation of temperature-actuated Graphene Oxide poly(N – isopropylacrylamide) composite hydrogels

Due to proprietary information this abstract has been redacted.

Rita Ewaz

Human Developmental Sciences, UC San Diego
McNair Scholars Program
Mentored by Amy Bintliff

Socioeconomic Status and Student Academic Resilience in Higher Education During The COVID-19 Pandemic

University and college students may face some of the most difficult and demanding challenges during their transition from adolescence to maturity. University students today experience increased housing prices, food poverty, financial challenges, lack of social connectedness, and anxiety about the future which affects their academic performance and well-being as a result of the COVID-19 pandemic. The SARS-CoV-2 or COVID-19 virus significantly affected social, environmental, and economic domains of life where all educational institutions either transitioned to remote learning or completely shut down. This study aims to understand how individual academic resilience is affected by socioeconomic status in higher education during the COVID-19 pandemic. The focus of this study is to examine the academic and personal experiences of students with the transition to remote learning. Our research highlights well-being practices, intrinsic motivation, and academic resources that students utilized during COVID-19 to persist in learning.

Sydnee Farnsworth

Material Science and Engineering, Phoenix College
MRSEC REU or RIMSE
Mentored by Reagan Beer

pH Dependent Dye Release experiments of TiO2 coated nanoparticles

It is known that TIO2 is a photocatalyst, presented by this knowledge, we want to investigate what happens when the TiO2 is used as a shell around organic dye-filled nanoparticles. Will the coat withstand its surrounding environment and prevent leeching? This project will heavily involve trapping chemistry which is the process of trapping a certain kind of substance that is attracted to the surface of the nanoparticles and then keeping them incased in the nanoparticles using an outer shell, in this case, we are synthesizing TiO2. Trapping chemistry is significant in the biomedical field when creating certain drugs it is sometimes needed to have the drug slowly released to treat an infection or certain diseases. The main experiment will look something like this: After, loading the nanoparticles with methylene blue or another dye, and using trapping chemistry to coat them in TiO2, we will take the nanoparticles and test them in various buffer solutions with different pH concentrations. After centrifuging the particles, we will measure the absorbance of the supernatants. In the end, We hope to measure the efficiency of the TiO2 shell in various pH conditions. We hope to see little to no leeching in its surrounding environment in the aqueous solution.

Farah Farouq

General Biology, UC San Diego
CoB-KIBM
Mentored by Dr. Stefan Leutgeb

Assessing the properties and potential mechanisms of time cells in working memory

Working memory is a type of memory that involves the maintenance of new information required to complete a task. During working memory, neurons termed time cells have been thought to be involved in the encoding of time-specific sequences during a delay period. However, the underlying mechanism for time cells, as well as their stability over different delay periods has not been thoroughly studied. This project utilizes the figure eight-maze to test working memory and to be able to assess time cell activity during the delay period of the maze. Our maze incorporates the delay through the use of gates prior to the choice point. We hypothesize that theta oscillations, which are involved in movement, may play a role in generating these time-specific sequences during the delay period. We test this hypothesis by utilizing a treadmill and turning it on/off between trials to assess time cells as a function of theta oscillations. Moreover, we will assess time cell activity over time during different delay periods and across trials to help us better understand time cell properties such as stability and time-specificity. After rats are

trained in the figure-eight delayed-alternation task, we will record their brain activity from the dorsal to ventral side of the hippocampus using a Neuropixels probe. Finally, histology will be performed to ensure that the recording is done from the area of interest.

Andrea Farrell

Human Biology, UC San Diego
Summer CAMP
Mentored by Dr, Wei Ying

The role of regulatory T cells in the development of non-alcoholic steatohepatitis

Liver fibrosis is caused by hepatic stellate cells (HSC) that store fat and secrete collagen which stiffens the extracellular matrix. This happens in obese people because there is excess fat stored in the liver. The liver becomes stiff which affects its normal function, consequently leading to problems such as liver cancer or cirrhosis. The NASH (non-alcoholic steatohepatitis) mouse model replicates liver fibrosis in obese people. The mice are fed a Western Diet which is high in fat, cholesterol, and sucrose. This leads them to become obese and develop liver fibrosis.

We observed that in the NASH mice, there is an increased regulatory T (Treg) cell population in obese mice compared to lean mice. The reason behind the increased Treg cells in the NASH mice is currently unknown, but these results suggest that Treg cells are critical in the development of the NASH phenotype. Additionally, the function of Treg cells in obese mice is largely unknown, but upon analyzing single cell RNA sequencing data of Treg cells, we can explore the gene profile to determine the possible function of Treg cells in the NASH phenotype.

Victoria Fawcette

Psychology, University of California Northridge
STARS
Mentored by Dr. Powell

Infants Understanding and Expectations of Ownership

Ownership is interwoven into the fabric of our society, from the written laws in ancient societies to our present-day laws dictating which actions are acceptable with owned property. How does the understanding of this important social construct develop? The current study examines whether 16 to18- month-old infants make inferences about ownership and have expectations of how owners will respond when their property is taken by others without permission. In the study, infants watch people interact with snacks and hear either possessive (i.e., “Here are my snacks”) or neutral language (“Here are the snacks”). Then infants see one of the individuals ask where the snacks are using the same language (i.e., either possessive or neutral). Following this, infants see one person take the snack previously eaten by the other person. During these events, the

person reacts by becoming happy in two trials and angry in two trials. If infants at these ages understand relations between owners and their property, then infants who heard possessive language should be more likely to look at the snack the person previously interacted with than those who heard neutral language. Further, if infants understand the rights owners have over their property, then they should be surprised (i.e., look longer) when the owner reacts positively when their property is taken. This research builds upon past research as 16-18 month old's understanding and inferences about ownership were not previously investigated. These findings will be informative about the development of an ownership concept.

Joelle Faybishenko

Computer science spec. bioinformatics, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Rob Knight

Classifying the human gut microbiome with animal gut microbiomes

Inside the human gut are a variety of archaea, fungi, and bacteria which make up the human gut microbiome. These organisms are increasingly proven to contribute to an individual's overall health, including susceptibility to obesity and diabetes. However, little is known about which factors most influence gut microbiome similarity. Two opposing theories propose that human gut microbiome composition is primarily influenced by either genetic factors or environmental ones. Understanding the evidence supporting these theories contributes to the broader knowledge of how and why microbial communities are structured. Since non-human gut microbiomes often share similar compositions within a species, we can use this as a comparison to better understand which of these factors influence human gut microbiomes.

Building off of previous microbiome analysis software, QIIME2 and the q2-sample-classifier, we developed a pipeline using machine learning classifiers nested within a hierarchical taxonomic tree to predict the most similar animal to an inputted human microbiome sample. This plug-in to QIIME2 enables the exploration of diversity between individual microbiomes through an evolutionary perspective.

The nested classification pipeline is trained with non-human animal gut microbiomes. Using 16S rRNA sequences to differentiate the microorganisms found in the gut, the pipeline trains models to identify the collection of animals from a popular and diverse gut microbiome dataset. From these classifiers, the pipeline queries over 10,000 human samples from the American Gut Project. The output is the accumulation of animals for analyzing the most similar gut microbiomes to humans and for exploring the diversity between individuals.

Kyra Fetter

Bioengineering: Bioinformatics, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Ferhat Ay

Developing a comprehensive database of high-resolution protein-centric chromatin conformation capture (HiChIP) datasets curated from the literature

The human genome, if stretched out, would span two meters linear distance. To fit inside a micrometer-wide cellular nucleus, chromatin folds in a highly intricate, non-random manner. Chromatin conformation studies increasingly recognize chromatin's 3D architecture as a mediator of genome regulation via long-range DNA-DNA interactions. The Hi-C assay allows us to study this architecture by combining DNA-DNA proximity-based ligation with high-throughput sequencing, capturing pairs of genetic loci genome-wide in close contact in 3D-space. HiChIP, a more recent method, combines immunoprecipitation of DNA-binding proteins with Hi-C, producing higher-resolution contact maps of chromatin interactions, often loops between gene regulatory elements like promoters and enhancers. These maps allow us to link disease risk genetic variants, identified from genome-wide association studies (GWAS), to target genes for several diseases. We aim to create a database of uniformly processed HiChIP data with WashU, UCSC, and IGV genome browser visualizations–raw datasets curated from literature dating from 2016 to the present–to elucidate the relationship between 3D chromatin conformation, DNA-binding proteins, and disease. We gathered 338 human and 182 mouse HiChIP samples from 91 studies and approximately 125 cell types encompassing keratinocytes, immune, kidney, neural, and others. We designed a pipeline including tools developed by the Ay Lab to uniformly process all datasets. Loop calling is currently running on all human samples. As HiChIP datasets increase tissue and cell type coverage, our database will enable researchers to easily access and download processed chromatin loop data from HiChIP studies, and with GWAS, discover disease-associated variants and genes for more diseases.

Roman Figueroa

Psychology, UC San Diego
McNair Scholars Program
Mentored by Thomas Brown

Attentional States and Their Influence on Sexual Arousal in Transgender, Nonbinary, and Gender Expansive Populations

Attentional patterns in transgender, nonbinary, and gender expansive (TNBGE) individuals and their relation to arousal remains understudied. As heightened arousal in sexual contexts can contribute to enhanced wellbeing across the lifespan, determining what influences it in TNBGE populations can give insight as to how this population

engages in sexual processing. Attentional states, which are integral to this, influence arousal. Engaging in different attentional states can have implications sexually, as experiencing it from a spectator's point of view (observational standpoint) versus an immersed and present point of view (participatory standpoint) can alter the experience and also have implications for clinical treatment. Further, there is minimal information regarding attentional patterns in TNBGE populations. Being able to engage in different forms of attentional states is integral to success in sexuality-based clinical interventions, and as engaging in these forms of attention are generally learned, there remains the fact that TNBGE individuals may not receive the full benefits of therapy should they be engaging in attentional patterns differently than cisgender individuals. Studying attentional differences can give insight as to how TNBGE individuals engage with different stimuli and assist in creating inclusive literature of which can be applied to future practice. This proposal aims to outline a scenario in which these attentional patterns may be studied, in where it is hypothesized that TNBGE individuals who engage with sexual stimuli featuring cisgender actors will use observational attention, experiencing less arousal, whereas TNBGE individuals who view sexual stimuli featuring TNBGE actors will use participatory attention, experiencing greater arousal.

Andrew Finebaum and Azeh Ndifor

Biomedical Engineering, Boston University / Georgia Institute of Technology
MRSEC REU or RIMSE
Mentored by Bryan Bishe

Cyanobacterial Strain Development in Alginate Hydrogel Matrices

Cyanobacteria represent a diverse and ancient lineage of photosynthetic organisms. Some of these photoautotrophic bacteria can be engineered to produce a wide variety of biochemicals used in agriculture and medicine. In our project, we will experiment with growing cyanobacteria embedded in an alginate hydrogel matrix. Hydrogels are typically used for biomedical applications such as tissue engineering and drug delivery. We study the growth of several strains of cyanobacteria embedded in hydrogels to test conditions including biofilming, phototaxis, secretion, and multicellularity.

We study three S. elongatus strains with distinct characteristics. PCC 7942, cannot biofilm or phototaxis. UTEX 3055 and 7942 PilB:Tn5 mutant can both biofilm, but only 3055 performs phototaxis. Motile and non-motile strains of Synechocystis PCC 6803 will be used to further measure phototaxis. Finally, we are using Leptolyngbya BL0902 and Anabaena 7120 to see how filamentous cyanobacteria behave in hydrogels. We are also engineering a secretion system into S. elongatus, which is naturally transformable and has well-developed genetic tools. We are constructing a fusion protein with a secretion sequence fused to a nano-luciferase reporter to determine the mechanism for protein secretion from a hydrogel. This protein will be constitutively expressed in S. elongatus, which will then be incorporated into hydrogel matrices. By measuring bioluminescence in the extracellular media, active nanoluc secretion can be quantitatively determined. If

successful, the experiment will prove that protein secretion in cyanobacteria can be monitored in hydrogels, enabling future research to take advantage of the bioactive properties of the organism for medical applications.

Christian Flores

Cognitive Science, UC San Diego
McNair Scholars Program
Mentored by Sean Kross

Reevaluating Artificial Intelligence Applications: Public Perception and Ethical Governance

Artificial intelligence systems leverage large sets of data with iterative processing algorithms that identify patterns to create an additional layer of expertise. It comes as no surprise that AI has catalyzed an entire ecosystem of general purpose technology that permeates various industry sectors. However, the transformational power operates in tandem with ethical risks. The dominant narrative behind AI remains tarnished. With exponential growth of the ubiquitous technology leaving public awareness in the dust, researchers in the field of computer science emphasize the importance behind balancing optimism about the vast potential of AI technology with a level-headed recognition of the moral hazards involved. This paper provides a current audit on the public opinion of AI in high-risk, domain-specific applications. More specifically, the study aims to determine the attitudes and sentimental responses towards AI-application in high-risk domains as well as the research gaps that span its governance.

Gabriella Flores

Sociology, University of San Diego
McNair Scholars Program
Mentored by Dr. Melissa James

Not finalized, will submit with the abstract!!

Due to proprietary information this abstract has been redacted.

Marissa Franco

Behavioral Neuroscience, University of San Diego
McNair Scholars Program
Mentored by Jennifer Wenzel

Adolescent cannabinoid exposure alters cocaine conditioned reward and attenuates cocaine-induced activation of the prefrontal cortex in adulthood

Cannabinoids (CBs) are the most widely abused illicit drug by adolescents. Adolescents who use cannabis are more likely to develop psychiatric disease, including substance use

disorder (SUD), in adulthood. Therefore, it is important to determine how cannabinoid CB exposure during adolescence may shape brain development and render individuals more susceptible to SUD. In our laboratory, we are particularly interested in the neural mechanisms of cocaine reward and aversion which motivate cocaine use through positive and negative reinforcement. In these experiments, we sought to determine how adolescent cannabinoid exposure shapes cocaine reward and aversion in adulthood in a rat model. To this end, we treated male and female adolescent rats with one of several doses of the synthetic CB drug WIN 55,212-2 or an inert vehicle, and in adulthood conducted behavioral tests to determine cocaine reward, cocaine aversion, cocaine-induced locomotion, cocaine-induced anxiety, and hedonia. Following behavioral testing, animals were treated with cocaine or vehicle one final time and then sacrificed. Brains were then removed and processed for immunohistochemical analysis of the protein product of the immediate-early gene c-fos, which serves as a proxy of cell activation by cocaine. Briefly, our data show that adolescent CB exposure alters cocaine conditioned reward and locomotion and decreases cocaine-induced activation of the prefrontal cortex in adult male, but not female rats. Thus, exposure to CBs in adolescence results in lasting changes in the brain and behavioral response to cocaine that may work to predispose individuals to cocaine abuse disorder.

Christine Frazier

Ecology, Behavior, and Evolution, UC San Diego
STARS
Mentored by Diana Rennison

Exploring morphology and gut microbiota diversity across threespine stickleback populations showing repeated shifts in trophic ecology

The three-spined stickleback are found to live in both freshwater and marine water located in many different regions with a gut microbiota made up of bacteria which is important for the digestive tract and immune system within the organism. We worked with 14 specific lake populations that are found in waters in the region of Vancouver Island, British Columbia to gather data on population morphology and gut microbiota. In this study, we looked at and compared the geometric morphometrics of the three-spined stickleback using the software tpsUtil32, tpsDig232, and MorphoJ. The software was used to landmark and measure morphological traits, then compared with graphs and statistics and data gathered from gut microbiota research. We characterized the gut microbiota of the three-spined stickleback to recognize contributions from host ecology, morphology and environmental factors to determine patterns of microbiota variation within stickleback populations. Our data has the potential to improve our understanding of the relationship between an environment, an organism's morphological traits, and the gut microbiota and how they are related to and adapt with each other. Future work could include looking at populations living in the same type of water environment and comparing how similar or different their traits and gut microbiota are from each other.

Errysteinn Frondarina

Chemistry, Southwestern College
San Diego Nanotechnology Infrastructure
Mentored by Dr. Ester Kwon

Formulating Lipid Nanoparticles with Targeting Peptides

Traumatic brain injury affects approximately 3 million people among all ages with a total cost of about $93 billion annually in the United States. Secondary injuries persist and lead to disease-specific changes to the microenvironment of the blood-brain barrier and cause long-term issues including physical, cognitive, and psychosocial impairments. Lipid nanoparticles carrying nucleic acids have been approved for use in humans for the treatment of hereditary transthyretin-mediated amyloidosis and the prevention of COVID-19. We propose that lipid nanoparticles carrying nucleic acids are potential therapeutics to address the gene expression changes after brain injury. One major challenge for delivery to the brain is targeted delivery. Therefore, the formulation of lipid nanoparticles conjugated with targeting peptides will be examined in this research. First, formulation procedures and parameters will be varied and assessed for impact on lipid nanoparticle properties such as sizes <100 nm and uniformity of sizes by dynamic light scattering. Second, we will formulate lipid nanoparticles with peptides for targeting specific cell types and measure whether the resulting nanoparticles can maintain their nanometer size and uniformity. Lastly, we will use single particle tracking to quantify the number of peptides per lipid nanoparticle. Ultimately, we believe targeted lipid nanoparticles as a promising innovation in precision medicine that can meet the urgent need for new therapeutics to treat brain injuries.

Xiomara Gaeta Agreda

General Biology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler

Exploring Social Media and Influencers' Impact on Breast Cancer Awareness

Social media and influencers present a cost-effective way to convey information to the general public. With over 82% of the North American population active on at least one social platform, social media offers a valuable strategy for disseminating breast cancer information to women from trusted sources.

A review of the scientific literature explored social media's involvement in breast cancer awareness. Articles published in English and Spanish between 2012 and 2022 were located using PubMed, Google Scholar, ProQuest, CINAHL and Dimensions.ai. Major search terms included: social media, breast, cancer, awareness, public health, disparities, screening, early detection, and guidelines. The 2020 through 2022 lay literature was also

searched for relevant articles. The Tiktok platform was analyzed using breast cancer, early detection, diagnosis, and cancer support as search words.

Social media and social influencers are effective promoters of breast cancer awareness and screening. They also generate shared access among their audience, thereby helping to build support systems for their followers worldwide. These can evolve into ongoing cancer support communities that can provide lower-cost opportunities to participate in cancer-related activities. Through these, meaningful discussions can occur such as screening and genetic testing. Influencers and celebrities diagnosed with cancer have shown to influence the amount of cancer-related content available, often reaching a wider audience than traditional campaigns.

Social media platforms have the ability to serve as forms of edutainment with entertaining yet educational content. Despite this, limitations still exist suggesting that further research and development of responsible use of these platforms are necessary.

Ruby Gamboa

Environmental Systems: Ecology, Behavior and Evolution, UC San Diego
Summer CAMP
Mentored by Dr. Michael Burkart

Protein Purification and Analysis of Pseudomonas Bacteria

Trash pollution has become a global issue that scientists have tried to lessen with biodegradable alternatives. Polyurethane (PU) accounts for 20% of plastic pollution, and current research has found an algae-based alternative for foam products made from this type of plastic. However, the biodegradation process of polyurethane foam has been of key interest. By isolating the specific proteins that are secreted from the bacteria that biodegrade, the PU foam can aid to find a fully recyclable material that can be distributed commercially. Previous research has identified bacterial strains that are present when algae-based PU foam has been in minimal media where it was the only carbon source for the bacteria to survive on, and their produced proteins must be further tested for polymer-degrading enzymes known as esterases.Their research was able to isolate a bacterial strain known as Pseudomonas (PS). Our current research will continue to focus on PS proteins using immobilized metal affinity chromatography (IMAC) to purify the His-tagged PS proteins of interest. This purification will be confirmed by SDS-PAGE gels, with successful results prompting tests for the enzymatic activity of the protein. This enzyme assay analysis can determine whether or not there is esterase activity of our proteins of interest, and results will allow us to infer if it could be tested on polyurethane.

Alexandra Garcia

Psychology, UC San Diego
Colors of the Brain
Mentored by Professor Kay Tye

Investigating the impact of social homeostasis on social rank representations in the medial prefrontal cortex

Social context can influence how an individual interacts with their environment. For example, social behaviors are differentially motivated by social rank placement within social hierarchies and varying periods of social isolation. Prior work has shown that dominant mice have an increased preference for social interaction compared to subordinate mice and that acute versus chronic periods of social isolation show contrasting effects on motivation for social contact. In addition, representations of social ranks have been shown to be encoded by the medial prefrontal cortex (mPFC), such that circuit manipulations can change motivation for social competition in mice.

While the mPFC has been found to be critical for representing social rank, little is known about how the mPFC undergoes state changes following isolation and shifts in social rank. Here, we hypothesized that manipulations to isolation status and social rank will change socioemotional behaviors and the coding scheme of mPFC neurons in response to both social and non-social stimuli. To test this, we used in vivo cellular resolution calcium imaging coupled with ultrasonic vocalization (USV) recordings and machine learning tools to measure mPFC neuron ensemble activity as animals engaged in social interaction, Pavlovian discrimination, the resident intruder task, and the elevated plus maze. Taken together, our findings may reveal how manipulations in social context alter the way in which the brain processes socioemotional information to dictate our interactions with the environment.

Mary Ellen Garcia

Clinical/Counseling Psychology, California State University, San Bernardino
STARS
Mentored by Dr. Kelsey Thomas

Associations of locus of control and memory self-awareness in unimpaired and MCI older adults

Background: While loss of insight into one's cognitive impairment is a feature in Alzheimer's disease dementia, little is known about factors that may impact memory self-awareness in cognitively unimpaired (CU) older adults or mild cognitive impairment (MCI). Greater external locus of control has been linked to worse health outcomes. Therefore, we examined associations between locus of control and memory self-awareness and whether MCI status serves as a moderator.

Methods: Participants from the ACTIVE study were classified as CU (n=2177) or MCI (amnestic n=313; non-amnestic n=170). Memory self-awareness was defined as: memory composite score minus self-reported memory functioning. Positive values indicate over-reporting of memory difficulties relative to actual performance (hypersognosia) and negative values indicate under-reporting (hyposognosia). Both internal (i.e., skills can be used to control one's destiny) and external (i.e., fate/powerful others serves as constraints) locus of control scores were examined.

Results: Across participants, lower internal and higher external locus of control were associated with hypersognosia (ps<.001). Relative to CU, only amnestic MCI showed a stronger association between external locus of control and memory self-awareness (p=.038) such that lower external locus of control was associated with hyposognosia. MCI did not moderate associations between internal locus of control and self-awareness.

Conclusions: In CU participants, higher external locus of control was associated with hypersognosia, which is consistent with findings that subjective cognitive decline is associated with greater amyloid burden. Conversely, in amnestic MCI, the association of lower external locus of control with greater hyposognosia may suggest that reduced insight results in not realizing the need for external supports.

Anshul Garde

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

Accelerometer and Magnetometer Calibration of an Oceanic Data Collection Platform

The growing dangers of climate change have resulted in a greater need to collect oceanographic data in order to study and predict its effects. Currently, oceanic data is primarily collected through a handful of off-shore buoys. However, this method is unable to collect scientific data near the oceanic surf zone since the zone is too shallow to accommodate buoys. Smartfin, a surfboard fin that continuously collects and uploads such data when deployed in this zone, offers a promising solution. In order to incentivize surfers to use the fin and collect more data, there are sensors aboard the fin meant to record information beneficial to the surfer's experience in addition to climate-related data. These sensors, primarily the accelerometer and magnetometer, are capable of being used to calculate data such as wave height and surfboard tracking/pathing. To advance these goals, my focus this summer is researching a method to reliably determine the surfboard's direction/heading at certain points during a session. My proposed solution seeks to mitigate the erratic behavior the sensors exhibit in surf zone conditions, even after being calibrated with traditional methods.

Serena Geroe

Engineering Science, Smith College
MRSEC REU or RIMSE
Mentored by Professor Michael Sailor

Detoxification of Chemical Warfare Nerve Agents via Zirconium Cluster Catalysis

Due to proprietary information this abstract has been redacted.

Arianna Girmai

Biology, UC San Diego
Summer Industry Internship via the UCSD PATHS Scholars Program
Mentored by Michael Croft

Psoriasis and Atopic Dermatitis

Due to proprietary information this abstract has been redacted.

Kaia Godsey

Sociology, Spelman College
STARS
Mentored by Dr. Mary Blair-Loy

Career Trajectories of Women CEOs

Due to proprietary information this abstract has been redacted.

Jay Golden

Bioengineering: Bioinformatics, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Marco Mravic

Engineering Membrane Spanning Proteins Using Statistical Methods

Engineering transmembrane spanning proteins have already shown significant bioengineering applications through their use in highly specific ion channels, long read DNA sequencing, or inducible control of cells' signaling pathways, creating a clear desire for computational methods for their development such that they meet specified parameters. I have developed an algorithm to data mine single-body and multi-body enrichment and covariance data from characterized natural proteins and convert this information into a graphical network from which an optimal pathway can be determined that will maximize the predicted level of interactivity based on known amino acid interactions determined by the bioinformatics mined data. Once sequences are determined, they are modeled with optimized rotamer selection onto the desired protein

backbone and analyzed in silico using Rosetta minimization and GROMACS all-atom molecular dynamics simulations. Bundles determined to have extremely high stability are further analyzed in vitro through the transformation of the protein encoding gene into bacterial cells, induction of protein production and purification of the protein, and various biophysical experiments to characterize structural elements of the protein. Currently, we are in the process of analyzing proteins with sequences optimized for the production of self-assembled pentameric homo-oligomer assemblies with variations in desired ion channel properties as well as two-pass antiparallel hairpin structures. The computationally designed sequences have all shown extremely promising results in initial analysis and are moving to biophysical testing.

Jordan Gomez-Padilla

Cognitive and Behavioral Neuroscience, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Sadler

Cancer and Dementia; Who Cares?

Patients with comorbid cancer and dementia (CCD) diagnoses have a higher mortality and shorter survival time than individuals with only one condition. The prevalence of CCD is low but, is expected to rise with the aging population. This study explored the scientific literature related to this disease dyad. Articles were found using PubMed, Academic Research Complete, CINAHL, ERIC, and Google Scholar. Articles published in English between 2017 to 2022 and with full text access were eligible for inclusion. Key search words included: dementia, cancer, decision-making, screening, treatment, caregiver, Alzheimer's, and guidelines. This review highlighted contributing factors: lack of dementia training for oncologists, oncology staff is not informed of the dementia diagnosis, caregivers are not sufficiently informed to assist with decision-making or are ignored by the clinical team, and the cancer treatment pathway is usually generic and does not cater towards dementia patients. Another related aspect is that dementia patients typically receive less cancer screening and less aggressive cancer treatments. Lack of efficient and consistent communication between all health professionals, caregivers, and the patient is the greatest influence on the negative outcomes for CCD patients. Multi-disciplinary teams focused on patient-specific treatment should be implemented early in the treatment plan. The health care providers who diagnose dementia should also encourage advanced planning and power of attorney discussions with the patient and their caregivers to alleviate the stress in the later stages of the patient's life. The studies were few, the samples small, and dementia definitions varied, underscoring the need for more research.

Ashley Gonzalez

Environmental Studies, University of San Diego
McNair Scholars Program
Mentored by Drew Talley, PhD

The Interconnection between Health Disparities and Junkyards in East Los Angeles County

Objective: Analytical and non-analytical studies on environmental racism have focused on the interconnections between policies and environmental hazards in low-income communities to determine the degree of racial inequality (Cutter 1995, Perez 2015). Majority of these studies explore the arrival and permanence of toxic spaces such as junkyards and polluting industries and their impacts; however, they overlook the direct consequence it has on the East Los Angeles community. The history of junkyards in East Los Angeles, California (ELA), is not often discussed, but it plays a crucial role in how environmental racism came to be in the community today. By denying the impacts of the past junkyard, it also denies the spatiality of racism that residents faced in the past and present. Methods. We analyzed demographic and land-use/zoning data in ELA using regressions to analyze ELA. Expected Results. We hypothesize that 1) industrial land use and green spaces inversely contribute to the air quality of the community; 2) the construction of toxic spaces, such as junkyards has a negative effect on the health of the marginalized communities that are living around the area; 3) race and ethnicity are still significantly associated with the toxic spaces and continued to be impacted by environmental racism.

Leonardo Gonzalez

General Biology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Yury Miller

ABCA1 and ABCG1 cholesterol transporters effect in nociceptive signaling in Chemotherapy-Induced Peripheral Neuropathy (CIPN) mice

Chronic pain is prevalent in many adults and to date available treatments imply high costs and serious side effects including addiction. Cholesterol metabolism in microglia has been shown to be key in the development of pain. Lipid rafts are cholesterol-rich domains of the membrane that hold increased levels of activated receptors such as toll-like receptor 4 (TLR4) that serve as a platform for inflammatory responses. The presence of these inflammarafts has been described in the spinal microglia of animals in the CIPN model. However, the role of cholesterol metabolism in astrocytes and its effect on neuronal function in the development of neuropathic pain are not well understood. In this study we focused on the cholesterol transporters ABCA1 and ABCG1 in astrocytes and its effect in the development and perpetuation of pain. Microscopy imaging and flow

cytometry of free cholesterol, lipid droplets, lipids raft and cholesterol transporters in neurons of the dorsal root ganglion will be analyzed in animals lacking cholesterol transporters in astrocytes (the main source of lipid for neurons), to see how astrocyte cholesterol metabolism is involved in the development of neuroinflammation, and pain. We will examine in vitro, with DRG neuronal cultures, how astrocyte-delivered cholesterol to neurons affects lipid rafts and TLR4 dimerization and interaction with other channels. We predict that reduced cholesterol transport from astrocytes to neurons will induce lipid changes in the neuronal lipid rafts and cholesterol handling that will affect TLR4 interaction with other receptor/channels in neurons that will ultimately reduce pain.

Sara Gonzalez

Public Health Concentration in Medicine Sciences, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Sadler

Telehealth exacerbates disparities in breast cancer care and education among Hispanic women

Telehealth services were initially thought to be a temporary solution to the isolation imposed by COVID-19. Instead, telehealth has become a widely accepted way to provide care. While welcomed by many, this transition raises concerns for health care access among economically challenged and digitally illiterate individuals.

Hispanic women, for example, may be disproportionally disadvantaged in coordinating their breast care. Telehealth services involving medical communications, scheduling of appointments, preliminary intake sessions, and educational sessions all require the ability to navigate and use the providers' technology, usually in the language selected by the provider.

This literature review explored the accessibility of digitally delivered health care access experienced by Hispanic women by identifying relevant articles using PubMed, CINAHL, and Google Scholar. Search words used included: telehealth, telemedicine, digital illiteracy, technical divide, telehealth/telemedicine satisfaction, technological divide, Hispanic women's income, and prevalent cancer among Hispanic women. Full-text articles published in English between 2017 and 2022 were eligible for inclusion in this review.

Limited technical knowledge partnered with limited access to computers, webcams, microphones, and high-speed digital services prevents them from receiving the benefits that telehealth offers. This includes faster scheduling, personally selected appointment times, lower costs, time efficiency, better care access, and better aftercare outcomes. This presentation will explore the potential factors contributing to Hispanic Women's digital illiteracy and possible solutions. How, if solved, telehealth could help improve their access to and quality of breast cancer care.

Valerie Gonzalez

Molecular and Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Gene Yeo

Developing an RNA-targeted therapeutic for microsatellite repeat expansion disorders using catalytically dead Cas13d

Microsatellite repeat expansion (MRE) diseases are caused by repetitive DNA sequences that can produce toxic RNA and protein products. Examples of MRE diseases include Huntington's disease, caused by a CAG repeat expansion in the Huntingtin (Htt) gene, and myotonic dystrophy type 1 (DM1), caused by a CTG repeat expansion in the DMPK gene. Knocking down the MRE-containing RNAs is an attractive therapeutic strategy for treating these conditions. However, previous work has largely relied on Cas13d, a protein with high levels of off-target RNA cleavage. In an effort to design a robust system for knocking down MRE-containing RNA, we have utilized PIN endonuclease fused to catalytically dead Cas13d (dCas13d). Our system takes advantage of Cas13d's RNA-targeting capabilities while avoiding the unwanted off-targeted effects associated with its native endonuclease domain. To test our system, we transfected human embryonic kidney (HEK293T) cells with three plasmids encoding 1) PIN-dCas13d, 2) a guide RNA (gRNA) targeting CAG repeats, and 3) exon 1 of the Htt gene containing 74 CAG repeats. We then quantified the CAG repeat RNA using RNA dot blots. We saw that both fusion orders (N-terminal or C-terminal PIN) resulted in strong knockdown of CAG repeat RNA when compared to a non-targeting gRNA. We are now testing our system's efficacy in HEK293T cells expressing 105 CTG repeats, the MRE implicated in DM1. Our preliminary results demonstrate that PIN-dCas13d could be an effective research tool and/or therapeutic system for knocking down MRE-containing transcripts.

James Gow and Christine Oh

Bioengineering: Bioengineering / Human Biology, UC San Diego
MRSEC REU or RIMSE
Mentored by Dr. Michael Sailor

Development and Characterization of Fusogenic Porous Silicon Nanoparticles for siRNA Delivery for the Treatment of Retinal Neovascularization

Due to proprietary information this abstract has been redacted.

Angie Gross

Psychology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Lindsey Powell

Examining the role of utility in ownership judgments

From early childhood, humans understand ownership as an association between an owner and an object and attribute particular rights to owners. Previous work suggests that children and adults use particular social cues to infer ownership, such as who possessed the object first, who created it, and whether someone is granting or denying others' access to the object (e.g., Kanngiesser et al., 2014; Goulding & Friedman, 2018; Friedman et al., 2013; Neary et al., 2009). Here we test the possibility that people think of ownership as an association that gives owners exclusive access to the expected reward value of the resources they own. In the current study, adults and children were presented with several scenarios each involving two agents and an object. In some scenarios, one agent engages in an action with the object that implies the agent has exclusive access to the potential rewards of the object, while the other agent engages in an action that reflects the aforementioned cues (i.e., first-possession, creation, control). Following each scenario, participants were asked to indicate which of the two agents owned the object. If ownership is understood as a privileged relation, then information that a person has exclusive access to an object should be a strong cue of ownership. That is, participants should be more likely to select the agent with more privileged access to the object than the other agent. The findings will be informative of how ownership is structured as a concept and whether it changes across development.

Abby Hackbarth

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Karcher Morris

Inertial and Optical Non-invasive Wearable Device for Recording Surgeon Ergonomics

Surgeons often spend long hours in the operating room, typically with poor posture. As a result, surgeons are victim to long-term neck strain, and oftentimes, musculoskeletal disorders. A study completed by Park et al. (2008) concluded, "87% of surgeons who regularly perform minimally invasive surgery suffer such symptoms or injuries". Therefore, it is important for surgeons to correct their posture before serious issues arise.

Researchers previously developed wearable devices with inertial measurement units (IMUs) to monitor ergonomics (e.g., Carbonaro et al., 2020, Meltzer et al., 2020, Chrouser, 2022). In our research, we collaborated with UC San Diego's Jacobs Medical Center to develop an inertial and optical non-invasive wearable device to record forward flexion, side flexion, and rotation, for surgeons to monitor their performance. The device

consists of two wireless ESP 32 devices: one enabling accelerometers over SPI, a common communication protocol, the other equipped with a camera. Additionally, we created a headpiece with three squares horizontally on the back, colored blue, red, and green from left to right. Hence, we calculated coordinates of squares' edges to find lengths and centers, to calculate forward flexion, side flexion, and rotation – enabling surgeons to prevent harmful ergonomics.

As we intend to translate this device over the next months into a medical environment, we need to better understand image processing using computational tools, like Python and MATLAB, for more effective data processing, and design our system to incorporate surgeon feedback. In this presentation, the device design and future human-subject research will be discussed.

Farah Haleem

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Tracy Harrison

Role of Testosterone on Luteinizing Hormone Level and Menstrual Cycle in Transgender Men

Luteinizing Hormone (LH) induces the release of steroid hormones and controls the menstrual cycle. This study aims to compare LH levels and the menstrual cycle before and after 3-6 months of exogenous testosterone (T) use in transgender men (TGM). A prospective observational study was conducted with 13 cisgender females and 7 TGM subjects. Subjects were excluded if weight <110lbs, hemoglobin levels <11 gm/dl, current thyroid or endocrine disorders, history of oophorectomy or hysterectomy, radiation or surgery concerning the brain, prior T therapy, or BMI >35. Control and TGM subjects require one 10.5-hour visit with a blood sample taken every 10 minutes during the mid- follicular phase during an untreated menstrual cycle. TGM are studied two additional times 3 and 6 months later. The blood is analyzed for T, LH, and estrogen levels. Currently, eighteen participants enrolled in this study (11 control, 7 TGM) and blood samples from 4 patients are processed. Based on current findings, T increases menstrual cycle length significantly (28.2 ± 1.5 vs. 84.0 ± 14.0 days, $P<0.05$). This study is highly relevant and beneficial to the transgender community. By understanding the mechanism for how T affects LH levels, clinicians can support patients experiencing infertility, amenorrhea, PCOS, and other disruptions to the menstrual cycle. The findings of this research will facilitate a deeper understanding of the intricate relationship between pituitary glands, ovaries, and the hypothalamus.

Justin Han

Environmental Systems EBE, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Sarah Aarons

Calibration of a procedure for separating isotopes

Due to proprietary information this abstract has been redacted.

Samantha Harmer

Political Science, Sociology, Communications, UC San Diego
Undergraduate Research Scholarships
Mentored by Harvey Goldmen

The Effects of Mentoring on Former Foster Youth

According to Voices to Children, a local non-profit, 670,000 children enter the foster care system nationally each year. Eighty thousand of these youth are in California, and 1,200 enter San Diego county's foster care system. Roughly 3% of these foster youth graduate college, with their educational difficulties starting very early in life. With these statistics, this research paper outlines the importance of mentoring for former foster youth, especially within their educational environment. Throughout this paper, I will conduct a research analysis of models for mentoring and conduct quantitative interviews with professionals who have established effective programs. As a result, I expect a holistic understanding of why mentorship is important for former foster youth and the foundation to create and implement one at the University of California San Diego.

Joshua Hartman

Human Biology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Georgia Sadler

Importance of Screening and Potential Biomarkers for Multiple Myeloma

Multiple Myeloma (MM) is the most common form of plasma cell tumor and the second most common lymphohematopoietic cancer. A narrative literature review was conducted to gather the most current information employing articles found using PubMed, Google Scholar, and Web-of-Science. The key search terms used were: Multiple Myeloma, Screening, Biomarkers, and Disparities. Articles published in English, between 2017 and 2022, and available in full-text were eligible for inclusion in this review. A diagnosis of MM is often delivered with a maximum predicted lifespan of five years, but often much less depending on disease progression. Diagnosis of MM is a long and difficult process requiring a number of conditions to be met and tests to be run. Currently, there are no

mechanisms in place for the early detection of Multiple Myeloma. MM is always preceded by Monoclonal Gammopathy of Undetermined Significance (MGUS) and/or Smoldering Multiple Myeloma (SMM). These mostly benign conditions are characterized by abnormal levels of serum m-protein in the blood and abnormal percentages of monoclonal plasma cells in the bone marrow. MGUS and SMM are commonly left untreated and perceived as inconsequential, but could serve as an important signifier. This presentation will explore the implications of a standard for MM screening with promising biomarkers such as PRDM1, IRF4, LTB and SP140. Disparities will arise if the screening processes are not developed and tested with highly diversified samples; recommendations for reduction of disparities will be discussed.

Bryce Henroid

Bioengineering: Bioinformatics, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Eugene Yeo

Applying Models to Cell Type and RNA-binding Protein Classification

mRNA and RNA binding proteins play important roles in molecular biology. As the well-known sister of DNA, mRNA has a key role in protein synthesis acting as a messenger who bridges between genetic information and functional proteins. Advancements in sequencing technology have made it possible to use mRNA to predict and classify cell types in cell culture and tissue experiments. Cell-type classification is important in understanding how diseases manifest and change over time. First, this presentation will explore how machine learning and other modeling methods can be utilized to predict cell types in diseases such as Autism spectrum disorder. In particular, it will explore how single cell RNA sequencing, a method of characterizing and quantifying the mRNA content of individual cells, can be used to both characterize and validate cell types of in vitro 3D model for brain investigation known as cortical organoids. Second, the presentation will explore a computational prediction method for RNA-binding proteins. Although lesser known than mRNA, RNA binding proteins also play a crucial role in the regulation of the whole life cycle of RNA molecules including transcription, splicing, translation and etc. However, our knowledge of the RNA-binding proteins are still very limited and many members of the group are still unknown. Machine learning approaches and how they are being utilized to predicting novel RNA binding proteins in humans and other species will be discussed.

Helen Hernandez

Biochemistry, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Sadler

Interface between Genomic Variation and Immunotherapy

African American women have the highest breast cancer death rate compared to other racial/ethnic groups in the United States. One factor known to contribute to this excessive death rate is that African American women are more likely to develop triple-negtive breast cancer (TNBC), a highly aggressive form of cancer. This narrative literature review explored the most recent data on the effectiveness of the various agents used in immunotherapy treatment based on the presence of specific biomarkers. There are three biomarkers that are commonly present in breast cancer that are used assess prognosis and provide details that help to predict the immune response to specific immunotherapy treatment agents. While prolonging breast cancer survival, those agents have significant side effects that have motivated scientists to develop better alternatives. Studies identifying the effectiveness of the various agents used in immunotherapy treatment were identified using the PubMed, NCBI, CINAHL, and Google Scholar databases. The following keywords were used to identify potential key articles: Cytokines, Immunotherapy, Breast Cancer, Triple-negative breast cancer, and Immune Response. Articles written in English and published between 2004 to 2022 were eligible for inclusion. Reference lists of articles were reviewed to identify additional articles. Findings from the literature review and key results will be presented with recommendations for future research and proposed solutions.

Veronica Hernandez

Psychology with a Specialization in Clinical Psychology, UC San Diego
STARS
Mentored by Dr. Lara Rangel

Neurophysiological activity within the dentate gyrus of the hippocampus during vicarious trial and error and object-pushing

At an intersection of two similar paths, our ability to learn and recall associations between each path and distinct destinations or consequences may be critical for survival. This ability to learn that similar spatial experiences are linked to distinct outcomes presumably heavily depends on the dentate gyrus (DG), a subregion of the hippocampus. DG seemingly aids this ability by activating distinct populations of cells given similar experiences. However, limited knowledge exists regarding how DG recruits these cells across experiences, and whether DG is important for learning and recalling associations as organisms deliberate between similar choices. To explore this, we trained rats to perform a task where they needed to associate an initial location on an arena with a

rewarding outcome, and later return to the initial reward location despite the presence of alternative (unrewarded) locations. In a learning phase, rats pushed over an object at a rewarded location to receive a food reward underneath. During a subsequent recall phase, rats needed to choose between two possible reward locations, each covered by an identical object. We acquired in vivo electrophysiological recordings from the rat DG during task performance, and examined whether DG exhibits unique oscillatory states during specific behaviors such as vicarious trial and error (VTE) and object pushes leading to correct decisions. This would suggest that DG changes the way it processes information in a manner tied to successful performance. Our results will provide valuable insight into temporal coordination of DG activity during successful learning and recall of distinct memories.

Victoria Herrera

Human Biology, UC San Diego
Youth Enjoy Science (YES) Research Education Program
Mentored by Dr. Georgia Robins Sadler

Neglected Endemics: How the Lack of Worm Research and Education has Contributed to Disparities in Bladder Cancer in Areas Endemic for Schistosomiasis

The most common type of bladder cancer worldwide is transitional cell carcinoma (TCC). On the African continent, squamous cell carcinoma (SCC) is the most common form of bladder cancer. Schistosomiasis, the most common parasitic infection in Africa after Malaria, is believed to trigger this difference. Approximately 90% of schistosomiasis cases worldwide affect Africans, two-thirds of which are caused by the species Schistosoma haematobium. Schistosomiasis is a neglected tropical disease (NTD) that is spread in its larval stage to humans when the parasite leaves its freshwater snail vector and penetrates the skin of the nearby human host. After penetration, these parasites enter the bloodstream and travel in mating pairs to the venous plexus of the bladder, where most of the damage occurs. It is believed that deposited eggs are inefficiently urinated out of the body, leaving many in the bladder where they trigger chronic inflammation. Chronic inflammation triggered by this species has been linked to SCC. The mechanism of SCC development is not well understood and requires additional research. Studies regarding disparities in this schistosomiasis-linked cancer are practically nonexistent in spite of the suffering in endemic areas. Despite mass preventative drug administration efforts, there is a great need for improved sanitation, mollusk control, education, cancer screenings, and programs for impoverished people in endemic regions. Of equal importance, recent studies have suggested that schistosome-infected snail vectors are increasingly being identified in European waters due to climate change, making this an international public health concern.

Isabel Herrera Guevara

Psychology with Specialization in Cognitive Psychology, UC San Diego
McNair Scholars Program
Mentored by Dr. Lindsey J. Powell

Emotion responses following failed goals

What are babies' expectations when members react emotionally incongruent to goal-directed actions? At 10 months infants expect happiness rather than sadness to follow successful goals but show no expectations about failed goals (Skerry & Spelke, 2014). Here we explore whether infants' expectations about emotional reactions of goal outcomes vary by social context and age. In Experiment 1, infants saw events in which one actor failed a goal in one block and a second actor completed a goal in another. An observer, affiliated with the actor, responded to this outcome by emoting either positively or negatively. Infants' looking to the negative outcome compared to the positive outcome was significantly greater than chance in the completed block but looking to the negative outcome during the failed block was not significant. Infants expect happiness to follow an affiliate's completed goal, but it remains unclear how infants are reasoning about failed goals. Experiment 2 replicated Skerry & Spelke's (2014) original study with 17-month-olds. Infants saw the same events as in Experiment 1 except that there was no observer and the actor emoted to their own goal outcome. A replication of the result shown in the first experiment, infants' looking to the negative outcome in the complete block was significant, whereas infants' looking in the failed block was not different from chance. These results suggest that reasoning about failed goals comes much later in development than reasoning about complete goals.

Jared Hoffart

Political Science, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Pinar Yoldas

Artificial Reef Art Installation

Marine tourism chases beauty trying to find the most pristine waters and breathtaking creatures. This creates a problem in that, oftentimes, the most beautiful environment is likewise the most delicate. Without proper precautions, snorkeling and scuba diving can damage the local marine environment. Anchors, fins, and even sunscreen all have the potential to hurt delicate marine life. To offset this, artificial reefs have the potential to create a unique environment to both protect marine life and draw traffic away from the more delicate environments. The goal of this research is to create an architectural installation in the ocean that would double as both art and an artificial reef for local marine life. The primary concern when implementing this project is focusing on not

disturbing the local life but rather complementing the environment already in place. In the future, a permanent installation off the San Diego coast is the intended result.

Duncan Hong

General Biology, UC San Diego
YES Program – Creating Scientists to Address Cancer Disparities
Mentored by Georgia Sadler

Disparities in Multiple Myeloma Treatment and Research in African Americans

Multiple Myeloma (MM) is a relatively common blood cancer of plasma cells in the bone marrow. As MM progresses, patients generally experience anemia (red blood cell deficiency), bone lesions, and hypercalcemia (excess calcium levels in blood). MM typically arises in older patients and has no proven environmental risk factors. However, numerous studies since 2017 have identified a significantly higher incidence in African Americans than in Whites. The disparity in MM incidence in Black patients is likely to widen due to the underrepresentation of African Americans in cancer research, particularly in relation to hematological clinical trials involving bone marrow. This literature review will explore such disparities, as well as potential actions that can be taken to reduce the barriers that African Americans face with access to education about and treatment of myeloma. Scholarly articles published within the last five years were reviewed from Google Scholar, PubMed, ProQuest, and the UC Library Search. The following keywords were used in the search: multiple myeloma, African-American, bone marrow donor, blood cancer, and disparities. Statistics for MM were obtained from the American Cancer Society, American Society of Hematology, and National Cancer Institute. Included in this literature review are details on the greater incidence of MM in African-Americans, their inclusion (or lack thereof) in associated research, and suggestions for future remedial action.

Casey Horn

Bioengineering: Biotechnology, UC San Diego
STARS
Mentored by Dr. Sonya Neal

Rhomboid Protease Dfm1: Its Role in the Mitigation of Cytotoxic Membrane Stress

Misfolded proteins and the cytotoxic aggregates they form due to conglomeration of abnormally protrusive “sticky” hydrophobic residues are a common feature of aged and diseased cells. The endoplasmic reticulum (ER) has a major role in maintaining cellular proteostasis, as it is the site of protein production, folding, and quality control for both membrane and secretory proteins. Endoplasmic Reticulum Associated Degradation (ERAD) is one of the main pathways responsible for the degradation of misfolded proteins at the ER; though there are three different branches of ERAD, our focus is illuminating the ERAD-M (specific to membrane proteins) pathway and the mechanisms

by which membrane protein aggregates cause toxicity within the cell. We have determined in yeast that the derlin Dfm1 has a chaperone-like function that promotes solubility of aggregation prone misfolded membrane proteins. We have also demonstrated that this chaperone function of Dfm1 does not depend on the recruitment of ATPase Cdc48 and is distinct from its role in the retrotranslocation of membrane proteins to the cytosol for degradation. There are numerous diseases attributed to or in some part influenced by cytotoxic membrane protein aggregates, including certain forms of Alzheimer's, Parkinson's, Huntington's disease, and cystic fibrosis. Enlightenment of the ERAD-M pathway components and roles may lead to improved prevention and treatments for afflicted individuals. We remain focused on determining the specific cellular impacts of misfolded membrane proteins in the absence of Dfm1, including disruptions to proteasomal and ubiquitin homeostasis.

Haoyang Hu

Bioinformatics, UC San Diego
199 or other independent study for credit
Mentored by DR. Julian Schroeder

Exploring Potential Mutant Candidate T-DNA Lines of Cadmium-Induced Arabidopsis thaliana's genes

Due to proprietary information this abstract has been redacted.

Emily Huang

Chemistry, Marine Biology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. William Fenical

Discovering Inhibitors of the SARS-COV-2 Protein in Natural Products from Marine Bacteria

SARS-CoV-2 is the coronavirus that causes COVID-19. Infection occurs when the virus enters human host cells through the following mechanism: the spike protein that is on the surface of the SARS-CoV-2 virus interacts with the Angiotensin I Converting Enzyme 2 (ACE2) receptor that is present on the surface of human cells, allowing entry into the human cells. The understanding of this infection mechanism makes it an ideal candidate for drug discovery - if inhibitors for the spike protein's receptor binding domain are found, they would prevent the virus from entering the human cells and infection would not occur. This study's aim was to identify and examine small molecules produced by marine bacteria that are able to inhibit this binding, interfering with the formation of the spike protein and ACE2 complex and preventing infection. This discovery could lead to the development of drugs that utilize these marine bacteria molecules to potentially prevent or treat COVID-19 infection. Scientists have successfully used marine bacteria and other natural products in the development of antibiotics, cancer fighting drugs, and

drugs to fight viruses. In this project, a wide variety of strains produced by marine bacteria were tested using a Spike-ACE2 Binding Assay Kit, a method used to characterize the binding affinity of the Spike-ACE2 complex when potential inhibitors are introduced. Using this methodology, strains that have inhibitory properties can be identified and further analyzed, leading to possible antiviral drug candidates.

Yucheng Huang

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Dinesh Bharadia

improving lidar auto-labeling with camera detection for radar model training

Millimeter wave radar is now playing a vital role in autonomous vehicles. Due to the physical properties of millimeter waves passing through small particles like fog and dust, mm-Wave radar can significantly improve object detection under bad weather conditions. However, as mm-Wave radars produce sparser point cloud data than lidars do, the existing lidar detection algorithms can not be directly used for radar point clouds. Currently, the research in this field is lacking due to the limited availability of training datasets for radar point clouds. The biggest challenge is to label the data collected, which is quite labor intensive and time-consuming. Although auto-labeled data from lidar detections can be used by radar for training, those outputs are usually inaccurate. Setting thresholds for each detection requires lots of manual human effort making the task infeasible. We introduce a novel way to automatically filter the detection results from lidar models by combining them with 2D detection results from cameras. Our insight is that the 2d detections on camera images are much more robust across datasets and can be reliably used to automate the labeling task, significantly reducing the inaccuracies. Our method requires minimal human effort and the detection results can directly be used as the ground truth labels for radar model training. We also showcase the utility of our system by collecting a large-scale dataset from state-of-the-art automotive radars and performing real-time detections in all weather conditions, that can be directly fed to the downstream tasks of path planning and control.

Ziheng Huang

Computer Engineering and Neurobiology, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Michael Yip

Endoscopic scene semantic segmentation

In surgical robotics, perception of the surgical scene is critical for autonomy. Because of the unpredictability of constantly deforming soft tissues, such autonomy in the endoscopic surgical scene is particularly challenging. One step toward surgical scene perception is endoscopic surgical scene semantic segmentation. Previous research on

endoscopic surgical scene semantic segmentation concentrated on surgical tool segmentation based on a single time stamp of the surgical scene. Yet, identifying different types of tissues in the background are also critical for surgical scene perception. With the usage of endoscope in modern surgical procedures, endoscopic surgical scene videos are recorded. Yet, these videos are not often leveraged when performing surgical scene segmentation. The goal of this project is to improve performance in endoscopic surgical scene semantic segmentation for both the instrument and background tissues by leveraging temporal consistency in the surgical procedure.

Lauren Huey

General Biology, UC San Diego
Genentech Scholars Program
Mentored by Dr. Alisa Huffaker

Beta-selinene derived metabolites produced by maize roots alter soil microbiome

Maize is among the most cultivated cereals and a staple crop in Africa and Latin America. Maize crops are essential in combating global food insecurity unfortunately, 22.6% of global maize crops are lost annually due to pathogen and pests (Savary et al., 2019). Maize has been utilized as a model organism for studying pathogenic plant-microbe interactions, however, relatively little has been studied about how maize roots interact with the soil microbiome. Maize roots are known to produce large quantities of different families of specialized metabolites either constitutively or in response to disease infection. These specialized metabolites are known to act as antibiotics, suppressing the growth of different species of agronomically important maize pathogens. One of the families of specialized metabolites produced by maize roots are beta-selinene derived specialized metabolites including beta-costol and beta-costic acid. Previous analysis of root microbiome community composition in wild type plants that produce beta-selinene-derived metabolites versus mutant plants that do not produce beta-selinene-derived metabolites presented a significant increase in Bradyrhizobium associated with the mutant plants. Bradyrhizobium is a microbe that facilitates the formation of nitrogen fixing nodules on the roots of legume plants. In this project we examine the effect of beta-selinene derived metabolites on the growth of Bradyrhizobium as well as the success of nitrogen-fixing nodulation of soybean plant roots. Ultimately, understanding the interactions between specialized root metabolites and the soil microbiome could aid in larger yields of maize crops through selective breeding and greater success of nitrogen fixating crops used in sustainable agricultural practices.

Yunjae Hur

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Matthew Shtrahman

rAAV-induced Toxicity in Neural Progenitor Cells

During fetal development, proper proliferation and differentiation of neural stem and progenitor populations are required to achieve appropriate brain and head size (Farkas, 2008). Consistent with this idea, a significant body of work indicates that viral infections cause microcephaly through toxic effects on neural progenitor cell (NPC) populations and impairment of neurogenesis.

Recently, we discovered that recombinant adeno-associated virus (rAAV) rapidly kills NPCs in a dose-dependent and cell-autonomous manner. Wildtype AAV contains a genome that includes the rep and cap genes, and a pair of inverted terminal repeat (ITR) DNA segments. These ITRs flank the AAV genome on both ends. During viral production, the rep and cap genes can be supplied in trans to create additional space for transgenes, resulting in the widely used rAAV vector. The only remnant of the AAV genome within rAAV are the ITRs (Wilmott, 2019).

We will examine the role of ITR-binding proteins by inducing rAAV-toxicity in vitro. We will use human H9 NPCs to investigate if the rAAV genome depletes the level of Parp1, a DNA damage response protein binding to said ITRs. We hypothesize that AAV ITRs induce cell cycle arrest and apoptosis in NPCs by functionally depleting Parp1.

In summary, we aim to identify the molecular basis for the susceptibility of NPCs to rAAV toxicity to develop an understanding of 1) viral illnesses of the developing CNS such as viral microcephaly and 2) rAAV-induced toxicity in the context of gene therapy, particularly in the treatment of children who have active neural proliferation.

Jaden Huynh

Cognitive and Behavioral Neuroscience, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Diaparities
Mentored by Dr. Georgia Sadler

ADHD and ADHD Symptomology Care in Pediatric Brain Tumor Survivors

This narrative review explores the relationship between attention deficit hyperactivity disorder (ADHD) and pediatric brain tumor survivors. A higher risk of ADHD and related symptoms were found in survivors of pediatric brain tumors. Databases such as PubMed, ScienceDirect, and Google Scholar were used. Search terms included: attention deficit, hyperactivity, brain tumors, cancer, neural divergence, treatment, and ADHD. References cited at the end of closely allied articles were also explored in the search for

other relevant articles. Peer-reviewed articles published between 2013 and 2021 were included if they focused on children and were available in full text and in English. This presentation aimed to identify evidence-based methods for assessing pre-brain tumor treatment risk status for ADHD, strategies for minimizing post-treatment ADHD, and medical and behavioral treatment methods for ADHD post-brain tumor treatment. There was a dearth of evidence-based studies related to pediatric post-brain tumor treatment and ADHD sequelae. It was found that select patients may benefit from behavioral or pharmacologic treatment of their ADHD. However, specific treatment depends on a case-by-case basis and is influenced by the part of the brain receiving the treatment. A few studies have suggested that methylphenidate may be beneficial in mitigating attention challenges in sure childhood cancer survivors. Future research is suggested to ensure optimal post-cancer treatment among pediatric patients who experience ADHD and/or symptoms of ADHD.

David Imig

Astrophysics, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Daniel Green

Imprints of Massive Neutrinos in the Phase of the Cosmic Microwave Background

The propagation of cosmic neutrinos in the Early Universe induces a temporal phase shift in the acoustic oscillations of the primordial plasma. This affects the phase of the Cosmic Microwave Background (CMB), which can be studied today. We explore the relationship between the neutrino mass and the resulting neutrino-induced phase shift to the CMB.

Emily Infante-Guzman and James Young

Biochemistry / Mathematics – Computer Science, UC San Diego
MRSEC REU or RIMSE
Mentored by Dr. Tod Pascal

Programmable Assembly of Binary Sized Gold Nanoparticles

The ‘bottom-up’ approach to assembling nanoparticles into desired structures is of great significance for the manufacture of metamaterials and functional devices with desired properties. Tremendous previous efforts have been devoted to the utilization of colloidal metal nanoparticles for metastructure fabrication and applications. Most of them focus on using single-sized nanoparticles as building blocks, whereas the use of nanoparticles with significantly different sizes for self-assembly remains scarce. We herein report the interfacial assembly of binary-sized gold nanospheres (Au NS) at the air-water interface, achieving size, composition, and surface chemistry- dependent assembly behaviors. Our binary sized assembly model represents a major advance from traditional assembly based on single sized nanoparticle building blocks.

Michelle Israel

Biology, Miramar College
STEMULATE program at UC Sand Diego CREATE
Mentored by Dr. Lalit Deshmukh

Identification of the Motif within ALIX Responsible for Phase Separation

Due to proprietary information this abstract has been redacted.

Snigdha Jagarlapudi

Genetics and Plant Biology, University of California, Berkeley
MRSEC REU or RIMSE
Mentored by Andrea Tao

PPS Driven Ligand Exchange to Facilitate the Removal of CTAB on the Surface of Gold Nano Cubes

Recent years have seen a dramatic increase in interest in the synthesis and applications of gold nanoparticles, due to their low toxicity, high stability, and their unique optical properties. These properties are heavily influenced by particulate shape and size. In particular, gold nanocubes (AuNC), with sharp edges and flat surfaces, are of interest due to their tunable electromagnetic properties, high electron density, and photoluminescence quantum yield. However, the production of such nanoparticles requires a complex multistep synthesis, including surface stabilizing agents such as CTAC and CTAB (cetyltrimethylammonium chloride; -bromide). Due to their cytotoxicity, formation of a robust double layer, and frequent destabilization during surfactant exchange, CTAC/CTAB must be removed from the AuNCs surface for further modifications. However, this removal process leads to partial aggregation and low recovery yields.

In this study, we investigate the use of a PSS-driven ligand exchange to overcome these issues. Polystyrenesulfonate (PSS) was used as an intermediate detergent to remove CTAB and stabilize the AuNCs in citrate. We show that these citrate-stabilized AuNCs are stable at low ionic strengths and are amenable to further modification without compromising stability. This new approach provides insight into one of the main hurdles in the production of AuNC-based materials and forms the basis for future research in surfactant exchange in AuNCs.

Jessica Jang

Human Biology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Kellie Breen Church

Brainstem and Hypothalamic Neuronal Activation during Immune Stress-Induced Hyperglycemia

Stress-induced hyperglycemia has been observed in non-diabetic SARS-CoV-2 patients, many of which develop new-onset diabetes.

The Breen Church laboratory has demonstrated that the neuropeptide Urocortin 2 neurons in the paraventricular nucleus (PVN-UCN2) are activated by metabolic stress and that UCN2 injected into the brain induces hyperglycemia. Based on this, it is hypothesized that UCN2 activation is sufficient for causing acute stress-induced hyperglycemia. Another neuron in the brain, the ventrolateral medulla that releases norepinephrine (VLM-NE), also plays a significant role in the stress response.

Thus, the Breen Church lab's purpose is to investigate the interaction between PVNUCN2 and VLMNE neurons during stress-induced hyperglycemia. This project aims to determine whether the VLMNE neurons and the PVNUCN2 neurons are activated during immune stress, using lipopolysaccharides (LPS), which causes hyperglycemia. There are two groups of mice: the control group, receiving saline; the experimental group, receiving LPS. Then, brain tissue is collected for immunohistochemistry, where tissue from the brainstem will be stained for tyrosine hydroxylase (TH) cells, which indicate norepinephrine-producing cells, and cFos, which indicates cell activation. By observing TH cells with cFos, we will be able to determine if LPS activates these neurons to cause acute hyperglycemia.

UCN2 and cFos will be stained in the midbrain to determine UCN2 activation in the PVN during immune stress-induced hyperglycemia.

Finally, the tissue will be analyzed by determining the percentage of UCN2 and TH cells that are considered activated.

Immunohistochemistry is currently in progress.

Jean Jeremie

Architecture, University of San Diego
McNair Scholars Program
Mentored by Dr. Juliana Maxim

Haitian Migrant Housing Stability in San Diego

This research examines the housing solutions developed by Haitian refugees living in San Diego. San Diego has seen a spike in the number of asylum seekers from Haiti after the Biden administration and the Supreme Court recently put an end to the controversial "Remain in Mexico" 2019 policy. The region has become a stopping point and major port of entry for those wishing to enter the United States of America. After a long journey, a long waiting period in Mexico, and at times imprisonment, Haitians often encounter harsh living conditions upon entering the U.S. A central challenge for Haitian families arriving in San Diego is finding housing. Without documentation, they are unable to legally rent houses or find work. This research explores how and where Haitian immigrants find shelter, housing, food, papers, and other essential living needs. Several Haitian immigrants were interviewed to hear their firsthand experiences of their journey to the United States and their ability to survive in the country as they await their immigration hearing.

We found that although there are few organizations helping migrants in San Diego, their services aren't abundant and often come with a time limit. Many Haitians often feel neglected and forgotten. Ultimately they hope to have documents to reach equal opportunities as others in the U.S.

Sachel Jetly

Computer Science, UC San Diego
MRSEC REU or RIMSE
Mentored by Professor Michael Sailor and Assistant Prof. Zheng Chen

Optimizing Electrochemical Etching Parameters of Silicon for Preparation of Polypyrrole-Coated Silicon Core-Shell Microparticles in Lithium-Ion Coin Cell Battery Anodes

Due to proprietary information this abstract has been redacted.

Hyoser Jo

Cognitive Behavioral Neuroscience, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Deanna Greene

Functional Network Organization of Comorbid Tourette Syndrome

Tourette syndrome (TS) is a neurodevelopmental disorder that shows complex symptoms of unwanted and continuous movements or vocal actions and is sometimes accompanied by cognitive deficits. Patients with TS may have difficulty establishing social relationships and develop anxiety problems due to uncontrollable tics, and the situation worsens with comorbid neurodevelopmental disorders.

Diagnosis and treatment of TS and comorbid disorders are made through behavioral assessments, such as clinical interviews. However, neuroimaging techniques such as fMRI are one way to understand more about neurodevelopmental disorders. Specifically, a better understanding of differences in brain network organization may provide valuable insight to the brain-behavior link associated with TS and comorbid TS.

One specific neuroimaging method for analyzing brain network organization associated with TS is resting state functional connectivity (RSFC). Derived from fMRI data, RSFC allows for analysis of baseline functional brain network organization that is absent of a specific task. Understanding how baseline network organization differs between groups with TS and comorbid TS may help identify opportunities to focus treatment on specific groups and help improve long-term clinical outcomes.

The current presentation will first describe the behavioral and demographic data of our dataset, which includes children experiencing tics, with or without common comorbid diagnoses: attention deficit hyperactivity disorder (ADHD) and obsessive-compulsive disorder (OCD). We will then examine differences in group RSFC organization between the groups. This research might lead to future research on other types of comorbid TS disorder and could be helpful in improving clinical interventions for ADHD or OCD comorbid patients.

Neelay Joglekar

Computer Engineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Michael Yip

Suture Thread Reconstruction with Physical Constraints

Automating the process of suturing incisions during surgery is a prominent problem at the frontier of surgical robotics, as automating this task can significantly reduce surgeons' fatigue during tele-operated surgery. This process relies on accurate suture thread

reconstruction, the process of creating a 3D shape representation of suture thread from 2D stereo camera surgical image pairs. Due to their thin structure, suture thread occupies a very small number of pixels in an image, their width spanning only 2-4 pixels. As a result, traditional purely image-based 3D reconstruction methods often produce noisy and inaccurate results. Hence, it is beneficial to integrate geometric and physical constraints that build on suture thread properties (i.e. smoothness, minimized internal energy, etc.) into the reconstruction process. We use a reliability metric to develop boundaries for the depth computed for each segmented pixel and to choose reliable keypoints as anchors. Next, we construct a 3D spline curve within these boundary constraints that passes through the computed anchor points, and we optimize this curve such that it minimizes a smoothing cost function. The optimized spline better approximates the 3D centerline of suture thread than traditional image-based reconstruction methods.

Daniel John

Bioengineering: Biotechnology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Weg Ongkeko

Characterization of the intratumoral microbiome in Papillary Thyroid Carcinoma

More than 44,000 individuals are diagnosed with thyroid cancer each year. While treatment options for thyroid cancer are available, these options vary significantly based on the sub-type of thyroid cancer present. Papillary Thyroid Carcinoma (PTC) is the most frequent type of thyroid carcinoma, making up almost 80% of cases. Even within PTC, patient outcomes vary greatly by sub-type, including classical variant (CV-PTC), follicular variant (FV-PTC), and tall-cell variant (TCV-PTC). Gender also plays a significant role, as women are 3 times as likely to develop thyroid cancer, but are just as likely to die as men. While the phenotypic differences and outcomes across PTC subtypes and gender are well-documented, the causes are not known. Additionally, studies of the intratumoral microbiome have revealed that microbes may play a key role in the progression of the cancer4, however, few studies have investigated if the microbiome is a key contributor to thyroid carcinoma oncogenesis. In this study, I worked to characterize the differences in the intratumoral microbiome composition between PTC subtypes and gender, which may be relevant to altered immune response and determination of clinical course. Pertinent microbes were first identified by comparing abundance across PTC subtypes and gender cohorts. Microbes of interest were then correlated to known oncogenic and immune-dysregulated gene signature pathways. Overall, this projects provides new insights into the potential driving mechanisms of thyroid cancer, which may be used in the future to better improve patient outcomes and diagnosis.

Hennie Marie Johnsen

Nanotechnology, University of Oslo
MRSEC REU or RIMSE
Mentored by Professor Michael Sailor

Targeted delivery of anti-cancer drug by albumin-coated porous silicon nanoparticles

Toxicity of chemotherapeutics on healthy tissues is a big challenge for cancer treatment. Therefore, delivering anti-cancer drugs specifically to the site of action is desired to improve the efficacy and reduce the side effects. Albondin/glycoprotein 60 (gp60), a well-known albumin receptor, has been shown to be overexpressed in several cancers including glioblastoma and intratumoral vessels. Albumin, the most abundant protein in the blood, is both endogenous and biocompatible. Also, its specific affinity to gp60 on tumors makes it a good candidate for development of targeted drug delivery. Porous silicon nanoparticle (pSi NP) is a promising drug carrier material due to its interesting features such as biodegradability and high drug loading capacity. We hypothesized that the pSi NP loaded with an anti-cancer drug and decorated with albumin can improve targeted drug delivery into the cancerous tissue while its biosafety and biocompatibility profile will be enhanced. Then, we prepared pSi NP and loaded it with indocyanine green, as a model for anti-cancer drug. Next, we are optimizing the albumin coating of nanoparticles through loading condition adjustments and surface chemistry modifications. A variety of different techniques such as Dynamic Light Scattering (DLS) and Fourier transform Infrared spectroscopy (FTIR) have been employed to characterize and quantify physicochemical properties of the prepared nanoparticles. The targeting ability of the nanoparticles will be tested in appropriate in vitro and in vivo cancer models in the future.

Brooke Johnson

Global Health, UC San Diego
McNair Scholars Program
Mentored by Dr. Fabian Rivera-Chávez

Phage susceptibility of Vibrio Cholerae under cholera toxin-inducing conditions

Cholera is a diarrheal disease caused by Vibrio cholerae, a human pathogen that uses cholera toxin (CT) to cause illness. Investigating potential preventative therapeutics is imperative to reduce the disease burden of cholera. Bacteriophages are viruses that infect bacteria and are promising candidates for treating cholera/other bacterial infections. Unlike antibiotics, phages can target bacteria with excellent specificity and co-evolve with their bacterial hosts, potentially allowing them to overcome evolved phage resistance. However, to fully assess the potential of phages as tools in treatment, it's necessary to study their interactions with their hosts. V. cholerae bacteriophage N-4 is a known phage that can infect and kill V. cholerae. Interestingly, CT is expressed by a

filamentous bacteriophage, known as (CTXφ), which can integrate into the genome of V. cholerae strains using its receptor, the toxin-coregulated pili (TCP). However, phage susceptibility of V. cholerae under CT-expressing conditions remains unknown. We hypothesize that CTXφ and CT-expression modulate the susceptibility of V. cholerae to N-4 infection. To test this, we'll assess the susceptibility of V. cholerae to N-4 under CT-inducing conditions vs. non-CT-inducing conditions. We predict that the N-4 killing of V. cholerae will be reduced under CT-inducing conditions because of the expression of TCP and possibly other CTXφ factors during induction. These studies will help expose the relationship between predatory phage infection and CT-encoding CTXφ V. cholerae, which may affect how this pathogen causes disease during outbreaks with the presence of predatory phage.

Ryan Jones

Chemical engineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Nisarg Shah

Nanoparticle Size

Polymer nanoparticles (NPs) are microscopic structures, generally spherical and less than 200 nanometers in diameter. NPs made from various biodegradable polymers have been proven for the prevention or treatment of a range of diseases. Their ability to facilitate treatment can be attributed to their ability to selectively target affected regions in the human body by way of customizable surface conditions, controlled drug delivery and tunable size (for more selective diffusion). Of these, size is one of the most important properties to consider, as the size of each NP affects where in the body it is able to diffuse into and which cells are able to uptake them. There are several formulation choices that can affect the resultant size of synthesized NP's; additionally, these factors, as well as the encapsulated drug included, may interact with each other and significantly affect size. Because NPs are so small, iterative experimentation is one of the only ways a custom particle can be size-calibrated. My research will thus focus on three particle conditions: selection of the organic phase, concentration of an aqueous surfactant, and the encapsulation of a selected payload. Based on initial experiments, I expect that NP size will depend on the organic phase concentration of polymer, and the surfactant (aqueous solvent) concentration. This data should also show if there is a threshold at which either variable becomes more greatly influential to particle size. Exploring this type of iterative process with polymeric NPs will provide insight on which synthetic factors influence size.

Hayelin Jung

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Kellie Church

How Stress Affects Blood Glucose Levels

Stress-induced hyperglycemia is the acute and momentary rise in blood glucose during illness, which occurs regardless of diabetic status. It was recently found that a brainstem population, VLMNE (neurons that produce norepinephrine in the ventral lateral medulla) cells, are an important component in the neural control of stress-induced hyperglycemia. It was shown that VLMNE neurons were necessary for psychosocial (restraint) stress-induced hyperglycemia. Stimulating VLMNE cells is enough to cause hyperglycemia via neural projections to the adrenal gland; however, the mechanism by which the VLMNE cells become activated is a major question. Neurons that produce the neuropeptide urocortin 2 located in the paraventricular nucleus of the hypothalamus (PVNUCN2) are responsive to other types of stress and may contribute to stress-induced hyperglycemia. Through this project, we hope to confirm that VLMNE cells are activated and determine if PVNUCN2 cells are activated during restraint stress. Adult ovariectomized mice were randomly selected to receive either 2 hours of restraint stress or control (no stress), and fixed neural tissue was collected and processed for immunohistochemistry. To assess cell activation, we used a marker for cell activation, c-Fos, in conjunction with a marker for norepinephrine cells, tyrosine hydroxylase (TH), in the brainstem and UCN2 in the midbrain. For analysis, we are counting the percentage of tyrosine hydroxylase cells in the VLM and UCN2 cells in the PVN that contain c-Fos. Cell counting and analysis on the tissues are ongoing.

Jasmine Jung

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Sonya Neal

Determining the Mechanism of Chaperone Function for the Yeast Derlin Dfm1

Endoplasmic Reticulum Associated Degradation (ERAD) has the responsibility of degrading misfolded proteins found within the endoplasmic reticulum (ER). The Neal Lab, working in yeast, has discovered that when an essential protein in this pathway, Dfm1, is absent, the cells become sensitive to cellular stress caused by the accumulation of misfolded membrane proteins. Along with this, the Neal Lab has recently characterized Dfm1 having a chaperone function, but the mechanism is unclear. I will determine what type of chaperone activity Dfm1 has, as well as determine whether Dfm1 is able to function in an ATP independent manner.

Ali Kattee

Mechanical Engineering, UC San Diego
UC LEADS
Mentored by DR. John Hwang

Continuous scale battery modeling for cube-sat design optimization

A cube-sat is a nano-satellite or a research spacecraft that is launched into low Earth orbit. The Virtual Super-resolution Optics using Reconfigurable Swarms (VISORS) is a mission that will launch two to three CubeSats into low-Earth orbit in order to create a virtual telescope that will be used to observe the Sun in 2023. In order for the mission to operate successfully, a battery model needs to be designed and optimized to accurately predict the electrical characteristics of the battery. Computational System Design Language (CSDL) will be used to optimize a battery where the cell parameters need to have non discrete values such as volume, state of charge, and mass. While most cube-sats typically use the lithium ion 18650 battery cell, which has a cylindrical shape, its battery configuration cannot be optimized because they have discrete parameters such as volume and cell count that restrict the performance of gradient-based optimization algorithms. Lithium-ion polymer battery cells on the other hand are flexible in their shape and cell structure because of their soft shells. Their cell packaging and geometric flexibility is highly advantageous to satellites where there are stringent mass and volume constraints.

Tatiyana Kazlova

Double major: Psychology and Communication, UC San Diego
McNair Scholars Program
Mentored by Dr. Gail Heyman

Understanding the Psychological and Social Dynamics of Disappointing Gifts

Gifts are generally intended to make the recipient happy and to strengthen social connections, but they often fail to do so. The present research examines such failures, which we refer to as disappointing gifts. In the present research, adult participants are asked to describe their experiences with such gifts from the perspective of gift-givers and recipients, and to characterize the reason that the gifts were disappointing as well as the nature of the relationship between gift-givers and recipient. Of primary interest is to determine the psychological and social correlations and the reasons for the disappointment and the responses to it. For example, we will examine whether problems related to gifts being inappropriately cheap or expensive are particularly problematic in relationships in which the giver and recipient are not emotionally close, and whether people in close relationships will be more likely to joke around about disappointing gifts. We will also examine whether people who have lived in countries other than the U.S. are more likely to falsely claim to like disappointing gifts, and whether people are more likely to falsely claim to like disappointing gifts with elderly people and with people they

view as sensitive or prone to negative emotions. This research will inform our understanding of the role of gifts in social relationships as well as our understanding of interpersonal emotion regulation more broadly.

Shoreh Ketabian

Biology, Mesa College
STEMULATE
Mentored by Alisa Huffaker

Phosphorylation of Asparaginase modifies the innate immune responses in Arabidopsis thaliana

Plants live in a hostile environment surrounded by different kinds of stresses. One of the mechanisms adopted by plants to initiate the innate immune responses is through the identification of pathogen-associated molecular patterns called elicitors. Some of these elicitors are plant derived peptides that are produced upon pathogen attack. One such peptide identified in A. thaliana is plant elicitor peptide 1, AtPep1 (Huffaker et al., 2006). This elicitor is recognized by plant encoded leucine rich receptors called PEPR1 and PEPR2. After their recognition, the immune signals are transduced into the cell, which in turn results in transcriptional, translational and metabolic reprogramming to produce proteins that help protect the plants from invasive pathogens.

In an attempt to discover novel immune regulators of AtPep1 induced immunity in A. thaliana, we identified that asparaginase protein was differentially phosphorylated after AtPep1 treatment. The amino acid asparagine is a primary molecule used by plants for nitrogen storage and transport, due to its high nitrogen to carbon ratio among all amino acids and its unreactive nature. Asparaginase (ASPGA) is an essential nitrogen-releasing enzyme, which catalyzes the conversion of asparagine to aspartic acid releasing free ammonia. In defending cells requiring nitrogen, ammonia (NH3) released from this conversion can be assimilated into other metabolic pathways. In plants asparaginase are especially necessary for nitrogen supply in sink tissues such as developing leaves and roots and in germinating seeds. A. thaliana genome includes two asparaginase genes, ASPGA1 with two isoforms ASPGA1.1 and ASPGA1.2, and ASPGB1. To further investigate the role of asparaginase gene in plant immunity we used the Salk-TDNA mutant lines that lack the function of this gene (aspga/b). We used these mutant lines to generate transgenic lines that overexpressed the phosphovariants of the gene ASPGA1 with its two isoforms viz., phosphoabolishing variants (named 1.1A and 1.2A with a mutation at amino acid site 169 where the serine is modified to alanine) and phosphomimetic variant (1.1D and 1.2D with a mutation at site 169 where serine is modified to aspartic acid).

Elise Kim

Molecular and Cellular Biology, UC San Diego
UC Scholars
Mentored by Dr. Robert Rissman

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

Due to proprietary information this abstract has been redacted.

Hannah Kim

Neurobiology, UC San Diego
McNair Scholars Program
Mentored by Professor Nicholas Spitzer

Validating a Chemogenetic and Optogenetic approach to study Neurotransmitter Switching

Neurons communicate by releasing neurotransmitters, which act as chemical messengers that bind to receptors on a postsynaptic neuron. Neurotransmitter switching (NTS) is a form of neuroplasticity in which a subset of neurons stop expressing the transmitter they were expressing before and start expressing a different one in response to chronic stimuli. Exposure to the drugs of abuse methamphetamine (METH) and phencylidine (PCP) are known to cause hyperactivity of the Prelimbic region, specifically the glutamtaergic neurons, and induce NTS. Because exposure to addictive drugs also induces phasic firing of Ventral Tegmental Area (VTA) dopaminergic neurons (DA), we now want to test if mimicking VTA DA neuron phasic firing is sufficient to induce NTS in the PrL. We are therefore validating an approach to optogenetically stimulate VTA DA neurons. Another focus will be validating a chemogenetic approach to suppress drug-induced hyperactivity and prevent the NTS in PrL glutamatergic neurons. Suppression of PrL hyperactivity is achieved by chemogenetically activating paravalbumin+ (PV) interneurons that provide inhibitory inputs to glutamatergic neurons. We are thus also validating an approach to chemogenetically suppress PrL glutamatergic neurons. While previous research has explained the different physiological and behavioral effects of various neurotransmitters, we have yet to understand the lasting affects of NTS in response to repeated exposure to drugs of abuse. Thus validating these Chemogentic and Optogenetic approaches will provide another tool to study drug-induced NTS.

Paula Kirya

Bioengineering, UC San Diego
McNair Scholars Program
Mentored by Dr. Lisa Poulikakos

Naturally Derived Nano-Optical Metasurfaces for On-Chip Breast Cancer Diagnostics and Drug Discovery

Due to proprietary information this abstract has been redacted.

Ryan Kosta

Computer Engineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Yiying Zhang

dataflOwS: an Exploration of Disaggregated Heterogeneous Accelerators

dataflOwS: an Exploration of Disaggregated Heterogeneous Accelerators

Workloads like machine learning, video processing, and stream data processing have become very popular in data centers and clouds over the last few years. Yet, the performance of CPU processors is not keeping up with these increased computing demands, which drives the need for various non-CPU processors such as GPU, Field Programmable Gate Arrays, and other domain-specific accelerators.

Traditionally workloads that run on a server use only the accelerators within the server, meaning all workloads must conform to the set of resources available on a server. This results in resource stranding where a workload only utilizes a portion of server resources and no workloads fit on the leftover resources. Resource disaggregation, in which resources are offered in pools, alleviates this problem. However, existing resource disaggregation work offers no unified mechanism for describing communication between heterogeneous devices, increasing development complexity of the applications which use them.

dataflOwS offers a simple data flow-based mechanism for utilizing heterogeneous disaggregated computing devices. It implements a management controller on end devices and provides support for various devices and program types.

Girish Krishnan

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Truong Nguyen

Lightweight Human Digitization System

This project involves the creation of digital 3D human models in Python from 2D images obtained from depth cameras. Digital 3D human models are useful for XR or metaverse applications and 3D video compression. Most existing 3D human digitization systems, however, are inefficient as they often use several capturing devices. To make a lightweight digitization system using a small number of cameras, this project uses the principles of perspective projection to generate 3D point clouds from each camera based on its intrinsic properties such as focal length and resolution. To align the point clouds generated from each camera and make a complete human model, stereo-calibration is performed using the standard checkerboard method to find the relative position and orientation of each camera. Although there are several common methods to calibrate two cameras, I had to work on developing a method to calibrate any arbitrary number of cameras, so that point clouds from multiple cameras can be effectively combined to generate a complete 3D human model.

Anish Kulkarni

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Yang Zheng

Smoothing Traffic Flow via Autonomous Vehicles: Python Implementation and Numerical Experiments

Traffic congestion can occur daily on major transport routes, causing both safety issues and lapses in efficiency. Recent studies have, however, shown that it is possible to use autonomous vehicles (AVs) as moving actuators to smooth the flow of traffic. In this project, we revisit some control-theoretical properties of mixed traffic (traffic where both human-driven and autonomous vehicles co-exist), such as stabilizability, controllability, and reachability. We then provide a Python-based implementation of this smoothing of traffic flow with AVs. Further, we use numerical simulations to test various aspects of AVs in traffic - such as the penetration rate, or the configuration - and their impact on the flow of traffic. Finally, we develop an informative webpage to display the results, which allows for public access to the code and facilitates the reproduction of our results. We believe these developments will contribute to the understanding of mixed traffic properties and help ease traffic congestion by efficiently controlling AVs.

Kristal Lam

General Biology, UC San Diego
STARS
Mentored by Professor Elsa Cleland

Trade-offs in Native Plants: Growing Season Length, Photosynthesis, and Water Use Efficiency

Drought and wildfire are projected to become more frequent in California as a consequence of climate change. Both stressors impact the composition and distribution of plant species within the environment. In response to water scarcity, species in Southern California cope through either escape or avoidance (drought tolerance) strategies. These strategies are directly related to growing season length (plants that escape have a shorter growing season than those that avoid drought) and are expected to be related to water use efficiency (WUE) and photosynthetic rate. The WUE, specific leaf area (SLA), and photosynthetic rate of native plant species representing different functional groups will be recorded using an infrared gas analyzer during summer months. Measurements will be collected from a recently burned (January 2021) San Marcos field site at three different plot types: unburned, burned not invaded, and burned invaded. Five plants will be measured per species per plot type. There is expected to be a tradeoff between maximum photosynthesis and growing season length as well as a tradeoff between maximum photosynthesis and WUE for all species. Evergreen species such as Malosma laurina are anticipated to have the greatest WUE and lowest maximum photosynthesis. Additionally, younger plants in the burned sites are expected to have a lower WUE compared to mature plants in the unburned site. Understanding how drought and wildfire influence species composition and response strategies, particularly the differences between native and invasive species, will better inform how climate change will affect environments in the near future.

Alison Lao

Nano Engineering, UC San Diego
UC Scholars
Mentored by Dr. Shaochen Chen

3D printing elastomer-based biomaterial for volumetric muscle loss

Due to proprietary information this abstract has been redacted.

Tristie Le

Environmental Systems (EBE), UC San Diego
Undergraduate Research Scholarships
Mentored by David Holway/Jess Mullins

Pollination Services: Is it really a native vs non-native competition?

Food insecurity is one of the biggest problems globally. Honey bees, essential pollinators for many crops, are necessary to combat global food insecurity. Domesticated honey bees (Apis mellifera L.) were imported to North America by European settlers in the 1600s for wax from honey bee combs and they later were very beneficial for providing pollination services in agricultural settings. Environmental stressors and colony mismanagement have contributed to declines in commercial honey bees. Pollinators' declines negatively contribute to food insecurity, which started a movement for people to start supporting and protecting bees. Fortunately, there are many many types of wild native pollinators in agricultural areas and in many cases, native pollinators are more fit for certain crop pollination than commercial honey bee pollination to meet crop yields. On the other hand, research has shown that there is a need for both commercial honey bee colonies and native pollinators to have a successful agricultural yield. Overall, it is essential to learn about the effects of both native and introduced pollinators in agricultural systems and how they contribute to crop yields and promote biodiversity. This literature review assesses both native and introduced pollinators; we can see how pollination services maximize fruit set to combat food insecurity and sustainable agriculture. By bettering our sustainability within the environment, we can prevent the bee populations from decreasing and support a better yield in crops.

Zaira Leal Hernandez

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

Examining Preterm Birth Rates by Race/Ethnicity Before and During the COVID-19 Pandemic

Due to proprietary information this abstract has been redacted.

Jina Lee

Biology with a specialization in Bioinformatics, UC San Diego
Undergraduate Research Scholarships
Mentored by Joseph Pogliano

Optimization of a Nucleus-Forming Phage for Molecular Applications

Certain jumbo phage forms a proteinaceous shell inside its host that resembles a eukaryotic nucleus during replication, separating transcription from translation and providing protection against bacterial defense systems such as DNA-targeting CRISPR-Cas and restriction enzymes. Due to this unique subcellular localization, these phages are a valuable tool for molecular and biomedical applications. However, currently characterized nucleus-forming jumbo phage are limited in scope as they infect Pseudomonas and Serratia. vB_EcoM_Goslar (Goslar) is the first studied nucleus-forming jumbo phage in Escherichia coli (E. coli). E. coli is a bacterium abundant in nature, a key component of the gut microbiome, and a model organism for gram-negative bacteria. Goslar can benefit from years of well-studied genomic and molecular mechanisms in E. coli. Up to date, utilizing Goslar in a lab setting faces multiple obstacles, namely the challenge in quantifying the amount of phage using classical methods. Here I optimize Goslar for molecular biology applications, applying the highly versatile and adaptive nature of phage in several different ways. The work expands the possibility of research utilizing Goslar, allowing further understanding of nucleus-forming jumbo phage through tools developed in E. coli.

Sharon Lee

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Xi Fang

Mitochondrial stress induces an HRI-eIF2a pathway protective for cardiomyopathy

Heart disease is a major contributor to deaths and mitochondrial dysfunction is present in many cardiomyopathy cases. Mitochondria, recognized as the powerhouse of the cardiomyocyte, has gained recognition as a hotspot for cell signaling cascades required for maintaining cellular functions and their stress responses. Mitochondrial dysfunction evokes stress signaling through an HRI-eIF2α-ATF4 mitochondrial nuclear communication axis, regulating the pathway. Though understanding whether the pathophysiological consequences of mitochondrial stress response (MSR) triggered ATF4 in vivo can potentially provide improvements to mitochondrial dysfunction by determining if the pathway is adaptive, the research surrounding the topic is notably barren. Therefore, using TAZ cardiomyocyte-specific-knockout (cKO) mice from previous published papers as a model of mitochondrial cardiomyopathy, we researched in vivo mechanisms and the effects of MSR in cardiomyocytes. We crossed HRI knockout

mice with TAZ cKO mice to determine whether deletion of HRI is beneficial to mitochondrial cardiomyopathy. TKO mice display mitochondrial dysfunction at 2 months and dilated cardiomyopathy at 4 months, but survive more than one year with impaired cardiac function. Our western blot and qPCR analysis confirmed that eIF2a-ATF4 signaling was activated in TAZ cKO hearts but abolished in TAZ/HRI double knockout (dKO) hearts. TAZ/HRI dKO mice died between postnatal day (P) 7-10 with enlarged hearts, compared to TKO mice that survived more than one year. We also observed increased ventricular weight to body weight ratios in dKOs. Echocardiographic analysis revealed severe cardiac dysfunction in dKOs. Our results suggested that MSR triggered HRI-eIF2a was protective for adult mitochondrial cardiomyopathy.

Valerie Lee

Environmental Systems (Ecology, Behavior, Evolution), UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Amy Lerner

Effects of Reducing Beef on Carbon Emissions at UCSD Dining Halls

The goal of this project is to assess the impact that reducing beef and increasing other animal and non-animal proteins has on reducing carbon emissions at the UCSD dining halls. Reducing beef consumption can occur as a result of reducing supply by offering fewer beef options, as well as reducing demand by educating students about carbon emissions and low-impact choices. The main focus will be reducing the supply of beef and calculating its impacts through proposing different scenarios that can be implemented in the dining halls. Prices of beef and its alternatives will also be assessed to see if there is a significant change in decreasing beef. This project will also consider the potential for reducing demand through carbon footprint icons or other methods to highlight the impact that different proteins have on carbon emissions. This project and its potential outcomes align with various goals that HDH, UCSD, and the UC system have created to promote reductions in beef and greenhouse gas emissions.

Karla Leon Zuñiga

Nanotechnology, CIDETEQ
MRSEC REU or RIMSE
Mentored by Professor Michael Sailor

Catalytic hydrolysis performance of enzyme-loaded porous Silicon nanoparticles in a hydrogel system

An organophosphate (OP) poisoning of the eye presents an acute emergency and requires effective countermeasure. To prepare a detoxifying formulation for topical ocular use, we focus on development of a porous silicon (pSi) nanoparticles embedded contact lens to formulate the enzyme that catalytically degrades OPs. The lens material is prepared by photopolymerization of 2-hydroxy ethyl methacrylate (HEMA) and N-vinylpyrrolidone

(NVP) using polyethylene glycol dimethacrylate (PEG-DMA) as the cross-linker. The critical lens properties such as light transmittance, water content, mechanical properties, and the ability to catalytically degrade OP are studied.

Allison Li

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Gene Yeo

CIRTS Constructs are Effective in Targeting Microsatellite Repeat Expansion Disorders

Microsatellite repeat expansion (MRE) disorders are caused by sequence repetitions within the human genome. These repetitions cause aberrant repeat-expanded RNA, leading to disorders such as Huntington's disease (CAG repeat), frontotemporal dementia (GGGGCC repeat), and myotonic dystrophy (CUG repeat). One viable way to treat these diseases is to knock down the repeat expanded RNAs. A tool previously utilized for this purpose is CRISPR-Cas13d, which can target and degrade RNA transcripts. However, Cas13d is a bacterial protein and thus can cause an immune response, limiting its therapeutic utility. In contrast, CRISPR-Cas-inspired RNA targeting system (CIRTS) overcomes this limitation by engineering programmable RNA effectors from human proteins. By eliminating bacterial proteins, this strategy avoids triggering an immune response. CIRTS has previously been validated only for non-repetitive target transcripts. Thus the objective of this project is to determine the effectiveness of CIRTS in eliminating RNAs that cause MREs. To test this, we transfected HEK293T cells with three plasmids: 1) a repeat plasmid encoding 105 CAG or CUG RNA repeats, 2), corresponding guide RNAs (gRNAs) targeting these repeats, and 3) the CIRTS construct. Then we extracted RNA and performed RNA dot blots to quantify the repeat-containing transcripts. We observed a strong knockdown of CAG and CUG repeats using their appropriate gRNAs when compared to non-targeting gRNAs. In contrast, there was no significant knockdown of CAG repeats by the CUG-targeting gRNA, or vice versa, suggesting strong sequence specificity. These results demonstrate that CIRTS could be an effective RNA targeting technology in MRE disorders.

Qiaolin Li

Civil Engineering, UC Davis
UC LEADS
Mentored by Dr.Tara Hutchinson

Prefabricated steel stairs to be tested as part of 10-story mass timber building

The proliferation of multistory buildings nowadays brings the public's attention to their structural integrity, but there is less attention to stairs, the primary egress system in many emergency situations. Post-earthquake studies have shown that stairs caused localized overloading of the structure. Therefore, maintaining the operation of stairs in a seismic

event is critical to ensure life safety. As part of the 10-story NHERI TallWood project, 10-story stairs with various boundary conditions are planned to be tested later this year. My research focuses on predicting seismic design forces of the stair connections based on ASCE 7-16 and NEHRP 2020 provisions. In addition, a simplified numerical model of a stair system with the concept of lamped story masses will be developed. This model will be helpful to predict the lateral forces imposed on the diaphragm by stairs. To better understand the seismic response of this prone to damage non-structural system, a dense layer of linear potentiometers, string potentiometers, accelerometers, and strain gauges will be installed. This presentation will discuss an overview of these stair systems and the planned shake table test.

Queenie Lin

Bioengineering, UC Riverside
UC LEADS
Mentored by Ester J. Kwon

Severity- and Sex-Dependent Biodistribution of an Activity-Based Nanosensor for Traumatic Brain Injury

Traumatic brain injury (TBI) is caused by a sudden, external physical force which leads to brain damage. According to the CDC, over 223,000 hospitalizations were caused by or related to TBIs in the United States in 2019. Of those that require surgery, there is a 50% lower mortality rate if the surgery occurs within 4 hours of admission. Calpain-1, a protease activated by TBI, plays an important role in the secondary damage that unfolds in the days to months after injury. Current approaches to diagnose TBI include the Glasgow Coma Scale, which can be subjective, or CT and MRI scans, which are costly and limited to anatomical information. To complement these diagnostics with molecular information, an activity based nanosensor for TBI (TBI-ABN) was engineered using targeting peptides and a FRET calpain substrate attached to a nanoscale polymeric scaffold to generate fluorescent signal in response to calpain-1 activity. To investigate calpain activity across different sexes and injury severity, male and female mice injured at varying severities of TBI were administered the TBI-ABN intravenously and organs were collected. To evaluate the biodistribution of activated sensor across organs, we homogenized and measured the amount of fluorescence in each organ. We expect to see a positive correlation between fluorescence and injury severity in injured brain tissue. We also will delineate sex-based differences, if any, in fluorescent signal accumulation within off-target organs. Measuring calpain-1 activity can supplement current diagnostic methods and give us insight into the molecular aspects of TBI that causes secondary damage.

TzuTung Lin

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Yoshitake Cho

The Role of Perm1 in Cardiomyocytes and Metabolism

Energy metabolism plays a crucial role in heart and mitochondrial function. This is evident in the cardiomyocytes of human patients experiencing heart failure due to ischemia-reperfusion injury and myocardial infarction, in which the energy supply was unable to match energy needs. Perm1, expressed in heart and skeletal muscles, was found to be involved in mitochondrial biogenesis and the regulation of related transcription factors in skeletal muscles. A series of experiments are being carried out to discover the role of Perm1 in cardiomyocytes and the metabolic pathway through which it functions. To perform this investigation, ischemia-reperfusion injury was simulated using an ex vivo hanging heart system and TUNEL assays and cellular assays have been carried out to identify key transcripts and metabolic enzymes whose activities would be downregulated in hypoxic conditions but restored by Perm1. Data are analyzed through Western blots. Thus far, findings have indicated that elevated expression of Perm1 is correlated with the restored activity of some mitochondrial enzymes and markers, while for other enzymes, no restored activity was observed. Further analysis and experiments with other cellular enzymes are still being performed to understand the role of Perm1.

Yan Zhe Liu

Bioengineering: Biotechnology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Bradley Moore

Establishing genomic, transcriptomic, and metabolomic libraries for a Xenia octocoral and using the libraries to investigate potentially bioactive terpenoids and their biosynthetic pathways.

Corals are known to contain bioactive terpenes and terpenoids, the largest class of secondary metabolites. The Moore Lab has since found a genetic basis for terpene biosynthesis in octocorals and characterized several terpene cyclases. One utilized resource was the sequenced genome of a Xenia coral (one type of octocoral) in literature that led the Moore Lab to establish gene candidates for terpene synthesis and characterization of a xeniaphyllene synthase that is the proposed precursor to a majority of Xenia diterpenoids. However, with Xenia corals producing hundreds of terpenoids, one can’t say which specific terpenoids are being produced by the sequenced coral when there is no sequencing data from all the chemical investigations of different Xenia corals.

To close this knowledge gap, the aim of this project is to collect metabolomic, genomic, and transcriptomic data from a Xenia coral that is morphologically similar, if not

identical, to the Xenia coral sequenced in literature. To achieve this, the Xenia coral of interest is already grown in the Scripps aquarium facilities. Fresh biomass from the growing Xenia coral will be used to obtain organic extracts that will be analyzed via GCMS and LCMS techniques, building the metabolomic library. Concurrently, DNA and RNA will be extracted through CTAB protocol and RNeasy kit by Qiagen respectively. These samples will then be sequenced by the IGM sequencing core facilities at UCSD via Illumina sequencing. Afterwards, the raw sequencing data will be bioinformatically processed and assembled which can then be used to find genes of interest.

Yizhang Liu

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Ke Sun, Professor Xinyu Zhang

Self-Supervised Egocentric Ambient Intelligence

Due to proprietary information this abstract has been redacted.

Amy Loeber

Psychology, UC San Diego
Multidisciplinary Educational Appraoch To Reducing Cancer Disparities
Mentored by Dr. Georgia Sadler

Pediatric Cancers and Microplastic Levels in Community Water Sources

Mexican children living in proximity to highly polluted rivers have higher rates of cancer than children living elsewhere in Mexico. This review explores the field of microplastics, levels of microplastics in rivers, and what is known about the correlation between exposure to high levels of microplastics and cancer.

A search of the scientific literature was undertaken related to microplastics and cancer in children. Articles published in English since 2010 were eligible, provided that a complete copy of the articles could be accessed for review. The following databases were searched: PubMed/Medline, PsycINFO, and CINAHL. The following terms were used to conduct this search: cancer, risk, microplastic*, children, pediatric*, Mexico, rivers, waterways, pollut*, clean water, education, prevention, solar nanobubbles, and restoration. Abstracts and reference lists of all identified articles were reviewed for articles of direct relevance.

Nine out of fifty-two articles were identified that examined microplastics and cancer risk in children in Mexico. Most studies used systematic reviews. The groups studied were adults and children who lived near or far from polluted bodies of water. Studies found that children living near bodies of polluted water were more at risk of exposure to microplastics, which increased the risk of contracting cancer.

Microplastics appear to have a positive correlation with inducing cancer in children living near and consuming contaminated water. Sustainable alternatives to plastic and innovative solutions to cleaning up polluted rivers may help lower the number of microplastics in our environments and ensure healthier standards for the next generation.

Laura Long

General Biology, UC San Diego
Ahmadian Fellowship
Mentored by Dr. Simon Schenk

Effects of Formin 2 Inhibition on Insulin-Stimulated Glucose Uptake in Skeletal Muscle.

Skeletal muscle is an important site of post-prandial glucose disposal. At the molecular level, insulin-stimulated glucose uptake by skeletal muscle requires the translocation of the glucose transporter 4 (GLUT4) from its intracellular location to the plasma membrane. GLUT4 is transported by motor proteins such as myosin 5A along the actin cytoskeleton and kinesins along microtubules Nevertheless, the precise contribution of the actin cytoskeleton, and the proteins that regulate its reorganization in response to insulin, remain to be fully elucidated.

Formin 2 is an actin-building protein which, when activated, functions on the inner cell membrane to build and support actin filament reorganization. However, the role of formin 2 in actin reorganization in skeletal muscle, and in response to insulin, is unknown. Addressing this gap, we used the formin 2 inhibitor, SMIFH2, to determine the effect of insulin stimulation on formin 2-mediated actin reorganization and whether formin 2 is required for insulin-stimulated glucose uptake in mouse skeletal muscle.

Shannon Lopez and Ethan Williams

Biological Psychology / Biochemistry, California State University, San Bernardino / Xavier University of New Orleans
STARS
Mentored by Dr. Chengbiao Wu

Identifying Abnormalities Present in Neurodegenerative Lysosomes and Mitochondria

Due to proprietary information this abstract has been redacted.

Michelle Luces

Chemistry and Mathematics, University of Guam
MRSEC REU or RIMSE
Mentored by Dr. Zheng Chen

Metal-organic Frameworks as Ion Conductors for Solid-State Batteries

Solid-state batteries (SSBs) have shown the potential for high energy density, improved safety and performance under wider temperature range. Due to the high specific surface area and ordered structure of metal-organic frameworks (MOFs), it can be suitable to use as an ion conductor and, essentially, act as the electrolyte. In order to imitate the solution structure of a liquid electrolyte, we will determine which Li salt infiltration method shows the most uniformity. In this study, we will use MOF UiO-66 and our goal is to optimize the ionic conductivity by observing the trends using different MOF to salt ratios, pelletizing pressures, and MOFs with different functional groups. We will then use symmetric Li-ion cells to study the cell's cycling life and degradation.

Goldar Luu

Probability and Statistics, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Danna Zhang

Transforming the Black-Scholes Equation to the Heat EQuation

The Black-Scholes partial differential equation is regarded as a pivotal concept in modern finance due to its nature of accurately approximating an options value within a frictionless market. Incidentally, the Black-Scholes equation is a variant of the heat partial differential equation, modeling the transferring of heat through a over a time interval. Here, we show the derivatation of each equation, and ultimately, the transformation of the Black-scholes equation to the heat equation opens a path to expand on the numerous underlying relations existing between the two equations while giving rise to any subsequent conclusions that may aid in their numeric solutions.

David Ma

Microbiology, UC San Diego
McNair Scholars Program
Mentored by Dr. Daniel Hollern

Developing an Autoantibody Response against Gene X in Mice

B cells are a crucial component of the adaptive immune system, responsible for producing antibodies that neutralize invading pathogens. However, there remains much to be learned about B cell behavior and their function against cancer cells. How do antigens

shape B cell behavior, and how do these antigen specific B cells play a role in either pro or anti tumor development? To answer this, we intend to create a mouse model that has an autoantibody response against Gene X, which is highly associated with cancer cells. By overexpressing Gene X, we hypothesize that an autoantibody response against it creates selection pressure for the mutated version, allowing for the proliferation of cancerous cells. To achieve this, mice will be inoculated with recombinant E. coli that contain Gene X and expressed with a bacterial promoter. Mouse blood will be collected and centrifuged to obtain serum. From the serum, antibody levels will be measured and compared against a control to determine the presence of an autoantibody response. The development of this mouse model will prove instrumental in future research regarding B cell function and its involvement in cancer biology.

Fatima Maciel

Public Policy and Ethnic Studies, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Gerardo Arellano

Constitutionality of Critical Race Studies in K-12 Education

The high political tensions following the murders of multiple Black individuals (George Floyd, Amir Locke, Breonna Taylor) stirred a heated conversation regarding race in America. From these cases of police brutality emerged discussions about applying Critical Race Theory to school environments in hopes of easing the nation's hostility. Developed in the 1980s, CRT examines structures of power through the lens of race, equity, and intersectionality. While CRT does not attempt to accuse or discriminate against any individual, many have misunderstood the curriculum and have made calls to ban its implementation. States have passed legislation banning CRT because of its supposed "anti-America" sentiments and violation of Article 14. Current research on the effects of CRT and its by-product, Ethnic Studies on the K-12 system has found substantial data supporting that overall participation, grades, and graduation rates have improved from its implementation. This divergence in opinions brings us to the current debate questioning whether CRT/ES is constitutional or not. My research critically analyzes the contents and motivations behind H.B. 1775, the law passed by Oklahoma censoring discussions of race and gender in classrooms, through a public policy framework. Ultimately after examining the ES curriculum, interviewing both professors and students, collecting data/feedback on its implications, and determining whether it violates student rights, we have concluded that ES is constitutional under U.S law and, therefore, should not be banned from the K-12 system.

Shruti Magesh

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Weg Ongkeko

The effect of behavioral and demographic risk factors on the infectivity and prevalence of the COVID-19 variants

COVID-19 has accounted for 88 million cases and 1 million deaths across the

Due to proprietary information this abstract has been redacted.

Samantha Mak

Neurobiology, UC San Diego
McNair Scholars Program
Mentored by Dr. Nicole Coufal

Role of Microglia in Neurodegenerative Langerhans Cell Histiocytosis

Langerhans cell histiocytosis (LCH) is a pediatric histiocytic disorder that begins with abnormal activation of the MAPK pathway with the most common mutation being BRAF(V600E) (Shi, 2021). This can lead to overproliferation of LCH cells which can damage tissue, cause lesions on the body, and can lead to a progressive neurodegenerative disease. Neurodegenerative LCH can occur years after diagnosis, regardless of remission from LCH. Previous studies suggested microglia are the main pathogenic cell type contributing to this neurodegeneration (Mass, 2017). In mice, those with this mutation suffered from a fatal onset of neurodegenerative disorder and loss of healthy microglia (Mass, 2017). Microglia are the innate immune effector cell of the CNS, playing an important role in CNS homeostasis, inflammation and infection. We're currently investigating the mechanisms by which microglia drive the neurodegeneration seen in LCH. This is important because there are no in vitro models or treatments for patients with neurodegenerative LCH. To do this, we use patient-derived iPSCs and CRISPR to insert the mutation. These iPSCs are differentiated into microglia in vitro for functional and phenotypic analyses. We've established coculture models with induced neurons and cerebral organoids, to better understand the role of microglia in disease relevant environments. Using an engrafted mouse model, we aim to recapitulate phenotypes seen in patients with LCH. This novel model is a tool to elucidate the pathophysiological contribution of microglia to the onset and progression of neurodegeneration and may extend to idiopathic neurodegenerative diseases such as Parkinson's or Alzheimer's Disease.

Wanting Mao and Cindy Wang

Data Science / Math -CS and Cognitive Science, UC San Diego
Computer Science and Engineering Early Research Scholars Program (CSE-ERSP)
Mentored by Dr. Imani N. S. Munyaka

The Impact of Security-Related Chatbot an User's Mental model

As machine learning techniques and technology advances, chatbots and AI assistants have also improved - responding more like humans and providing more accurate responses to queries. Researchers are now studying how humans interact with AI chatbots and what aspects of that interaction impact the users mental models. In this study, we plan to investigate how working with a chatbot to complete a security-related task impacts the user mental model. Phrase-level sentiment analysis toolkit to develop an appropriate dataset for the chatbot. First, we create our own vpn reviews dataset by websrcapping publicly available information. Then, we develop our chatbot after a conversational recommender framework that utilizes the sentires. Finally, we plan to run a user study using this chatbot in the future. The results of this study will complement prior work in the area by exploring how conversation topic impacts user mental models and trust of these assistants.

Kyleen Martin

Ethnic Studies, UC San Diego
McNair Scholars Program
Mentored by Dr. Lilly Irani and Dr. Stuart Geiger

Whiteness, Data, and Property: How California Digital Privacy Laws Protect White Privilege

This research examines California digital privacy laws from a critical race perspective and asks how these laws position data within racial capitalism. In a time where many legislators around the world are considering the impacts of the digital informational economy, it's important to not only hold Big Tech companies accountable and ensure safety of users but also to examine how these digital infrastructures impact Black, Indigenous, people of color (BIPOC), immigrants, and other intersections of oppression such as gender, class, sexuality, and abilities. This research will mostly be examining how current privacy laws may reproduce racial hierarchies.

The methods I use in this research are a close reading of the California Consumer Privacy Act and California Rights Act as well as a discourse analysis that examines the dialogue of supporters, opposition, and main actors. By grounding my analysis through the foundational critical race theory, including Whiteness as Property by Cheryl Harris, I am able to better examine the connection between race, property and privacy. This renders an analysis that privacy is a form of racialized property that privileges whiteness. California digital privacy laws privilege those who have the most access to exercise their rights

(White, middle/upper class, cisgender, heterosexual males) as well as exempt institutions that target racialized communities (law enforcement, ICE, credit reporting agencies). This research scrutinizes the limitations of individual property rights over personal information within digital economies and considers how privacy rights could be reoriented to meet the needs of BIPOC and immigrant communities.

Ivan Martin Del Campo

Chemistry, University of California, Irvine
UC LEADS
Mentored by Dr. Nathan Romero

Sulfonium ions as intermediate used to synthesize Conjugated Polymers

Due to proprietary information this abstract has been redacted.

Francesca Massa

Psychology, UC San Diego
Colors of the Brain
Mentored by Dr. Kay Tye

Delineating the acute effects of psilocybin on behavior amid conflicting cues of reward and punishment

Psychedelics enhance emotional arousal, but it is unclear whether the direction of change in emotional valence processing (i.e., determining if something is positive or negative) depends on context or pre-existing individual differences. Prior research has found that when dose and context are controlled, psilocybin increases positive mood, decreases negative mood, and reduces reactivity to negative emotional stimuli. Outside of a controlled context, psychedelics can heighten emotional sensitivity and arousal bidirectionally, with some reporting adverse reactions characterized by anxiety and impaired cognition. This variability in the emotional response limits the therapeutic use of psychedelics by those without access to a clinical context.

Here, we sought to explore how psilocybin impacts valence processing in an animal model. We hypothesized that when context is controlled, psilocybin will uniformly reduce the expression of fear-related behavior amid conflicting cues of sucrose and shock. To test this, we used computer vision and machine learning techniques for pose estimation and behavior tracking as mice faced cues of ambiguous valence. Using dimensionality reduction and unsupervised clustering, we identified changes in reward- and fear-related behavioral motifs prior to and following psilocybin administration. Our findings may give insight into how neurobiological and contextual variables influence the emotional response to psychedelics.

Alison McAnally

Material Physics, UC San Diego
McNair Scholars Program
Mentored by Dr. Kaixuan Ni

Investigating Electron Bursts and S2 Signal Rates

Due to proprietary information this abstract has been redacted.

Allison McKenzie

Biomedical engineering, CWRU
MRSEC REU or RIMSE
Mentored by Dr. Steinmetz

Complementary binding domains allow for loading of agrochemicals onto VNPs

Due to proprietary information this abstract has been redacted.

Clara Medina

Environmental Engineering, UC Merced
UC LEADS
Mentored by Dr. Morgan Levy

Coastal Climate and Groundwater Systems Analysis in the California Pajaro Valley from 1957-2020

In coastal regions, changes in surface water and groundwater levels can influence groundwater quality. In the Pajaro Valley, surface water sloughs and groundwater wells are used to supply irrigation water for the predominantly agricultural region. Therefore, both the quantity and quality of surface water and groundwater are important to sustain agricultural practices. Fluctuating patterns in coastal conditions (sea levels, storm surges) and inland hydrology (precipitation, flow) over the observed period of 1957-2020 have jointly impacted groundwater elevation levels and quality, causing water management changes and deleteriously impacting water systems. For example, water with high levels of salinity limits mineral availability in soils, reducing plant growth and impacting overall crop yields. This research aims to explore temporal and spatial correlations between groundwater levels and groundwater salinity, observing how these relationships have changed throughout the specified historical period. Methods used to create this analysis include a combination of statistical and geospatial analyses performed using the R programming language and ArcGIS Pro. The quantification and visualization of groundwater data relationships will improve understanding of understudied spatial aspects of groundwater quantity and quality, which will aid in water management decision-making in the region.

Steven Meikle

Materials Science and Engineering, University of Florida
San Diego Nanotechnology Infrastructure REU
Mentored by Dr. Ping Liu

Solid-State Synthesis of Iron Fluoride Nanocomposites as Cathode Materials for Lithium Ion Batteries

Iron fluorides are energy-dense cathode materials for lithium-ion batteries (LIBs). Fluoride mass production is hindered by fluorine sources and fluorine-containing gasses, which are highly corrosive and dangerous. In this work, a simple and feasible solid-state reaction is reported to synthesize iron (II) fluoride (FeF2) by using polyvinylidene fluoride (PVDF) as a fluorine source and ferric oxide (Fe2O3) as an iron source. This method delivers carbon coated FeF2 (C@ FeF2) nanocomposites with a particle size of less than 100 nm, characterized by scanning electron microscopy (SEM). As the ratio of PVDF:Fe2O3 increased from 1:1 to 3:1 wt%, all Fe2O3 precursors were fully converted to FeF2, evaluated by X-ray diffraction (XRD) and SEM. Ongoing work includes using polytetrafluoroethylene (PTFE) as a new fluorine source to synthesize carbon-coated FeF2. The fast charging performance and cycling stability of carbon-coated FeF2 electrodes, paired with lithium metal as a counter electrode in LIBs is intended to be investigated in the future.

Lilyan Mendez

Biochemistry, UC San Diego
Changemaker Institute
Mentored by Dr. Claire Meaders and Dr. Melinda Owens

Factors Influencing Introductory Biology Students Attitudes Towards Chemistry

The introductory biology course begins with chemistry topics to help students understand biology in a deeper way, but students often struggle with these topics. Thus, our overarching goal is to research how we can improve the teaching of chemistry topics within the introductory biology course to help all students feel like they belong in biology. Our initial question was what factors influence how introductory students currently feel about these chemistry topics. Instructors conducted a post-course survey with over 700 students during two quarters that asked about minoritized/ majoritized demographic data (race, ethnicity, first-generation college-going status), if they had prior experience with chemistry, and how the chemistry topics influenced how they felt about themselves as a biologist. We also conducted 10 interviews asking similar questions with a diverse group of students. We found that Latinx students are more likely to receive lower grades on the chemistry-focused midterm. Using qualitative thematic analysis, a common theme we identified is that someone who struggles with these topics is likely to feel less confident about themselves and less like they belong in biology. However, if

someone had prior chemistry knowledge, they felt more confident and saw substantial connections between biology and chemistry. In the future, we intend to analyze factors that contribute to exam and course grade equity gaps and investigate how these gaps relate to student perceptions of chemistry in the course. We also plan to create and evaluate instructional videos targeting chemistry topics to help future students.

Paola Méndez González

Chemical Engineering, University of Puerto Rico at Mayagüez
MRSEC REU or RIMSE
Mentored by Jonathan Pokorski

Plant Cell Modification to Generate Cell/Polymer Hybrid Materials

Engineered living materials (ELMs) is an emerging field that integrates living systems and synthetic components to impart functions that cannot be achieved using solely genetic means. Specifically, cell-polymer hybrid materials allow for potential bioreactor formation that will increase the lifetime and yield of biosynthetic production. By covalently integrating thermoset networks within cell walls, the production of biologics can be continuous using without the need for cell separation. In this study, we aim to synthesize norbornene-PEG-amine (Nb-PEG-NH2) attached to lignin, which serves as a plant cell wall model. The modification of lignin was achieved by using laccase as an enzymatic unit to couple the Nb-PEG-NH2 under reaction conditions of pH 4.5 and 37□C. Modification was evaluated at 3, 12, and 24 hours. The Nb-PEG-NH2 and its coupling was characterized through NMR, agarose gel electrophoresis, and FPLC. The results of this research will provide optimal conditions for the coupling of Nb-PEG-NH2 to plant cells. Once incorporated, ring opening metathesis polymerization (ROMP) will be performed for the creation of a plant cell based biohybrid material.

Amaya Mendez-Molina

Pharmacological Chemistry, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Georgia Sadler

Addressing Adenoid Cystic Carcinoma of the Salivary Glands

Adenoid Cystic Carcinoma (ACC) is a rare malignant tumor that presents itself in glandular tissues. ACC accounts for approximately 1% of head and neck cancers and 10% of salivary gland cancers. It is characterized by slow growth, perineural invasion, and a unique chromosomal translocation. The etiology is unclear and late recurrence is common, the 5-year survival rate is about 89% and the 15-year survival rate is approximately 40%. Currently, the most effective treatment options include surgical resection and radiotherapy, making detection at the earliest point in the disease progression important. This narrative review searched for evidence-based interventions designed to produce earlier detection of ACC. Relevant articles were found using

databases such as PubMed, CINAHL, and Google Scholar. The search was conducted using keywords such as: adenoid cystic carcinoma, salivary glands, detection, guidelines, mortality, treatment, examinations, dentist, dental, and hygienist. No guidelines were found for healthcare or dental providers related to the early detection of salivary gland cancers, a factor which contributes to people experiencing late-stage diagnosis and metastasis. No educational program were found related to raising the public's awareness of ACC. This presentation will discuss these findings, highlight implications, and discuss recommendations for future research.

Mayra Mendiola

Human Biology, UC San Diego
Summer CAMP
Mentored by Dr. Susan Ackerman

Sequence variation upstream of a cytoplasmic tRNA modifies neurodegeneration induced by ribosome stalling

Through genome-wide association studies, it is understood that most complex disease risk loci are located in non-coding regions containing single nucleotide polymorphisms (SNPs) within regulatory elements. Additionally, sequence variation at these non-coding risk loci can have an epistatic interaction with other risk loci which can then lead to the appearance of a complex disease. Transfer RNAs (tRNAs) are responsible for physically bringing the proper amino acid, based on the nucleotide sequence of an mRNA (messenger RNA, the template for the creation of proteins), to ribosomes (macromolecular complexes that generate proteins from amino acids) during protein synthesis. On a sensitized mouse background with ribosome stalling (ribosome stops translating and assembling the protein), our lab found SNPs upstream of a tRNA gene that differentially regulate its expression by regulating RNA Polymerase III recruitment. Furthermore, these SNPs interact epigenetically to enhance neurodegeneration induced by ribosome stalling. Interestingly, regions directly upstream of tRNAs in humans are found to be highly susceptible to genetic variation, yet the consequences of sequence variations on tRNA expression and function are not fully understood to date.

Jose Mercado

Mechanical Engineering, UC San Diego
McNair Scholars Program
Mentored by Ralph Keeling

Creation and Evaluation of the Viability of an Air Pressure Driven Affordable Water Flow Rate Control System

This project looks to improve the ability of oceanographic laboratories to measure the CO2 isotope contractions in seawater samples Currently in order to analyze seawater CO2 data, oceanicCO2 laboratories must first take a seawater sample, isolate and extract

the CO2 content from the sample, and then analyze the CO2 via a spectrometer. This process while being accurate is tedious and time consuming, limiting the amount of samples that may be analyzed. A proposed technique of utilizing a contactor setup in which seawater flows into a glass tube encased teflon channel in order to allow CO2 to be extracted and analyzed from seawater in a much more rapid manner. To enable this the evaluation of the viability of air pressure powered water flow control os needed. Evaluation of such systems is done via pressurizing a water-containing bottle with air and analyzing the resulting flow for reproducibility, stability, and inherent trends, adding or subtracting elements (flow restriction, pressure control system, etc.) as deemed necessary. It was deemed that such a system does have some form of viability, offering consistent flow rates with similar behavior, with a mean time variance across multiple data sets of E-6. This presents a promising basis for the viability of utilizing finely controlled gas pressure as a means to control water flow rates. Data accuracy however is limited due to the introduction of noise and human error during data collection procedures.

Albert Miao

Data Science / Music, UC San Diego
Undergraduate Research Scholarships
Mentored by Associate Professor Michael Yip

A Semantic-aware Surgical Perception Framework for Robotic Tissue Manipulation

Due to proprietary information this abstract has been redacted.

Ashley Miller

Ecology, Behavior, and Evolution, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Jonathan Shurin

Influence of Selective Pressures on The Fitness and Growth of Microalgae Nannochloropsis sp.

Humanities' growing dependence on fossil fuels has called for a demand for alternative sources of energy, hence leading to the growing interest in the use of algae as a form of biofuel. Unlike traditional energy sources, algal biofuel is carbon neutral and renewable, making it environmentally friendly. Our goal is to understand the fitness and evolution of the microalgae Nannochloropsis sp., in order to provide insight on trait evolution in microalgal production systems. We conducted four experiments in which we took samples from an existing, directed evolution experiment and grew algal cultures in the opposing nutrient and light conditions of which they were originally grown. The cultures will be compared to the baseline strain from which they were originally sampled, as well as the cryopreserved ancestral strain. Over the span of two growth cycles per experiment, we used a microplate reader to measure optical density (OD) and chlorophyll fluorescence values of the samples, and used the values to calculate growth rate.

Preliminary results show our samples originally grown with 100% light conditions were able to adapt to being relocated into 10% light conditions better than the samples grown in the opposite manner, and that generally our samples grown at 24° C yielded higher OD values than those grown at 18° C. Future plans include conducting data analysis, including genomic (i.e. SNP, QTL) analyses and pigment profile documentation to compare the growth rates of our four experiments, and quantifying phenotypic traits of the Nannochloropsis sp. strains via a high-throughput assay.

Judy Mohamad

Mechanical Engineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Sylvia Herbert

Residual Dynamics Learning Using Bayesian Uncertainty

Many methods for controlling autonomous drones rely on a consistent model of the drone's dynamics. However, small changes in their dynamics may not be accounted for in the model (e.g. changes in the mass of the system when carrying a load). Collisions are more likely to occur when they do not incorporate uncertainties in dynamics in their model. While it is possible to create a highly accurate model that tries to account for non-linearities in dynamics, it would take a considerable amount of training data to implement. To circumvent this, our work focuses on using a combination of a known nominal model and a to-be-learned residual model. Our research tries to answer the following: Can we use a learning-based control algorithm to improve drone trajectory planning?

We reduce the uncertainty of the residual dynamics as follows: We maintain a Bayesian uncertainty representation of the unknown dynamics, which is updated based on new measurements of the environment. Our goal is to conduct a simulation and a hardware implementation of this control method on a drone. In our experiment, the drone will have to autonomously navigate through an unknown environment without fully knowing its dynamics coupled with the payload. It will have to make small maneuvers to learn the unknowns, then plan a trajectory and reach its destination, all while staying within safety constraints. Our approach seeks to make the drone better able to handle a priori unknown payloads. A possible application of this method is in improving delivery drones.

Mohammedali Mohamed

Engineering Physics, University of San Diego
McNair Scholars Program
Mentored by Gregory Severn

Does presheath ion flow affect electron density mea- surements for Langmuir probes near boundaries?

It has recently been shown that that Langmuir probes (LPs) measure an unphysically positive plasma potential in the presheath of low temperature plasma, near conducting boundaries at which ion rich sheaths form [Li et al., Plasma Sources Sci. Technol. 29 (2020) 025015]. It has been argued heuristically that the difference between plasma potential profiles measured by LPs and emissive probes (EPs), in the presheath, is related to ion flow caused by sheath formation. We present experimental evidence the electron density is also overestimated by standard analysis in the presheath, that the two anomalies are interrelated, having to do with ion flow near the bound-ary where an ion rich sheath forms. We attempt to estimate the sheathexpansion due to ion flow using the constraint of the quasineutrality of the presheath. These experiments are performed in weakly collisional ($\lambda mean-free-path \ \lambda D$), low pressure ($Pneutral \leq 1mTorr$), low temperature ($kTe \sim O(1eV)$), single ion species plasma, where the feedstock gas is Ar or He or Xe or Kr.

Carlos Monterosa

Data Science, UC San Diego
McNair Scholars Program
Mentored by Huiwen Lu

Graph Neural Networks and Directed Graphs

Not many studies have delved into using Graph Neural Networks algorithms for Directed Graphs. As researchers find Directed Graphs difficult and strenuous to use at times. Unlike Directed Graphs, Undirected graphs are positive definite and symmetric matrices which allows the eigenvalue to be easily ascertained. This is important as Undirected Networks can then be compared using their respective eigenvalues. In turn, even if an eigenvalue is found for a Directed Graph it may or may not tell us anything about it even if another Directed Graph has a similar eigenvalue. Aside from eigenvalues, we will be sparsifying our Directed Graph to outline the core structure of our network. There are two networks that we will be testing our algorithm on: Powerlines and Airline Networks. We will be gathering and cleaning real-world data from open access databases for both Powerlines and Airline Networks. Using our sparsified Directed Graph we will then feed our core structure to our Graph Neural Networks to make predictions. It will be important

to test whether the algorithm is able to accurately predict the route of our airline flight or the position of a powerline.

Alyssa Mugavero

Sociology & Interdisciplinary Humanities, University of San Diego
McNair Scholars Program
Mentored by Dr. Marilynn Johnson

Criticism of Scalia's Thesis: The Statutory Interpretation of Textualism

Through the intersection of critical legal studies and the philosophy of language, I focus on the conceptual structures of statutory interpretation within the philosophies of classical intentionalism and textualism that uphold competing views of how legal statutes are interpreted within the U.S. Supreme Court. Within my research, I criticize Scalia's thesis, that the use of language in law has "a limited range of meaning, and no interpretation that goes beyond that range is permissible." Claiming Scalia, as a textualist, does not discuss the interpretational versatility of various social and cultural understandings of the law. Within this analysis, I refer to Scalia's support of William Eskridge Jr.'s work Dynamic Statutory Interpretation. Specifically, I examine how Scalia's support of Eskridge's understanding of statutory interpretation is not in accordance with Scalia's general thesis of textualism, as Eskridge understands statutory interpretation on the basis of the "'needs and goals of our present day society.'" Since the legal lexicon contains many words that have fixed and frozen meanings to borrow from law professor Jody Armour, I articulate the importance of understanding the language of the law as a vehicle of social action and change for a more socially just legal system.

Jessica Muojekwu

Neurobiology, UC San Diego
CoB-KIBM Schoalrs Program
Mentored by Tom Hnakso

Leveraging CRISPR-Cas9 tools to selectively disrupt glutamate or dopamine release from VTA glutamate projections.

The ventral tegmental area (VTA), located in the midbrain region, is a major part of the mesolimbic reward circuitry of the brain. In addition to dopamine neurons, the VTA also contains GABA, glutamate neurons, as well as neurons that co-release dopamine and glutamate or glutamate and GABA. Importantly, each of these cell types influence reinforcement and avoidance behaviors. For example, VTA glutamate neurons project to the nucleus accumbens (NAc) medial shell, and their activity drives reinforcement in optogenetic self-stimulation assays, but also avoidance in other assays. Yet, these neurons also co-release dopamine in NAc medial shell. In order to test the selective contribution of glutamate vs. dopamine co-release by VTA glutamate projections to reinforcement and avoidance behaviors in mice, we used CRISPR-Cas9 technology. We injected

channelrhodopsin (ChR2) combined with a cre-dependent CRISPR-Cas9 virus in VGLUT2:cre mice to selectively disrupt either glutamate or dopamine signaling in VTA glutamate projections. We first verified specificity of CRISPR-Cas9 vectors, by quantifying dopamine neurons in VTA of Cas9-injected vs. un-injected mice. We found that CRISPR-Cas-mediated disruption was selective to either dopamine or glutamate release and did not cause non-selective toxicity to VTA dopamine neurons. We then tested mice in both optogenetic self-stimulation and place avoidance assays and found that glutamate and dopamine co-release from VTA glutamate neurons differentially promote reinforcement and avoidance behaviors.

Vikash Muruhathasan

Bioengineering: Biotechnology, UC San Diego
UC Scholars
Mentored by Dr. Hemal Patel

Using Nano-pillars to Probe Membrane Repair Kinetics as a Function of Caveolin Proteins

Hutchinson-Gilford progeria is a genetic disorder resulting in accelerated aging and is linked to a single gene mutation in lamin A which regulates nuclear shape. Recent studies show that a patient exhibiting progeria-like symptoms has a frame-shift mutation in the C-terminal region of caveolin-1 (Cav-1, but no changes in lamin A) with similar nuclear and altered plasma membrane structures. Cav-1 is a major component of caveolae (little caves), which are lipid-enriched invaginations of the plasma membrane. Caveolins act as scaffolding membrane proteins and contribute to membrane curvature. The impact of this unique Cav-1 mutation on membrane dynamics is limited. To investigate the role of Cav-1 in membrane curvature and repair, we are inducing membrane curvature and disruption utilizing nano-pillars, which are small glass needle-like protrusions that physically induce curvature and can be integrated with nano-circuitry to perform nano-electroporations. We will compare dermal fibroblasts (DF) in the Cav-1 mutation patient as well as in a healthy control. In order to determine Cav-1 localization and nuclear morphology, we performed immunofluorescent staining for the nucleus and Cav-1 and imaged at high resolution. Using ImageJ, I quantified the nuclear area from the fibroblasts of the diseased patients and healthy control. I found that the nuclear area of the diseased patient appears significantly smaller than healthy controls. Furthermore, the nuclear morphology from the Cav-1 mutated DF appears abnormal. After placing the nano-pillars on top of the cells to generate membrane curvature, we plan to investigate the repair kinetics of Cav-1 on the plasma membrane.

Michelle Nacayama

General Biology, UC San Diego
Summer CAMP
Mentored by Soumita Das

The Interactions of Endosomal Proteins and ELMO1 Play a Role in the Internalization of Salmonella

Enteric pathogens, such as Salmonella are a significant cause of mortality worldwide. Following infection, the host system initiates responses to clear the infection and maintain tissue homeostasis. Alteration of this process contributes to tissue damage and disease pathogenesis. Following internalization, Salmonella resides inside phagosomes called Salmonella Containing Vacuole (SCV). Despite sharing host endosomal markers, SCVs are specialized to help bacteria escape degradation and survive inside the host cells. Effector proteins secreted by Salmonella, such as SifA help in this process through the binding to host endosomal proteins, like Rab9, to hijack the host lysosomal enzymatic mechanism. We previously showed that the engulfment and motility protein 1, ELMO1 controls bacteria internalization, clearance, and immune responses following bacterial infection (PMID:29029244, PMID:26878033). In addition, ELMO1 binds to the Salmonella effector protein SifA for the regulation of bacterial pathogenesis through the control of the immune responses (PMID:34719317), and microscopy studies demonstrated that both ELMO1 and SifA control the integrity of SCV. Thus, we hypothesize that ELMO1 regulates the endo-lysosomal signaling required for SCV and Salmonella pathogenicity. Immunoprecipitation and GST pulldown using control and ELMO1-depleted J774 macrophages challenged with wild-type and Salmonella lacking SifA show that ELMO1 interacts with markers of the endo-lysosomal pathway, such as Rab5, Rab9, and Rab14 and that such interaction is impaired by bacteria infection. Our data provide new insight into the role of ELMO1 in regulating the fate of the bacteria through the endosomal-lysosomal system.

Srushti Naik

Cognitive Science, UC San Diego
UC Scholars
Mentored by Dr. Andrea Chiba

Do rats priviledge neediness or familiarity in prosocial decision making?

Rats, a rodent species with a complex social structure, have been shown to engage in prosocial behaviors that help others. In particular, rats differentially help conspecifics of the same strain, members of their in-group, in comparison to conspecifics of a foreign strain. However, it is unknown if rats will preferentially help an out-group conspecific in the case that it needs more help than an in-group conspecific. To examine this, the present study employs a novel paradigm in which an actor rat is simultaneously presented

a rat of the same strain and a rat of a different strain confined in independent restrainers with varying levels of need. A low-need condition is created by trapping a rat in a restrainer while a high-need condition is created by trapping the rat in a restrainer that has a frozen ice-pack covering the floor. The actor rat will be exposed to a member of its strain and a rat of a foreign strain in various combinations of these conditions to assess whether the actor rats privilege familiarity or neediness in making decisions of who to help. The results may provide insight on the biological roots of bias and assessment of others' needs.

Angela Ng

Biology, Baruch College
STARS
Mentored by Dr. Tsung-Ting Kuo

Blockchain Technology in Nursing Informatics: A systematic review

Due to proprietary information this abstract has been redacted.

Albert Nguyen

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Priyadarshini Pantham

Placental extracellular vesicles and small RNA expression profiling in pregnancy and preeclampsia

Preeclampsia (PE) is the leading cause of maternal and fetal mortality worldwide. This disease is characterized by the onset of high blood pressure and damage of multiple organ systems such as the liver and kidneys after 20 weeks of gestation. Preeclampsia is resolved by delivering the placenta and baby, often prematurely, and the placenta plays a primary role in preeclampsia. It is known that placenta releases extracellular vesicles with RNA, DNA, protein, and lipid cargo throughout pregnancy (1). The levels of EVs are much higher in preeclampsia pregnancy compared to normal pregnancy. EVs released by the placenta, more specially the cytotrophoblasts, syncytiotrophoblast, extravillous trophoblasts, endothelial cells, and stromal cells in the villous core, initiating a variety of biological processed due to the cargo of RNA, protein and lipid can cargo it contains (1). Research experiments by Tong et al (2, 3) showed that when EVs produced from human placentas are injected into pregnant mice, it can be seen that these EVs are destined to the maternal lung, liver and kidneys. Though the effects that these EVs have one these targeted organs are yet to be discovered, there may be a link between the number, size and cargo of EVs and the damage to these organs that preeclampsia causes. In this project, we will characterize EVs isolated from placental explants from normal pregnancy compared to preeclampsia, and profile the small RNA expression of placental tissue.

Anna Nguyen

Mechanical Engineering, UC San Diego
Genentech Scholars Program
Mentored by Professor Lisa Poulikakos

Amyloid-Beta (Aβ) Plaque Deposition in the Human Eye for AD Diagnosis

The aggregation and deposition of β-amyloid peptide (Aβ) plaques are a hallmark of Alzheimer's disease (AD). Aβ is detectable through polarized light microscopy in the eye's retina, but is a problematic imaging target. Studies have recently shown Aβ deposits in the eye's lens before the presence of AD symptoms (Moncaster et al., 2022). The lens is a more accessible imaging target due to its posterior position in the eye. Thus, an extensive examination of the lens' polarization properties with and without Aβ deposition can develop a new prognostic tool for AD. There are two significant forms of Aβ: the 42-residue (Aβ42) and the 40-residue (Aβ40). The primary difference between Aβ42 and Aβ40 is the amino acid sequence. The additional amino acids of Aβ42 change its secondary structure and aggregation mechanisms. Aβ40 suppresses plaque formation, while Aβ42 promotes it. The ratio of Aβ40 to Aβ42 is hypothesized to affect the severity of AD and is a potential path for the pre-symptomatic prognosis of AD. These secondary structure differences can be detected by circular dichroism: the difference in intensity of right and left circularly polarized light. Through modeling and computational simulations, it becomes possible: to understand the polarization properties of Aβ deposits in the lens and detect circular dichroism differences with varying ratios of Aβ42 to Aβ40. The light-matter interactions can be implemented for quantitative, colorimetric, and non-invasive detection of Aβ plaque deposition in the human eye. These simulations can assist in developing innovative diagnostic and prognostic modifications to existing ophthalmoscopes.

Khoa Nguyen

Electrical and Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Karcher Morris

Bringing electrical engineering into high schools: Reinventing a hands-on introduction to electrical engineering through analogies and creativity

Many UCSD students who have taken ECE 5, a college course that introduces students to electrical engineering and builds practical skills, have communicated the benefit and need for a similar engineering introductory experience in high schools. The aim of this educational research is to modify the course and tailor it to the high school level. Adapting a college class to high school is often difficult, as concepts are more difficult for students to understand, especially with no prior experience in the subject. Based on the work of Arık et al (2020), we hypothesize that by connecting electrical engineering to

previously taught STEM concepts, the project will successfully introduce students to electrical engineering and create an engineering culture beyond the classroom.

The modified course utilizes educational analogies that focus on explaining engineering concepts to students without engineering experience through simple, relatable examples. Similarly, the final assessment has been restructured to reflect this change, where students are encouraged to connect aspects of their high school education with electrical engineering. The design of this research study is to create research questions that investigate how these changes, such as teaching through analogies, affect students' retention and engagement in engineering. Students will answer weekly surveys related to their knowledge and interest in electrical engineering, which will be used to show the effects of our reinvention of engineering education. The course and its modifications will be implemented in Spring 2023 with the intention of creating an engineering culture on high school campuses.

Peter Nguyen

Material Science and Engineering, UC Riverside
UC LEADS
Mentored by Dr. Ken Loh

Bio-Inspired Active Skins for Passive Temperature Sensors

Passive sensors that can react to different stimuli and activate systems without batteries have been used for remote sensing applications. Such passive sensors have life threatening response applications such as seismic sensors, which warn seismologists of an incoming earthquake and infrared sensors which are used as motion sensors in security systems. In this study, we incorporated the mechanical metamaterial geometry with the Stimuli-Responsive Polymer (SRP) to exhibit the 3D deformation under certain temperatures to use it as a passive temperature sensor. The actuation of mechanical metamaterial geometries through SRPs has been limited since SRPs cannot generate sufficient mechanical energy for surface morphing. Here, we used poly(N-isopropylacrylamide) (PNIPAM)-nanoclay(Laponite) based hydrogel with high stretchability. We fabricated hydrogels with variations of 3, 5, 7, and 10 weight percent Laponite and measured the swelling ratio when the sample was casted, swelled, and exposed to hot water. The hydrogel specimens were subjected to uniaxial tensile tests to obtain the hyperelastic properties by applying the least-square fit method. Then, the deformation mechanism of Bio-Inspired Active Skin (BIAS) bowtie geometry was analyzed to determine the key location for 3D deformation through the experimentally calibrated finite element method. Notches were induced on the key location where the localized compression was generated to reduce the mechanical energy for actuation. Altogether, the SRP and BIAS geometry were assembled to create a passive temperature sensor for many applications.

Tammy-Nhu Nguyen

Bioengineering: Biotechnology, UC San Diego
Ahmadian Fellowship
Mentored by Dr. Bichen Zhang

The NOX4 Isoform is the Major Contributor to the Production of ROS in Adipocytes and its Inhibition Decreases the Expression of UCP1

Due to proprietary information this abstract has been redacted.

Thuy Khanh Nguyen

Bioengineering, Santa Ana College
MRSEC REU or RIMSE
Mentored by Dr. Michael D. Burkart, Dr. Stephen Mayfield

3D printing filaments from renewable and biodegradable thermoplastic polyurethanes (TPUs)

Ever since the discovery of Bakelite in 1907, synthetic petroleum-based polymers production has increased tremendously, resulting in the omnipresence of plastics in any single individual's life. The accumulation of small particles of plastic debris – termed microplastics – has had destructive consequences on marine and other animal life, associating as well with some serious human health problems including hormone-related cancers, infertility, and neurodevelopmental disorders like ADHD and autism. From these concurrent environmental and health issues, there is an urgent call for alternative materials options, one of which is biodegradable plastics. Our lab has developed thermoplastic polyurethanes (TPUs) that are bio-derived and fully biodegradable. TPUs attract significant attention because of their exceptional properties, including abrasion resistance, mechanical strength, transparency, and elasticity.

In this study, our goal is to develop methods to produce 3D printing filaments on biosynthetic TPUs with varying molecular weights and chemical structures and to evaluate these products in biodegradation studies. In the process, different temperatures will be optimized to make a smooth and uniform filament with a diameter of close to 1.75 mm. In terms of biodegradation, small cubes of polyester polyurethane foams were incubated in compost and soil with high humidity, as well as sea water. Scanning Electron Microscopy (SEM) and Fourier-transform Infrared spectroscopy (FTIR) are used to quantify the biodegradation activity. We have demonstrated positive results by producing 3D printing filaments and have demonstrated biodegradability of polyurethane foams. Future studies will consider the application of bioderived TPUs in manufacturing products including watch bands, shoes, and phone cases.

Sandy Nguyenphuoc

Marine Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Jeff Bowman

The effect of heterotrophic prokaryotes on the growth rates of halophilic algae Dunaliella salina in varying salinities

Halophiles are organisms that have a unique nature of being able to tolerate salinities higher than seawater and having biological adaptations to environments with high ion strengths and low water activity. Because they are also able to produce industrially relevant compounds, they have also become significant in modern scientific research and biotechnology. The halophilic algae Dunaliella is the most salt-tolerant photosynthetic eukaryote known to have varying growth characteristics in the presence of different heterotrophic prokaryotes (Le Chevanton et al., 2013). At high salinities, D. salina is thought to have higher growth rates in co-culture with certain halophilic haloarchaea (Melissa Hopkins, unpublished observations). However, the mechanisms underlying this putative symbiosis are not known. Thus, I am studying the effect and change in these growth characteristics in the presence of several different heterotrophic bacteria in conjunction with a salinity gradient, which can uncover unique bacterial-algal relationships that can provide insight into symbioses in extreme environments.

Zhengyun Nie

Data Science, UC San Diego
UC Scholars
Mentored by Professor Lutz Warnke

Costas array

Costas arrays are a N x N permutation matrices with structural properties that are useful in a range of applications, including radar/sonar, communication systems and cryptography.

There are two main ways of generating Costas arrays: (1) using a computer to exhaustively search for all possible N x N Costas arrays, which so far was only completed for small N <= 29, and (2) using explicit constructions for Costas array, which so far only work for certain N which satisfy some number theoretic assumptions.

My research involves first understanding the theoretical foundations of existing explicit constructions, and then using a mix of theory and computer programs to get further insight into these constructions and variations there of, e.g., whether these satisfy some additional useful structural properties.

Ida Nikjeh

Human Biology, UC San Diego
Multidisciplinary Eduactional Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler

How Marginalizing the SWANA Community Can Be Damaging to Their Health Disparities and Clinical Studies

SWANA is a geographical term for Southwest Asian and North African and generally refers to the Middle East, including Caucasian countries. SWANA's classification as racially and ethnically non-Hispanic White risks concealing critical within-group health and well-being disparities. This review of evidence-based research published in English between 2014 and 2022 examines whether SWANA are at risk for unidentified health disparities and underrepresentation in clinical research. PubMed, CINAHL, and Google Scholar databases were searched using such terms as: Arab American, Middle Eastern, Southwest Asian, North African, White, identity, inequalities, social and physical well-being, underrepresentation, misrepresentation, and epidemiology research/data. Key articles' citations were reviewed for eligible articles. The findings demonstrate that, compared to the Non-Hispanic White communities, SWANA communities have a higher risk of chronic illness diagnosis, cancers such as thyroid and bladder cancer, and lower cancer screening rates. The SWANA community has a higher reported incidence of diabetes, obesity, coronary heart disease, lung cancer, asthma, and hypertension than the US average. Individuals of SWANA descent have a greater risk of serious psychological distress than non-Hispanic Whites. SWANA immigrants have less access to health care, lower health literacy, and higher food insecurity than non-Hispanic Whites. No SWANA-specific clinical trials were found. The SWANA community's masked representation influences the outcomes of potentially significant clinical findings. The review shows the presence of within-group health distinctions and how the masked representation influences the outcomes of potentially significant clinical findings. Other solutions include increasing ethnic and racial representation in research.

Andrew Oabel

Computer Science, UC San Diego
UC LEADS
Mentored by Professor Mai ElSherief

Detecting Risk Levels in Problem Gamblers Through Online Communities on Reddit

Problem gambling is a form of excessive gambling where the gambler has a perceived lack of control, resulting in negative health effects. It is a public health issue that is increasingly becoming recognized by governments across the world. Problem gamblers are a high-risk group, as many of them face debt and are unable to financially support themselves and their families. Because of this, there is a need to identify individuals at

risk for problem gambling in order to create systems of intervention and prevention. In this work, we aim to leverage machine learning techniques to identify individuals at risk for problem gambling. To train these models, we will utilize over 39,000 posts from the online forums r/problemgambling and r/gamblingaddiction, which allow individuals to discuss issues surrounding problem gambling. We also aim to study the effect of the Covid-19 pandemic on the discourse and modality of problem gamblers. The results of this study will develop classifiers to detect factors indicative of problem gambling. These tools can be used to improve moderation in online problem gambling forums and give tailored advice to problem gamblers. We will examine the presence or lack of significant changes in the frequency and modality of gambling due to Covid-19, which may influence policy with the aim to reduce problem gambling.

Brenda Ochoa

Molecular & Cell Biology, UC San Diego
Multidisciplinary Educational Approach to Addressing cancer Diaparities
Mentored by Georgia Sadler

Calling the Shots: Mechanisms Behind Alcohol-Induced Breast Cancer to Explore Disparities Concerning Sexual Minority Women

Sexual minority women (SMW) experience multidimensional barriers to accessing optimal health care. When breast cancer statistics are tallied, they are included with binary, non-SMW. However, it is known that psychosocial risk factors, specific to SMW, mediate preventive care barriers, increased morbidity and mortality rates, and long term prognosis. For example, psychosocial risk factors include and influence substance abuse. Stasticially, SMW are twice as likely to consume alcohol at moderate to high rates compared to heterosexual women. Moderate to heavy alcohol consumption is associated with hormone receptor-positive breast cancer. A narrative literature review was conducted using Google Scholar, Proquest, and LGBT Life to review scientific literature including the keywords: sexual minority women, LGBT, breast cancer, alcohol consumption, one-carbon metabolism and alcohol, and DNA methylation. Mechanisms behind hormone receptor-positive breast cancer include epigenetic aberrations and one-carbon metabolism disruptions. The common mechanism explored in this study is DNA methylation; methylation decreases linearly as alcohol intake is increased, thus inducing tumorigenesis in breast cells. Studies related to trans women and men were excluded due to hormone replacement therapy, as well as intersectional groups due to coupled risk factors that may stem from ethnicity, occupation, residence, and much more. Exploring psychosocial risk factors and intricate biochemical mechanisms will be critical future research.

Steven Ocón

Human Biology, UC San Diego
Genentech Scholars Program
Mentored by Dr. Tony L. Yaksh

The Behavioral Effects of TAK-242 on LPS-Induced Mice

Spontaneous activity is a marker of an animal's well-being. A typical mouse displays a clear diurnal activity cycle with high levels at night and low during the day, while mice in discomfort show a disruption of nocturnal activity. We have developed a home cage sensor based on thermal signature to measure the ongoing cage activity of singly housed mice. To validate this model, we have used the systemic delivery of lipopolysaccharide (LPS) to generate an inflamed state, which we hypothesize will reduce ongoing nocturnal activity. In recent experiments, we have shown that intraperitoneal LPS in male C57BL/6 mice will produce a dose-dependent disruption and reduction of nocturnal activity for a period of 72-96 hours. In ongoing experiments, we will examine the effects of TLR4 antagonist resatorvid (TAK-242) on this activity and extend these studies to female mice. This model allows an unbiased assessment of drug action and the effects of putative altering drug action. The significance of this study is three-fold: 1) It will validate a simple, cost-effective model of assessing diurnal activity. 2) It will assess the systemic activity of TAK-242 that we believe will produce a behaviorally defined TLR4 inhibition. 3) If the model works in defining the antagonist actions of a molecule thought to produce a TLR4 blockade, it will provide a screening platform to assess the effects of other TLR-targeted agents.

Diana Oliva Najarro

Environmental Systems; Earth Science, UC San Diego
STARS
Mentored by Dr. Sarah Purkey

Understanding the Equatorial Pacific Ocean Biogeochemistry and their Connection to El Niño and La Niña Events

The Pacific Ocean is the largest ocean on Earth and influences the global climate through its regulation of heat between the ocean and atmosphere. It regulates heat through an ocean-atmosphere coupled phenomena within the Equatorial Pacific Ocean Region known as the El Niño and La Niña oscillation (ENSO). ENSO affects the biogeochemistry of the Equatorial Pacific Ocean, as well as, the global health of ecosystems, humans, and economy. Although, the biogeochemistry is still not widely understood, there's been recent technological advances changing this. Autonomous robots, known as Argo Floats, along with GO-SHIP, collect oceanic data including temperature, pressure, oxygen, pH, salinity, downwelling radiance, and chlorophyll. In this research, the data from 11 ARGO floats and 4 GO-SHIP surveys located through the

equator will be analyzed through a series of coding and graphs. Using these data we aim to i) characterize the biogeochemistry of the equatorial pacific ocean, ii) asset spatial and seasonal variability along the Equator and iii) examine its connection to ENSO. Through this analysis we expect to find spatial and seasonal variability in the ocean's salinity, pH and oxygen levels that correlates with La Niña events that we have been experiencing for the last 2 years. These findings can lead to further research on the biogeochemical changes of the Pacific and other oceans. The data analysis can also be used to make predictions of the intensity and expectancy of future El Niño and La Niña events.

Ethan Olson

urban studies and planning, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Amy Lerner

What to Do about the Eucalyptus?: A Speculative Design Proposal for UC San Diego's Largest Eucalyptus Grove

This project aims to create a comprehensive vision plan for the historic eucalyptus grove in the northern part of UC San Diego's campus. The proposal is guided by a combination of social, historical, and ecological research; site analysis; and collaboration with campus planning officials to explore different possibilities for the future of UCSD's most historic open space. The objective of the project is not to eradicate the eucalyptus grove and replace it with something new entirely, but to propose a series of interventions that will increase biodiversity, resilience in the face of climate change, and social benefits.

The final product of the project will be a report featuring diagrams, maps, illustrations, renderings, architectural cross sections, collages, and other visualizations that convey the recommended interventions for the grove, including, but not limited to: the introduction of native species as older eucalyptus trees die off, infrastructure to make the grove more accessible to all people, and small built features that create pockets of social interaction in a space that is currently underappreciated.

Elan Ortiz

Biochemistry, San Diego Mesa College
Make UR MARC
Mentored by Dr. Miguel Lopez-Ramirez

An Analysis on the Localization of Cerebral Cavernous Malformations through in Situ Hybridization

Cerebral Cavernous Malformations (CCMs) are neurovascular lesions caused by loss-of-function mutations in one of 3 genes, they are KRIT1 (CCM), CCM2, and PDCD10 (CCM3). Despite this, the factors that determine the tendency for CCMs to form in the

brain are still unknown. Previous studies in our lab have demonstrated a communication cycle between brain endothelium and astrocytes. In addition, RNA sequencing analysis from isolated astrocytes has shown that several genes are more expressed in CCM afflicted brains, when compared to healthy brains. Here, we aim to observe the influence that 4 specific CCM-reactive astrocyte genes have on the formation of these lesions through in situ hybridization.

In order to identify which of these astrocyte genes are being expressed in areas surrounding the lesions, we will attach a fluorescent component to a probe of each of the 4 selected genes, which will then be hybridized with a sample of CCM brain tissue (Pdcd10-knock-out mouse model). Using microscopy techniques, the test will qualitatively assess the presence of fluorescence in the tissue sample. If one of the selected genes is expressed within the tissue sample, the corresponding probe will give a fluorescent signal. And if the gene is not expressed, no fluorescence will be registered. This analysis will allow us to determine whether these differentially expressed genes are present in lesion areas, and in doing so, we aim to gain further insight into their role and contribution to the mechanisms behind CCM formation, development, and propensity to develop within the brain.

Emily Pan

Physics, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Liang Yang

The Search for Neutrinoless Double Beta Decay: Development of a Cryoprobe for Barium-tagging R&D

nEXO, the successor to the EXO-200 experiment, is attempting to search for the neutrinoless double beta decay of Xenon-136 by using a larger mass and improved instrumentation. The double beta decay of Xenon-136 produces a Barium-136 daughter ion and two electrons. Barium-tagging is a proposed procedure that will be used to detect the singular barium ion. As part of the R&D, we are developing a cryogenic probe to freeze a precise amount of liquid xenon in order to capture and image the barium ion. Through extensive testing, the design of the cryogenic probe will be modified and improved upon until the probe can successfully control the cooling, thickness, and transparency of xenon ice. If the barium-tagging technique can be successfully developed, it could be a future upgrade path for nEXO.

Zerui Pan

World Literature and Culture, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Professor Géraldine A. Fiss

Treading on the Tiger's Tail: Chinese and Japanese Action Cinema Reacting to State Censorship

Deeply rooted in the East-Asian cultural traditions, wuxia (武侠 martial arts films) and jidaigeki (時代劇 period films) are subgenres of action cinema, depicting folktales around righteous warriors using swords to embody their moral codes. Although both genres achieved peerless popularity in Chinese and Japanese cinema in the 1920s and early 30s, they lost their dominance in the domestic film industry after struggling to cope with state censorship. For wuxia films, they suffered political suppression for encompassing "superstitious" folk religions when China was striding toward scientism. In jidaigeki's case, they were criticized by the militaristic Japanese government for "embracing Americanization" while excoriated by the U.S. occupation censorship later for celebrating "feudalistic values". This paper investigates the interactions between action cinema and state censorship from a comparative perspective, comparing and contrasting Wancang Bu's wuxia film A Spray of Plum Blossoms 一剪梅 with Akira Kurosawa's jidaigeki The Men Who Tread on the Tiger's Tail 虎の尾を踏む男達. Both films made substantial changes to abide by government regulations; my research demonstrates that those thematic and cinematographic alterations are creative solutions to preserve the essential characteristics of each genre while cloaking sensitive messages. The paper starts with an overview of the connections between both genres and East-Asian cultural traditions, followed by elucidation on the political context that rendered them problematic. Afterward, it offers a comparative analysis of the two films. The paper concludes that while the solutions helped both films survive through suppression, they failed to restore either genre back to their former level of popularity.

Briana Parker

Literatures in English, UC San Diego
McNair Scholars Program
Mentored by Seth Lerer

Crossing Brooklyn Ferry: A Socially Activated Pedagogical Experiment in the Literary Mapping of Poetic Landscapes, Boarders, and the Imagination

Literature curriculum at the undergraduate level has called for new strategies in relaying the relevance and necessity of literary canon to modern readers with ostensibly distanced cultural narratives. Research in pedagogical practices that bridge literary canon and

modern worldviews must be invested in. Not only to preserve the academic tradition of analyzing literature but also to use literature as a vehicle for creating social and cultural meaning, so that newer generations can be part of a learning that embraces past perspectives while imprinting and acknowledging new voices. Through an analysis of Walt Whitman's transcendentalist poem "Crossing Brooklyn Ferry", I will create a theoretical template of a curriculum that explores themes of border crossing. The goal of designing a curriculum that develops a shared analysis of the poems geographical landscape is to relate to modern readers perspectives of multi-dimensional identity and the spaces in which readers and students traverse in the pursuit of self and academia.

Amaya Parks

Sociology, concentration in Public Health, Spelman College
STARS
Mentored by Dr. Mary Blair-Loy

The Impact of Covid-19 Pandemic on Academic Careers

Due to proprietary information this abstract has been redacted.

Oscar Partida

Biology, UC San Diego
Summer CAMP
Mentored by Terence Hwa

Bacterial Sensation and Aggregation; Deciphering Chemical Language of Particle Associated Marine Bacteria

The ocean is a large and substantially important part of our planet, oceans phytoplankton responsible for primary production accounting for roughly half of the primary production globally each year. Marine bacteria are responsible for a significant portion of decomposition and recycling of the organic matter produced by primary production. Moreover, these bacteria can impact the distribution of organic matter within the water column by driving aggregation and sinking of various particles in a pathway known as the biological carbon pump. While the bacteria within the ocean experience a nutrient depleted environment with occasional encounters of nutrient hotspots, we know very little about how this may impact their aggregative behaviors. Through my research I have examined a variety of marine bacterial strains and their aggregation behaviors with various nutrient sources in vitro. After examining over a dozen strains in 29 nutrient sources we have found distinct patterns in their aggregation and growth. The bacteria demonstrate the capability of aggregation with no growth as well as growth with no aggregation. Each strain has a unique combination of nutrients which support growth vs aggregation. Future work will include examination of the genetic basis by which marine bacteria aggregate to better inform metagenomic based studies of marine bacteria performed by other groups. Ultimately I hope to answer whether there is a trend in

aggregation behaviors of bacteria in specific nutrient sources as a better understanding of these behaviors will give us insight into the ways in which bacteria can contribute towards biological pump.

Jesus Peng Zhao

Biochemistry, UC San Diego
Genentech Scholars Program
Mentored by Dr. Jazz Dickinson

Characterization of a novel role of citrate mediated root development in Arabidopsis thaliana.

Root development is an adaptative process that plants modulate to survive in a variety of different environments and conditions. Anchor roots and root hairs are important root structures that plants rely on to withstand natural adversities such as drought, nutrient deficiency, and soil disruption. Anchor roots emerge from the junction between the root and the shoot, often as a response to nutrient deficiency and environmental stress. Root hairs are elongated cells that increase the root-soil surface and facilitate plants to absorb nutrients and water. However, the molecular mechanisms underpinning the development of these structures remain unclear. Here, I report a role for citrate in the pathways controlling the formation of these two important root structures in the model organism Arabidopsis thaliana that differ from its conventional role in ATP generation. Using buffered exogenous treatments, it was found that increasing citrate concentrations induce anchor root formation and suppress root hair growths. By characterizing genetic report lines for major plant hormones such as auxin, cytokinin and abscisic acid, the changes in hormonal levels uncovered indicate a crosstalk of signaling pathways with citrate. Furthermore, histochemical staining for reactive oxygen species (ROS) revealed that citrate causes significant changes in ROS concentration in developing roots. Finally, citrate treatments improve vigor in plants grown in phosphate deficient soils without relying on unsustainable chemical fertilizers. Therefore, understanding these uncharacterized mechanisms that enable plant survival is not only important for improving agricultural practices today but might even prove vital in a near future threatened by climate change.

Mina Perez

Chemistry, University of Nebraska - Lincoln
STARS
Mentored by Dr. Dionicio Siegel

The Synthesis of Novel Compounds to Combat Binge Eating Disorder

Binge eating disorder is a life-threatening condition that can be identified in two-thirds of obese patients. Over one-third of adults in United States are obese. Obesity is the cause of many illnesses such as Type 2 Diabetes, Sleep Apnea, High Blood Pressure, etc. Type 2

Diabetes and Prediabetes are the source of morbidity and mortality in patients with obesity. Novel Compounds are a combination of chemical elements that are in the beginning stages of testing. These Novel compounds are designed to bind onto ion channel proteins and suppress the binge eating disorder. Methods such as thin layer chromatography and column chromatography are used to separate the compounds from impurities. The preeminent of synthesizing compounds is to create an essential and efficient way of improving world health while specializing in pharmacotherapies or pharmaceuticals. By identifying novel hypothalamic therapeutic targets, it was discovered that over-consumption is the cause of obesity, prediabetes, and diabetes epidemics. Therefore, it is important to identify the mechanisms of the hypothalamic neurochemical system to synthesize novel compounds specific to the inhibitors. With this in mind, we hypothesize that conducting the reactions to synthesize a modified version of IAA-94 (Indanyloxyacetic acid-94) with methods such as Friedel-Crafts reaction will improve efficiency in reducing food intake.

Cassandra Pheiffer

Mechanical Engineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Laura Vasquez-Bolanos

Analysis of the immune system's impact on rotary cuff tears

Due to proprietary information this abstract has been redacted.

Lisa Phung

Human Developmental Sciences, UC San Diego
McNair Scholars Program
Mentored by Dr. Amy Bintliff

Responding to Injustice: Can Strategic Implementation Create Social Change?

Due to proprietary information this abstract has been redacted.

Quinn Picard

Computational Physics, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Alex Frano

Deep Learning for Music Analysis

Artificial intelligence–particularly deep learning–is valuable due to its ability to process information similarly to the human brain. This allows deep learning to identify, interpret, and create art in a way classical computing has yet to accomplish. Music is characteristically suited for deep learning due to its complex composition,

dimensionality, and subjectivity; which would be interpreted differently depending on the training of the neural network. Music interpretation has come a long way–however, anthropomorphic deep learning models may prove more effective to understand human perception of music. Utilizing a new model, I will find new forms of music interpretation that could shed light on human perception of music concerning music theory, human emotional response, and neuromorphic computing.

Deep learning neural networks have been able to separate polyphonic music into separate stem tracks for more detailed analysis by utilizing convolution neural networks (CNN) and long short term memory (LSTM) neural networks with rectified linear unit (ReLU) activation on spectrograms. I replicated this standard and am implementing spiking activation to better model the action potential of the human brain for stem separation and analysis. Spiking neural networks (SNN) have shown unique success in voice recognition which share many qualities with music analysis. Furthermore, the spectrogram-based method of audio analysis does not capture all of the information from the original music source. Incorporating the phase information that is lost in a spectrogram allows the model to perceive music more similar to how our brains do, allowing for advanced implications in cognitive understanding.

Denise Picazo

Psychology, University of San Diego
McNair Scholars Program
Mentored by Laura Getz

Speech Perception in Bilinguals

The Language and Music Perception (LAMP) Lab is run by Dr. Laura Getz who is facilitating the current study which is geared towards learning about bilingual individuals and the perception of speech within priming differences. The research specifically observes the Ganong effect which is the way that we as individuals recognize the differences between similar sounding phonemes based upon what we know to be comprehensive. The motivation behind the study is to analyze and interpret how bilinguals interpret speech based on previous knowledge and exposure to specific stimuli. There is a sound proof booth where participants will be read instructions in either ENglish or Spanish then they will hear a series of audio with various voice onset times (VOT's) depending on the language. Spanish words have a negative voice onset time in increments of 10 (ie: -40, -30, -20, etc.). English words have a positive voice onset time. There are three sets of words which have similar ending sounds and different beginnings which completely alter the meaning of the word. By editing the audio, and making it ambiguous we are studying whether or not there is a correlation in how bilinguals interpret the word based on exposure to English or Spanish instructions. We expect to see a bias towards the English word based on the prime and vice versa.

Matthew Plazola

Biochemistry, CSU Long Beach
MRSEC REU or RIMSE
Mentored by Dr. Jon Pokorski

Development of a biocomposite PCL patch for accelerated wound healing

Proper wound treatment is important for preventing infection and other complications. Hyaluronic acid (HA) is a natural polysaccharide that accelerates wound healing; however, HA has a short half-life in skin due to enzymatic degradation. Here we propose a biocomposite patch consisting of a polycaprolactone (PCL) matrix harboring evenly dispersed and modified Bacillus subtilis spores for sustained production of HA. B. subtilis is chosen for its diverse genetic toolbox, its biodegradation properties, and its ability to form metabolically dormant spores which can withstand the harsh temperature and shear stress of biocomposite PCL fabrication. Plasmid vectors will be modified to produce HA by incorporating the hasA and tuaD genes, encoding hyaluronic acid synthase and UDP-glucose-6-dehydrogenase respectively. Modified plasmids are transformed into B. subtilis, which are lyophilized and processed by melt extrusion. 3D bioprinting shapes the bioactive patch using the biocomposite PCL as ink, allowing for patch design accommodating wound shape and size. When exposed to blood at the wound site, B. subtilis spores on the surface of the biocomposite patch germinate and begin the production and release of HA. As the biodegradable PCL patch decreases in volume over time, fresh B. subtilis spores are exposed to blood nutrients and germinate, creating a sustained release of HA. A scratch assay will demonstrate the ability of the biocomposite patch to accelerate wound healing in fibroblasts and endothelial cells. Our proposed bioactive patch has long shelf-life due to spore stability, and a sustained release of HA to facilitate proper healing of chronic skin wounds.

Natalie Pok

Molecular and Cell Biology, UC San Diego
Industry Internship at Escient Pharmaceuticals
Mentored by Michelle Solomon

Expression of Mast Cell Inflammatory Mediators in the Bronchoalveolar Lavage of Asthma Patients

Approximately 25 million people in the U.S. suffer from asthma, roughly 1 in 13 people. Despite the increased knowledge in both the pathophysiological mechanisms and biology of asthma, which have paved the way to asthma management, severe persistent asthma remains as an unmet clinical need. Treatment consists of inhaled corticosteroids, which long term use can lead to thinning of bones, susceptibility to infections, and suppression of adrenal gland hormone production. Mast cells are resident immune cells that play a therapeutically validated role in the pathophysiology of many diseases including allergy,

gastrointestinal disorders, and pain. They contain granules which have inflammatory mediators such as histamine, tryptase and inflammatory cytokines that can recruit other immune cells to sites of inflammation. We are working to characterize the difference in mast cell inflammatory mediators in the bronchoalveolar lavage fluid from the lungs of severe asthmatic and healthy patients. Bronchoalveolar lavage fluid was collected from healthy and severe asthmatic patients to compare the expression of mast cell inflammatory mediators. The fluid was centrifuged and the pellet added isolated for RNA extraction. The RNA was reverse transcribed into cDNA for quantitative PCR analysis of mast cell inflammatory mediators including tryptase beta 2 and tryptase alpha/beta 1, substance P, c-kit, and MRGRPX2. The results from our study will determine whether mast cells play a significant role in severe asthmatic patients.

Samantha Prestrelski

Mathematics-Computer Science, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Curt Schurgers

Machine Learning Models for Acoustic Species Identification of Avian Biodiversity

Wildlife population estimates act as a metric for environmental change and overall ecosystem health. Collecting audio clips by deploying long-term microphone arrays has become a low cost alternative in this area to more invasive or time-consuming traditional methods. Experts label audio with the species in the clip and exact times vocalizations occur, referred to as “strong” labels. However, our dataset consists of over 1,500 hours of field audio from the Madre de Dios region in the Peruvian Amazon, making manual labeling unrealistic. This process could potentially be automated via machine learning models. Most publicly available avian datasets are “weakly-labeled,” where the bird present in a clip is known, but not exactly where the vocalization occurs. However, to develop well-performing models that detect individual bird calls and do species level classification, it is necessary to train on large amounts of strongly-labeled data. By adapting existing convolutional (CNNs) and recurrent (RNNs) neural networks trained on North American and European birds, we aim to use weakly-labeled datasets to generate large amounts of strongly-labeled training data for other region-specific classifiers. We will also evaluate the efficacy of training models on computer-generated labels versus manually created annotations. This work is done in collaboration with the San Diego Zoo Wildlife Alliance Population Sustainability group.

Elisa Prohroff

Marine Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Jennifer Taylor

Mechanical integrity of Pandalus gurneyi exoskeleton in response to ocean acidification and ocean warming conditions.

Due to proprietary information this abstract has been redacted.

Chenxing Qiu

Computer Engineer, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Hanh-Phuc Le

A battery charger converter circuit with charge measurement (Coulomb counter) and maximum power point tracking for solar energy system.

Due to proprietary information this abstract has been redacted.

Cathy Quach

psychology, California State University Northridge
STARS
Mentored by Dr. Gail Heyman

The Essence of Being American

Prior research suggests that people may represent nationality as a dual concept, viewing nationality as both an essentialized notion that is inheritable and biologically based as well as a social construct that is alterable through citizenship acquisition. However, it is unknown how people conceive of nationality for individuals who change their national groups, such as immigrants. Due to the complex representation of nationality as both a fixed and fluid identity, a potential explanation for this phenomenon is that people might not view immigrants as having the same nationality identity as natives, perhaps believing immigrants are not less Americans. To explore this possibility, we will examine how American college students think about immigrants and natives as "truly" American. Specifically, we will look at how participants make such inference based on their personal attributes - one's race, religion, political ideologies, economic status, residential periods, parental nationality, prosocial personality, and loyalty to a country. Our results will shed light on how Americans conceive of the essence of being American and whether they use different yardsticks when inferring immigrants' American identity.

Jocelyn Quiroz

Cognitive science, neuroscience specialization, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Diaparities
Mentored by Georgia R Sadler

Exploring Body Image Interventions for Patients with Breast Cancer: A Review of the Literature

Breast cancer and its treatment can have profound effects on bodily appearance and functioning, altering subjective perceptions of the body or body image (BI). These BI alterations are of special concern, considering poor body image predicts elevated levels of depression, anxiety, impairment of intimate relationships, and shorter length of survival. A review of the scientific literature was done to explore the impact of breast cancer on body image, quality of life, and interventions. PubMed, PsycINFO, and Google Scholar databases were searched to identify relevant articles published in English between 2011 and 2021. Combinations of the following search terms were used: breast, cancer, body, image, esteem, psychological, psychosocial, and intervention. Reference lists were reviewed for relevant articles. The literature confirms that breast cancer and its treatment adversely alter body image and that different types of psychological interventions are effective in reducing body image dissatisfaction. The literature also identifies a key programmatic weakness: some interventions lack a holistic approach that focuses on the complex interplay between breast cancer, the individual, and the broader sociocultural context of women's lives. Interventions using Cognitive Behavioral Therapy (CBT) and other forms of psychotherapy are particularly promising in addressing adverse body image issues. Body image is a complex, multidimensional construct. Enhancing body image can be accomplished with personalized and/or collaborative psychological interventions designed to meet patients' needs and preferences. Further research in novel and mixed-method approaches is crucial in the development of improved interventions.

Gabriela Ramirez

Cellular and Molecular Biology, CSU San Marcos
STARS
Mentored by Nicole Coufal

Creating neurodegenerative disease models from iPSC-derived microglia

Microglia, the primary immune cell in brain, are important in development and regulate immune response in neurodegenerative disease. However, their role in the pathogenesis of neurodegenerative diseases remains unknown. Using iPSC-derived microglia, we performed various techniques, such as organoid generation and cocultures, to create disease models to better understand their function. The use of organoids and cocultures illustrates how microglia interact in a more complex environment compared to current in-

vitro methods. Microglia are also dependent on their environment for their phenotypes, so we also utilized both immunofluorescent and live imaging of cells in both in-vitro and mouse models to understand how microglial morphology and function is impacted in diseased states. Using these techniques, we hope to elucidate the role of microglia in neurodegenerative diseases and ultimately develop microglia-specific therapies.

Katelyn Raney

Microbiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Suresh Subramani

Investigating novel players impacting cellular peroxisome homeostasis.

Due to proprietary information this abstract has been redacted.

Anna Rapp

Public Health, UC San Diego
YES Program
Mentored by Dr. Georgia Sadler

Cancer Disparities Exacerbated by Inaccessible Scientific Literature

While the average American reads at a seventh to eighth grade level, literacy is directly correlated with socioeconomic status, resulting in widely diverse literacy levels within the population. In the United States, where most scientific research funding is raised through taxation, there is a growing recognition that information about those scientific discoveries should be accessible to all. This literature review will investigate the accessibility of scientific literature to lay audiences. Twenty articles on Multiple Myeloma were collected from PubMed using four of its filters to assure diversity and relevance among the literature being evaluated: reviews, clinical trials, randomized controlled trials, and systematic reviews. Each article's abstract was scored using Word's Flesch-Kincaid (FK) reading grade level evaluation tool. The average reading grade level for all 20 articles was 16.48, which reflected the reading level of a college graduate. Five articles were gathered with each filter. The reviews' average FK was 18.22, the clinical trials' average FK was 15.68, randomized control trials' average FK was 15.74, and systematic reviews' average FK was 16.28. Scientific abstracts' information is critical to the scientific community where the vocabulary and process are commonly shared. To increase the public's access to information about scientific discoveries, a second abstract could be provided that will have a Flesch-Kincaid reading grade level no higher than seventh grade. The lay abstract should be written so that the information is neither diluted nor should information critical to understanding the scientific discovery be omitted. Such abstracts are already required by NIH grant applications.

Kamen Redfield and Sukham Sidhu

Data Science and Linguistics / Economics – Minor: Data Science, UC San Diego
CSE Department
Mentored by Dr. Christine Alvarado

Early Research Scholars Program: Analyzing Correlation with Academic Outcomes in Computer Science Students

The Early Research Scholars Program (ERSP) is an inclusive research opportunity for lower-division students in Computer Science which takes place over an academic year. Students study the principles of research, gain mentorship by graduate students and faculty, onboard to existing CS research, and present the results of their work at the end of the program. Our hypothesis is that students who participate in ERSP have improved academic outcomes, particularly when accounting for student demographics. With data of grades, majors, and demographics of students from the previous five ERSP cohorts, we hope to shed light on the retention rates and GPA differences of ERSP students compared to the control (demographically similar students who did not participate in ERSP). Previously published papers on ERSP program structure, mentors, and overall GPA and retention impacts have shown that retention rates and average GPAs of ERSP students are higher than the control. While some work has been done analyzing the impacts for underrepresented minority, first generation, and transfer students in other research programs, we sought to analyze these groups within ERSP. We present the results of our analysis on retention and GPA for ERSP students.

India Robinson

Biology pre-medicine, Southern University of New Orleans
Skaggs School of Pharmacy
Mentored by Conor Caffrey

Identifying new drug leads to treat Human African Trypanosomiasis

Trypanosoma brucei (T. brucei) is a protozoan parasite that causes Human African Trypanosomiasis (HAT), also known as African sleeping sickness. Found in sub-Saharan Africa, individuals become infected with T. brucei by the bite of an infected tsetse fly.Between 50,000 to 500,000 people die each year in Africa from this disease, particularly those who live in poverty, who hunt and fish. HAT consists of two different stages: stage I is characterized by the presence of the parasite in the bloodstream, and stage II by the parasite multiplying in the central nervous system. The objective of my research is to detect potential drug leads that can kill T. brucei in an in vivo culture assay. The assay; utilizes 96-well microtiter plates, and the positive control drugs, fexinidazole and pentamidine, and DMSO as a vehicle (negative) control. Control and test compounds

are tested in triplicate. The fluorescent DNA binding agent, SybrGreen, is used to measure growth-inhibition of the parasite. From these assays. I identified two novel compounds that killed T. brucei and these may hold promise as potential antitrypanosomal drugs.

Isaac Rodriguez

Neurobiology, UC San Diego
Make UR MARC
Mentored by Dr.Bryan, Ru

The Comparisons of Nicotinamide Riboside Treatments for Osteoarthritis

Osteoarthritis is the form of arthritis that causes the degradation of articular cartilage. Articular cartilage prevents friction and impact in the joint of the knee which protects and allows the joint to move in fluid motions. The degradation of it from inflammation and stress forces causes it to be placed with bone that is unable to complete the same task and causes fluid movement and pain.

The use of Micro-Ct allows for the ability to scan using x-ray slicing to gather data and images of the inside of the OA-affected knee. Micro-CT enables the ability to gather data such as bone mineral density, tissue volume, and bone volume through the program CTAn which utilizes these scans. Then the program CTvol can be used to create 3-D models of certain sections of the knee or its entirety for analysis, with this, the specific group studied focuses on mice that have undergone DMM(Destabilization Medial Meniscus) to promote Osteoarthritis in 10 weeks. After this, the mice will go through two separate treatments, NR (Nicotinamide Riboside) and NRA (Nicotinamide Riboside with Apigenin). NR reduces inflammation while Apigenin inhibits CD38 to assist in the reduction. The goal is to determine whether a Co-treatment of NRA will produce any significant results in comparison with the NR treatment. The method in which this will be analyzed is through Micro-CT and CTAn.

Jennifer Rodriguez

Molecular and Cellular Biology and Global Health, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Samara Reck-Peterson

Understanding the mechanism by which Lis 1 activates dynein

The microtubule motors dynein and kinesins drive intracellular transport of protein cargoes and organelles. Localization of these cargoes at the right place and time is necessary for cellular function and defects in dynein lead to diseases such as cancer and neurodegeneration. Lissencephaly 1 (Lis1) is a key regulator required for dynein's function. Lis1 gene is mutated in patients with the neurodevelopmental disease lissencephaly. Dynein motors are autoinhibited in a "Phi" conformation and undergo a

series of conformational changes to form active complexes, which consist of two dynein dimers, the dynactin complex and activating adaptor(s). We and others have recently shown that Lis1 is required to form these active dynein complexes but how Lis1 activates dynein and promotes dynein motility, is poorly understood.

Here, using cryo-electron microscopy, we solve a high-resolution structure of two Lis1 dimers ‘wedged’ on each side of an autoinhibited dynein motor dimer. Our structure reveals two new contact sites between dynein and Lis1 and is suggestive of the mechanism by which Lis1 promotes the relief of dynein autoinhibition. Using structure informed mutagenesis, we disrupted each of these sites and show that they are required for Lis1’s regulation of dynein in vivo in S. cerevisiae. The in vivo significance of the mutations for Lis1’s regulation of dynein were evaluated by nuclear segregation and dynein localization imaging assays. We propose that our structure represents an intermediate in dynein’s activation pathway and the study of these sites sheds light into how Lis1 regulates dynein and promotes intracellular transport.

Kelly Rodriguez

Psychology, California State Unviersity Northridge
STARS
Mentored by Dr. Prashant Bharadwaj

Mental Health Service Utilization by Race: A Examination of Household Income, Emotional Care, and Family Involvement Factors

There are ethnic and racial disparities in children's mental health service utilization. Counseling has been shown to be particularly effective for treating mental health necessities among youth, but the need for counseling is not being met. This study utilizes secondary data on thousands of adolescents from diverse ethnic and racial backgrounds from the National Longitudinal Study of Adolescent to Adult Health (Add Health), 1994-201. The role of household income, emotional care, a self reported measure of “feeling cared for” by adults and friends, as well as adolescents' psychological counseling utilizing differences by race in individuals in necessity measured by a self reported depression are analyzed through regression. Findings from this study will help better understand whether mental health service utilization varies by race and the factors underlying those differences.

Hope Romero

Biology, University of San Diego
McNair Scholars Program
Mentored by Kate Boersma

Macrophytes in the Anza Borrego Desert State Park

Macrophytes in the Anza Borrego Desert State Park were identified to see the relationship between the aquatic ecosystem within desert streams and the macroinvertebrates that reside in those streams. I will be presenting the macrophytes that I have identified according to the sites visited while out in the field.

Edwin Ruiz

Cognitive Science (Spec. ML & Neural Computation), UC San Diego
McNair Scholars Program
Mentored by Alysson Muotri

Strategies that analyze networks in brain organoids to promote the growth of more complex neural tissue

At the forefront of Neuroscience, lab-grown neural tissues named Brain Organoids have shifted 2D Brain Models into 3D structures. In turn, this has transitioned clinical trials to human biology, which can better demonstrate the effects of new drugs on the brain. Current challenges involve analyzing this new type of data and vascularizing the organoids to promote a healthier and more complex neural tissue. Overcoming this question can lead to insights about the early developing brain, as well as susceptibility to mental disorders.

Our experiment attempts to simulate the naturally occurring environment of developing stem cells by stimulating a brain organoid with an electrophysiological input and retaining its self-organizing properties as an output. The aim is to statistically analyze the molecular and cellular processes to develop a model of information exchange dynamics that are important to global organoid growth and function. We predict that the data comparison between natural and stimulated developing neural signals of brain organoids can reveal the mechanisms and range of affects that are needed for fostering synaptogenesis throughout a developing brain organoid. This will result in a new brain model for growing more complex neural tissue.

Taylor Rytlewski

Physics, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Suckjoon Jun

Understanding growth rate control in Bacillus subtilis

Bacteria have lived on Earth for millions of years and thrive in diverse environments. These single-celled organisms can sense and adapt to changing environmental conditions to maximize survival and growth. Because exponential multiplication is a hallmark of bacteria, it is often assumed that they regulate their physiology to ensure fast growth. This study directly quantifies how resources are allocated in Bacillus subtilis when grown in nutrient-rich and nutrient-limited environments. Using genetically mutated strains of B. subtilis, we modulated the rate of ribosome synthesis and determined that in almost all nutrient environments, B. subtilis exhibits growth maximization. However, sub-maximal growth is observed when B. subtilis is grown in environments containing chloramphenicol, a ribosome inhibiting antibiotic. We have also examined the role of ppGpp, a nucleotide involved in the bacterial stress response, in affecting resource allocation in B. subitilis. Interestingly, the preliminary results show that eliminating B. subtilis' ability to synthesize ppGpp does not alter the growth rate in a significant manner when compared to the wild-type.

Rahul Sahjwani

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Piya Pal

A Critical Look at Deep Learning Based End-To-End Super-Resolution and the Need for Physics-based Modeling

Image super-resolution is a highly ill-posed inverse problem with applications in medical and biological imaging, radio astronomy, and autonomous systems, to name a few. Deep learning based end-to-end techniques have garnered attention because of their empirical success in computer vision and purported performance increase on standard benchmark datasets (SRCNN achieving a PSNR of 30.5 dB on Set5 and RDN achieving a PSNR of 28.8 dB on Set14). In this project, we critically evaluate the performance of state-of-the art deep learning-based methods, and show that data-driven solutions (particularly deep learning) are unable to resolve high frequency details when attempting to super-resolve test images that do not strictly adhere to the specific parametric settings of the training datasets. In other words, deep-learning methods do not adequately 'learn to invert' the forward map and hence fail to generalize on 'truly' unseen data. This uncertainty of 'black box' methods necessitates the studying of recent advances in physics-driven super-resolution techniques.

SMLM (single molecule localization microscopy) and SIM (structured illumination microscopy) techniques exploit the laws of physics to 'surpass' the diffraction limit. PALM and STORM are widely applied examples of such techniques with guaranteed nanometer-scale resolution. We study recent advances in reconstruction algorithms for these techniques. These reconstruction algorithms rely on signal processing algorithms that crucially utilize the knowledge of the forward model, as well as geometric priors on the data. Our ultimate goal would be to infuse these model-based signal processing algorithms with "learned priors" from available training datasets to further enhance their performance.

Megan Salek

Physics-Biophysics, UC San Diego
MRSEC REU or RIMSE
Mentored by Dr. Michael J. Sailor

Synthesis of Titanium Dioxide-coated Silicon Nanoparticles and Characterization via X-Ray Diffraction

Porous silicon nanoparticles have many biomedical applications as biosensors, drug release particles, and more. Since silicon readily dissociates in aqueous solution, sealing chemistry is used to coat the nanoparticles and extend their lifespan in aqueous solution. However, many of these methods lack long-term stability in aqueous solutions. Here, we explore the viability of titanium dioxide as a more stable sealing chemistry for use in aqueous solutions. Titanium dioxide is applied using a hydrolysis reaction. X-ray diffraction is used to characterize the titanium dioxide-coated porous silicon nanoparticles. Specifically, x-ray diffraction is used to confirm the structure of porous silicon nanoparticles.

Jose Samano Catalan

Psychology and Cognitive Science Double Major, University of California, Davis
UC LEADS
Mentored by Dr. Thomas L. Beaumont

Chromatin Remodelers in Brain Tumor Oncogenesis

Gliomas are the most common primary malignant brain tumor in adults. Even with the standard of care treatment including maximal safe surgical resection followed by chemotherapy and radiation, gliomas remain incurable. Characterization of the glioma genomic and epigenetic landscape has revealed distinct molecular subtypes associated with distinct clinical behavior and survival. Despite these advancements in molecular classification and clinical stratification, there has been no new treatment for gliomas and the median survival remains poor. However, large-scale genomic sequencing efforts have also identified mutations in epigenetic regulators that represent attractive targets for the development of new treatments. One such target is (SwItch/Sucrose Non-Fermentable)

SWI/SNF chromatin remodeling complex that can carry mutations in up to 40% of lower grade gliomas (LGG) and that may play a critical role in the anaplastic transformation of lower grade gliomas to higher grade tumors such as glioblastoma. These ATP-dependent chromatin remodelers, such as ARID1A and SMARCB1 are known to oppose epigenetic silencing and may regulate critical tumor suppressor loci such as CDKN2A/B. We hypothesize that BRG1/BRM associated factor (BAF) SWI/SNF chromatin remodeling complex subunit mutations are critical regulators of anaplastic transformation and disease progression in LGG. We will test this hypothesis in gliomas stem cells (GSCs) in vitro by systematically modulating the expression of critical BAF subunits using siRNA and CRISPRa/I knockdown. The phenotypic effect will be assessed with in vitro growth assays and stem-like clonogenic frequency. Favorable targets will also be assessed with in vivo tumorigenesis and survival analyses. This work will provide critical insights into brain tumor oncogenesis while identifying new cancer dependencies that can be exploited with precision therapeutics.

Emi Sanchez

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UCSD PATHS Summer Reasearch Program
Mentored by Dr. Anjana Rao

Improving anti-tumor functioning by degrading transcription factors involved in T cell exhaustion

Due to proprietary information this abstract has been redacted.

Alfredo Santiago

Psychology, Criminology and justice studies, California State University, Northridge
STARS
Mentored by Dr. John Wixted

Photo Lineups: Which one is better?

Both in the lab and in the real world, eyewitness memory is often tested using a photo lineup. A photo lineup consists of one suspect (who is either innocent or guilty) and five or more “fillers” (i.e., people who are known to be innocent but who physically resemble the suspect). The witness can identify the suspect, identify a filler (a known error), or reject the lineup. The usefulness of a lineup procedure is assessed by considering two measures: (1) the hit rate (i.e., the proportion of lineups containing a guilty suspect from which the guilty suspect is correctly identified) and (2) the false alarm rate (i.e., the proportion of lineups containing an innocent suspect from which the innocent suspect is incorrectly identified). The lineup photos can be presented simultaneously, or they can be presented sequentially (i.e., one at a time). From 1985 until 2011, many studies concluded that there is a “sequential superiority effect” because the “diagnosticity ratio” (hit rate / false alarm rate) was higher for the sequential procedure. In response, more

than 30% of U.S. police and sheriff departments switched from the simultaneous to the sequential procedure. However, in 2012, researchers realized that the diagnosticity ratio does not identity the superior procedure after all. Instead, the superior procedure can be determined using receiver operating characteristic (ROC) analysis. ROC analyses conducted since that time show conclusively that the simultaneous procedure is diagnostically superior to the sequential procedure (the opposite of what was long thought to be true).

Angel Sarabia

Microbiology, UC San Diego
The Dutton Lab
Mentored by Dr. Rachel Dutton

Unearthing The Molecular Mechanisms Underlying Host-Phage Co-Evolution In Cheese Microbial Communities

Although we can study bacteriophage coevolution in the lab, the literature lacks a detailed study of how bacteria-phage coevolution occurs within a natural community context. These studies have historically been impeded by the lack of a manageable system that is able to model microbial community complexity. Cheese biofilm communities have been established as model systems for investigating community assembly and microbial interactions because they follow reproducible growth patterns, contain few species, and are tractable under laboratory conditions. This system has yet to be exploited to reveal the interactions between the phage and the community. Previous work in the Dutton lab used a model community containing Hafnia strain JB232, Penicillium camemberti and Geotrichum candidum to demonstrate how Hafnia genetic requirements are affected by the fungi (Morin et al. 2018; Pierce et al. 2020). Additional efforts in the lab have established Hafnia strain JB232 and its phages as model virus-host pairs (unpublished data). To approach this question, we grow the model community with the phage over three days, quantify the phage, and sequence its genome each day. Moreover, in this experiment, we used an RB-TnSeq-based high-throughput genetic screening method to identify the genetic basis of phage infection success in the community. The results of this investigation will reveal how the fungi influence the phage growth rate and its evolution, as well as the host factors that enable and hinder phage infection. Understanding this molecular basis of phage-host coevolution within a community is useful in assessing safety risks involved in phage therapy.

Siena Schumaker

General Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Eric Schmelz

Defining complex interactions between maize growth and defense pathways

Phosphate plays a central role in cellular metabolism and is commonly limiting for plant growth. All plant interactions with their surrounding biotic and abiotic environment are mediated in part by small molecule specialized metabolites (SM). Predominant yet poorly understood maize (Zea mays) SM include a biosynthetically interconnected network of sesquiterpenoids and diterpenoids that produce in non-volatile antimicrobial organic acids. My research focuses on understanding root secreted acidic diterpenoids in maize and investigating their relationships with soil pH, phosphate limitation, and markers for phosphate uptake. Alkaline soils dramatically limit available phosphate and diverse root secreted acids have the potential to lower rhizosphere pH enabling improved phosphate uptake. I am examining genetically diverse maize inbreds under soil and hydroponic growth conditions while controlling pH and phosphate levels to consider impacts on root acidic terpenoid production. I hypothesize that specific inbreds have the ability to increase root acidic terpenoid production in response to high pH and low phosphate conditions. I will use gas chromatography (GC) coupled with mass spectroscopy (MS) to quantify root acidic terpenoids in replicated experiments to document plant SM responses to phosphate limiting abiotic conditions. Environmental levels of arsenic (As) will also be quantified in plant tissues of defined SM pathway mutants for use as indirect markers for phosphate acquisition differences. Beyond established antifungal defenses, my research focuses on additional complex roles for acidic maize terpenoids in agriculturally important traits such as soil nutrient acquisition.

Gabrielle Scott

Mechanical Engineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Frank Talke

Analysis of Novel Silicone Composite Vaginal Tissue Analogs Using Digital Image Correlation

Vaginal stenosis (VS) is a common injury caused by cervical cancer radiotherapy. It is characterized by the narrowing or shortening of the vaginal canal, which is often detrimental to patient quality of life. Stenosis can lead to discomfort, painful sexual intercourse and, in severe cases, prevents physicians from examining patients for further tumour growth. Currently, there is no established in vitro model of the vaginal canal in which to simulate vaginal stenosis. This project aims to develop a standard medical baseline for simulating and accurately diagnosing VS severity in patients. This is a

continuation of previous work in the Talke lab analyzing vaginal tissue composites consisting of silicone elastomer matrices and 3D printed flexible scaffoldings. Uniaxial tensile tests will be conducted and the data analyzed using digital image correlation to compare the stress-strain properties of the composites to the established properties of vaginal tissue.

Saya Shahoy

Human Biology, UC San Diego
Owens Lab, Biological Sciences
Mentored by Dr. Melinda T. Owens

Student understanding of COVID-19 vaccines and central dogma

Can students apply their biology knowledge to issues like the mRNA COVID vaccines? Previous research shows many students misunderstand the "central dogma" (DNA codes for RNA, which codes for protein), but this concept is necessary to understand how mRNA COVID vaccines work (Briggs et al, 2016). To see to what extent biology students at different levels are able to apply the central dogma to understanding mRNA COVID vaccines, we first surveyed 214 biology students at a large, public R1 university, "How does a COVID vaccine work?" This was the "uncued" condition. Then, we "cued" them to think about mRNA by asking, "Some of the COVID vaccines have mRNA in them. What is the mRNA's role in how the COVID vaccine works?" To analyze student responses qualitatively, we used thematic analysis. We found that in the cued condition, students at all expertise levels (non-biology, entering, and advanced biology majors) mentioned the central-dogma code "mRNA to protein" equally ($p=0.25$). However, advanced biology majors (ABMs) were more likely to use the more specific codes "mRNA to COVID protein" ($p<0.002$) and to apply knowledge of central dogma in general ($p<0.05$). We are currently analyzing the responses from the uncued condition to see potential effects of "cuing" as well as analyzing influences of demographic factors like political orientation, gender, transfer status, and ethnicity. We hope our results can further illuminate student understanding to help instructors better teach students about these vaccines.

Yutong She

Biochemistry, UC San Diego
MRSEC REU or RIMSE
Mentored by Professor Michale J. Sailor

Loading and Releasing of Lysozyme on Partially and Fully Oxidized Porous Silicon Nanoparticles

Mesoporous silicon nanoparticles have been established as excellent candidates for drug delivery applications owing to their high drug-loading capacity, lower systemic toxicity, and ability to protect bioactivity of a range of therapeutics. However, the dissolution rate

of porous silicon nanoparticles tends to be rapid at higher pH (pH >7) with the formation of orthosilicic acid as a byproduct. Reprecipitation of silicic acid may further result in aggregation of nanoparticles. Porous silicon dioxide (pSiO2), obtained by thermal oxidation of porous Si nanoparticles, has been demonstrated to be more stable at higher pH. This work aims to study loading and releasing of protein payloads from thermally oxidized pSiO2. Lysozyme will be used as the model protein. The approach includes synthesis of mesoporous silicon nanoparticles, followed by partial and complete thermal oxidation. The goal is to load lysozyme into the porous nanoparticles and to study its temporal release in vitro. The nanoparticles will be characterized by Fourier-transform infrared spectroscopy (FTIR) and Dynamic light scattering (DLS). Stability of the nanoparticles will be assessed through changes in size during incubation in PBS buffer at 37℃.

Evinn Shelton

Biology Pre-med, Xavier University of Lousiana
STARS
Mentored by Dr. Alisa Huffaker

What metabolites do maize plants produce to defend itself from microbes

Plants protect themselves by producing antimicrobial metabolites as chemical defenses. I am studying how chemicals made by maize roots affect microbes in their community environment. A previous experiment in my lab showed that maize plants that don't produce the metabolites costol and costic acid have altered levels of Bradyrhizobium species in their root and soil communities. Bradyrhizobium is nitrogen-fixing bacteria that establishes symbiotic nodules in legume plants like soybean, which are commonly cocultivated or rotated with corn. Nitrogen fixation through legume symbiosis is an important sustainable way to increase nitrogen availability as an alternative to application of chemical fertilizers, and so it is important to understand how maize metabolism could affect Bradyrhizobium and potentially legume symbiosis. To better understand how costol/costic acid produced by corn affect Bradyrhizobium, my partner and I will treat Bradyrhizobium with purified special metabolites or root extracts that contain a mixture of special metabolites and use a plate reader to assess bacterial growth rates.

Celina Shen

Molecular and Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Christina Towers

Investigating Mechanisms of Mitochondrial-Derived Vesicle Formation

Autophagy is a metabolic process in which autophagosomes engulf damaged cell parts for degradation by the lysosome, effectively recycling these components. The clinical use

of autophagy inhibitors, such as hydroxychloroquine, has been a novel treatment strategy against many kinds of cancer, particularly those that are resistant to other therapeutic strategies. Experimentally, however, some autophagy-dependent cancer cell lines develop resistance to drug and genetic inhibition of autophagy.

Clinical trials also report both inherent and acquired resistance in tumors. Previously our group found that during autophagy inhibition, breast cancer cells release mitochondrial-derived vesicles (MDVs) at significantly greater levels than baseline. Others have also shown that MDVs are induced after oxidative stress.The functions and mechanisms of MDV formation are still largely unknown. We now find that treating autophagy-dependent lung and pancreatic cancer cells with oxidative stress and autophagy inhibition also increase MDV levels from baseline. I hypothesize that eliminating DRP1, the GTPase important for mitochondrial fission, will reduce MDVs.

To test this, I treat cells with pharmacological agents to induce oxidative stress and generate cancer cell lines that lack DRP1 and/or core autophagy machinery with CRISPR/Cas9 tools. I then image the samples via immunofluorescence and confocal microscopy.

These studies shed light on the functions and mechanisms of MDV formation in lung and pancreatic cancer. The role MDVs have in drug resistance during the treatment of autophagy-dependent cancers will also be better understood. These findings will improve the efficacy of current autophagy inhibition therapies.

Xinran Shi

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Andrew Chisholm

Collagen Localization in the C. elegans Larval Cuticle

The goal of this work is to define the localization of specific cuticle collagens during development. Nematode worm C. elegans is encased by an apical extracellular matrix (aECM), the cuticle. It forms the animal's exoskeleton and mediates many interactions with its environment. The mature adult cuticle consists of a lipid-rich epicuticle, and a collagen-rich cuticle with cortical, medial, and basal sublayers as well as structural compartments (furrows, annuli, struts). C. elegans also generates 4 larval cuticles (L1 to L4) and an alternative L3 stage ('dauer') cuticle. Each cuticle is a complex aECM containing hundreds of collagens, mucins, cuticulins,

and lipids. Mutations in collagens cause cuticle morphology defects e.g., "dumpy",

"roller" etc. The location of collagens within cuticle is not well understood.

We use fluorescent protein (mNeonGreen) tagged knockins to endogenous genes, which allow

localization to be examined at high spatial and temporal resolution. The cuticle

collagens DPY-3, 5, 9, 10 and 13 and the mucin DPY-6 are expressed in all stages based on studies of their transcription. My research focuses on DPY protein knockin localization in the larval cuticles. To study this I synchronized worms based on a standard worm developmental timeline. I examined protein expression in larval cuticle under different stages using a compound microscope and epifluorescence. The expression pattern and expression intensity will be compared across each larval stage. The results will help build up an atlas of how a complex aECM is generated at each stage, which could help understand other complex aECMs.

Aman Shihora

Pharmacological Chemistry, UC San Diego
Genentech Scholars Program
Mentored by Dr. Lalit Deshmukh

Investigation of the Proline Rich Domain of Annexin A11

Amyotrophic Lateral Sclerosis (ALS) is a progressive neurodegenerative disease that leads to the breakdown of spinal cord motor neurons and hippocampal neuronal axons, leading to patients having severe muscle weakness and the eventual loss of skeletal control. With no cure and limited treatments, new avenues must be discovered for tackling this complex neurodegenerative disease. Mutations in a calcium-regulated membrane-binding protein called Annexin A11 are thought to play a vital role in the proliferation of ALS. The Deshmukh Group at UC San Diego has investigated a variety of intrinsically disordered proteins, and the proline-rich domain of Annexin A11 is no exception. Annexin A11 is involved in a plethora of neuronal cellular functions such as apoptosis (cell death), cell signaling and transduction via binding to calcyclin (S100A6), and tethering RNA for transportation along axons. Through working in the Deshmukh Lab, some interesting properties of the beginning segment of this protein (the N-terminus proline-rich domain) have been revealed such as the formation of liquid-liquid droplets, amyloidogenic fibrils, and pathogenic aggregates. The characteristics of Annexin A11 are dramatically altered when sporadic point mutations found in ALS patients are introduced, such as increasing the rate of fibrillization. It is through this project that I hope to illuminate how these ALS mutations affect Annexin A11 binding, stability, and cellular structures via measurements of aggregation kinetics, visualization by microscopy, changes in binding affinity, and other novel methods. In elucidating how these mutations hinder Annexin A11, new therapeutic pathways can be explored in treating ALS.

Gabriel Alfredo Siguenza

Software Engineering, CSU San Marcos
STARS
Mentored by Dr. Graham McVicker

Predicting the effects of genetic variants on allele-specific chromatin accessibility

Non-coding genetic variants are associated with many human traits; however, they are difficult to interpret because we currently do not have detailed knowledge of how they function. One way to interpret non-coding variants is to identify statistical associations between genotypes and molecular traits such as gene expression or chromatin accessibility. The associations between genetic variants and traits are known as quantitative trait loci (QTLs). However, they are not typically able to examine associations with rare genetic variants.

Recently, machine learning methods have proven to be effective for predicting the molecular function of DNA sequences in the human genome. To date, these methods have been trained using only the reference human genome sequence as input and do not consider sequence variation that is present in the human population.

We are currently developing a machine learning neural network to predict the effects of rare genetic variants on open chromatin. We hypothesize that our machine learning model can attain higher performance with these predictions by incorporating genotype and molecular function data from QTL studies.

To obtain measures of allele-specific open chromatin (ASOC), we use a suite of tools called WASP, which was developed for unbiased allele-specific read mapping and QTL molecular discovery. WASP measures chromatin accessibility on each chromosome by counting assay for transposase-accessible chromatin with sequencing reads (ATAC-Seq) that overlap heterozygous sites and identifying the alleles that are present in the reads. These results will be used as a benchmarking method to assess the performance of predictions from the machine learning model.

Aaron Simon

Computer Engineering, University of the Pacific Stockton Campus
UoP CO-OP
Mentored by Philip Myint

Simulation of Multiphase, Multicomponent Mixtures

Lawrence Livermore National Laboratory (LLNL) works extensively with plasma physics, and as such has developed many programs for modeling materials at exceptionally high temperatures and pressures. One such program is the multiphase equation of state (MEOS) code, which provides a general way to generate EOS tables,

with extensive customization options. MEOS has proven to be a versatile platform, and its use has expanded beyond the original intent. However, there are still some applications for which MEOS cannot be used. One such application is the modeling of solutions, a combination of multiple materials in different phases. The multiphase, multicomponent mixture (MM_Mix) code was developed to bridge this gap. The code uses particle swarm optimization to determine the equilibrium state of a mixture. MM_Mix was originally developed in Python, but it was determined that C++ would offer improved speed and ease of parallelization. As such, the current stage of MM_Mix development has centered around translating it from Python to C++, and adding support for parallel runs using the Message Passing Interface (MPI). By enacting these changes, we have generated significant improvements in the speed of MM_Mix, which has in turn increased its ability to generate larger datasets in a reasonable period of time.

Sonata Simonaitis-Boyd

Physics with Specialization in Astrophysics, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr Shelley Wright

"They Grow Up So Fast!": Studying Galaxy Evolution Over Cosmic Timescales

The star formation rate (SFR) of a galaxy is a major indicator of the dynamical state of a galaxy. By compiling a statistical sample of galaxies over long timescales and studying SFR, stellar mass, and element abundance as a function of time, we can learn how galaxies such as our own Milky Way form and evolve. With data from Keck MOSFIRE and archival data from the Hubble Space Telescope, Spitzer Space Telescope, Sloan Digital Sky Survey, and Wide-field Infrared Survey Explorer, we model a spectral energy distribution for galaxies around the quasars 3C9 and 4C0584 in the redshift range $1.24 \lesssim z \lesssim 3.35$ using Python-based stellar population modeling code Code Investigating GALaxy Emission (CIGALE). CIGALE will output desired galaxy properties—such as SFR, stellar mass, dust luminosity, and metallicity—which will be examined as a function of redshift. Through analysis of these results, we hope to gain insight into how galaxies, their compositions, and their star formation histories have evolved over cosmic timescales, helping improve general understanding of galaxy evolution.

Satvik Singh

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Electrical and Computer Engineering SRIP
Mentored by Tse Nga Ng

Developing High Energy Super Capacitor for Wide temperature Range

Open shell conjugated polymers have attracted significant attention in energy storage fields due to their high energy density, high power density, and flexibility. However, the

practical applications of redox polymers are limited by their shorter cycling life than traditional electrode materials (e.g. graphite, activated carbon, etc.), especially at high operating temperature. In this work, a failure mechanism analysis on the open-shell conjugated polymers (PCQTh, PCQMe, etc.) were conducted under 25, 40, and 60 ℃ to clarify the influence of functional groups on electrode stability. The CV and GCD curves analysis at high temperature showed that the two redox peaks of these polymers merged into one after 1000 charging/discharging cycles, revealing the serious side reactions during the cycling process. This mechanism study proves that redox polymers with more stable functional groups are needed to be operated at high operating temperature.

Adriana Siordia

Biochemistry, UC San Diego
McNair Scholars Program
Mentored by Dr. Itay Budin

Dissecting the contribution of sterol structure to GUV phase separation

The Bloch hypothesis states that sterol properties are gradually optimized for function along the biosynthetic pathway. Here, we compare the ability of sterol intermediates in the ergosterol biosynthesis pathway to support phase separation in Giant Unilamellar Vesicles (GUVs). To visualize the GUVs we use NBD-PE to localize the liquid ordered domains and Texas red for liquid disorder. If the Bloch hypothesis holds true, then we expect to observe a trend, where intermediates found in the early stages in the ergosterol biosynthesis pathway exhibit little to no ability to promote phase separation. In contrast, late-stage intermediates should exhibit a moderate ability to promote phase separation compared to ergosterol, the final product.

Isabel Smith

Neurobiology, UC San Diego
Colors of the Brain KIBM
Mentored by Dr. Nicola Allen

Is astrocyte c-fos expression dependent on store-mediated Ca2+ release?

Astrocytes are glial cells involved in synapse regulation. Previous research shows that astrocytes increase intracellular calcium in response to neuronal activity. Unpublished data from the Allen lab found transcription factor X (TFX) mRNA increases with neuronal activity in astrocytes of the mouse visual cortex (VC). The exact mechanisms of astrocyte TFX expression remain unknown. Here we explore whether TFX protein expression in astrocytes is neuronal activity- and calcium-dependent. We hypothesize that light stimulus activates retinal pathways and projects onto the VC, increasing neuronal activity leading to astrocytic calcium elevation which induces astrocytic TFX expression. We will explore astrocyte TFX protein expression with and without light

exposure while abolishing somatic intracellular calcium elevations through an IP3R2 knockout (KO) mouse model. IP3R2 is enriched in astrocytes,leading to intracellular calcium elevation as IP3 binds to IP3R2. We will expose adult IP3R2 KO and wildtype (WT) mice to 1 hour of light or no light after 12-hours of dark housing. To assess TFX protein expression levels in astrocytes, we will perform an immunohistochemistry assay, and analyze co-localization of TFX with astrocyte marker s100b. If TFX expression in astrocytes depends on neuronal activity and intracellular calcium elevations, we predict that the IP3R2 WT mice exposed to 1 hour of light will show significant increase of TFX compared to no light conditions, which will not be observed in the IP3R2 KO. Our results will provide insight on the mechanism of TFX astrocytic expression.

Jim Solomon

Electrical Engineering, UC Los Angeles
STARS
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Autonomous Car Path Tracking with PID Control

Control systems are a relevant part of many real-world projects. They are well utilized in the field of robotics to control motion, force, and many other design specifications. In the field of autonomous vehicles, control systems are essential to accurately track the trajectory provided by the path and motion planning module. The widespread use of controls makes the study of control systems and its applications quite relevant. To that end, we design a PID feedback control system to allow a car to follow an expected path. While we are in the process of attaining results on the efficacy of the feedback control, we expect that the feedback control would allow a car to follow a path consistently.

Sharanya Sriram

Molecular and Cell Biology, UC San Diego
Ahmadian Fellowship
Mentored by Dr. Maike Sander

Characterizing the islet cellular landscape during diet-induced progression towards type 2 diabetes

A notable characteristic of the type 2 diabetes mechanistic pathway is chronic tissue inflammation within the pancreatic Islets of Langerhans, clusters of endocrine cells including the insulin-secreting beta cells which regulate glucose homeostasis. Islet inflammation is characterized by increased production of cytokines and chemokines, as well as immune cell recruitment. It has previously been shown that macrophages, the main immune cells involved in obesity-associated islet inflammation, are a main source of insulin-like growth factor 1 which may induce beta cell proliferation following beta cell death. This project utilizes a Western diet [42% kcal fat, 42.7% kcal carbohydrates] as a model for type 2 diabetes progression, and aims to study its effects on both beta cells

and islet macrophages' gene expression to understand how resident macrophages signal and interact with beta cells. We performed immunohistochemistry (IHC) for EdU (5-ethynyl-2'-deoxyuridine), a thymidine analog which marks in vivo cell proliferation, to measure proliferation across 1-week and 12-week feeding timepoints. To monitor cell death, we utilized TUNEL (terminal transferase-mediated dUTP nick-end labeling), an IHC method which labels DNA strand breaks to identify late-stage apoptosis in tissue after 24 weeks of feeding. Severity of inflammation within islets is currently being characterized via IHC for the leukocyte marker Cd45 across feeding timepoints. Increased knowledge of the role of macrophages in diet-induced islet inflammation may aid in the development of novel therapies to reverse beta cell failure and restore beta cell function in type 2 diabetic patients.

Tessa Sterns

Molecular Biology, San Diego Miramar College
UCSD STEMulate
Mentored by Dr. Yu-Hwa Lo

Cell Protein Analysis Utilizing Capillary Array

Due to proprietary information this abstract has been redacted.

Eleanor Stewart-Jones

Chemistry, Yale University
MRSEC REU or RIMSE
Mentored by Professor Michael Sailor

Fabrication of Deuteride-terminated Porous Silicon

Deuteride-terminated porous silicon (D p-Si) has been reported to resist oxidation better than its hydride-terminated counterpart (H p-Si). The surface passivation gained through deuteration has been employed in the creation of CMOS devices that exhibit a higher resistance to hot carrier degradation. However, there are not many well-defined procedures for making D p-Si. This work will explore and compare two general routes to fabricate D p-Si: in the first, DF will be used rather than HF in standard electrochemical etches, and in the second samples of H p-Si will be oxidized followed by the removal of the oxide layer in a solution containing DF. The preference of Si-D over Si-H sites, and surface passivation will be explored for each method. Additionally, the reactivity of surface deuterides will be examined through reactions with a well-behaved hydride acceptor, crystal violet. These data will allow for the consistent fabrication of D p-Si and for the surface chemistry of surface hydrides to be better understood.

Kaitlyn Strandberg

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McNair Scholars Program
Mentored by Dr. Robert Sah

Dose-Dependence of EdU for Localization and Tracking of Proliferating Chondrocytes

In tissue engineering and regenerative medicine, localizing and tracking proliferating cells are critical to understanding cell fate. One possible approach is to incubate cultures with 5-ethynyl-2′-deoxyuridine (EdU), a thymidine analog, that is incorporated into newly synthesized DNA. The incorporated EdU can then be reacted with azide-modified fluorophores to allow detection. If cells can be labeled with EdU at concentrations sufficiently low to be non-toxic, EdU could also be used as a cell tracer. However, previous studies indicated 5-10μM EdU for >24hrs is cytotoxic.

We hypothesized that incubation of chondrocytes at sufficiently low concentrations of EdU will allow normal growth as well as identification of proliferating cells.

The effect of EdU concentration on cell growth and tracing was assessed by daily phase contrast and endpoint fluorescence microscopy. Bovine calf chondrocytes were seeded at 10,000 cells/cm2, and incubated for 3 days in DMEM+20%FBS, supplemented with 0, 0.002, 0.02, 0.2, or 2μM of EdU (N=4 cultures/group), and analyzed by 2-way ANOVA.

Cell growth was affected by EdU in a dose-dependent manner ($p<0.0001$). At day 3, cultures at low concentrations (0, 0.002, 0.02μM EdU) increased to 23,600-30,500 cells/cm2, whereas those at higher concentrations grew less (15,900 and 9,300 cells/cm2 at 0.2μM and 2μM, respectively, each $p<0.05$).

These results suggest that low doses of EdU might be useful for cell tracing. Ongoing analysis is assessing whether the incorporated EdU is detectable.

Bettina Suarez Davila

Biology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Georgia Sadler

Higher Rates of Prostate Cancer Observed in Latino Men in the United States than Latino Men in Mexico

Latino men born and living in the United States are more likely to develop prostate cancer than Latino men born and living in Mexico. Possible explanations of this difference were explored.

This literature review use PubMed, CINAHL, and Google Scholar and such search words as: Latino men, prostate cancer, Hispanic, acculturation, health care, diet, language

barrier, living/work environments, education, and familial support. Articles published in English or Spanish from 2015 to 2022 were included. Citations from eligible articles were reviewed for additional articles. Only full-text articles were eligible. Internet sites were also searched, such as the American Cancer Society, National Cancer Institute, and Prostate Cancer Foundation.

Differences related to lifestyle, education, lack of health care access, and language barriers to health information have been proposed as correlated with the higher rates of prostate cancer among U.S. Latinos. Studies showed that Latino men born and raised in the United States have different lifestyles from Latino men living in Mexico. Overall, Latino men in the United States are more likely to have lower physical activity levels, lower socioeconomic status, less healthy diets and limited access to education.

Mexican Latinos born and raised in the United States experience a lifestyle that resembles traditional American lifestyles and levels of prostate cancer similar to other American men. More research is needed to define the specific prostate cancer protective factors of Mexican-born Latinos and so they can be promoted for adoption among American-born Latinos.

Kiara Summers

Psychology, University of San Diego
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Mentored by Dr. Clara Azevedo

Spanglish: the creative expression of intercultural Latinx identity

This paper examines how Spanglish allows space for the emergence of a third intercultural identity and how that identity and story is portrayed in Spanglish written poetry. The use of Spanglish amongst the Latinx community is often stigmatized and debated; many perceive the form of communication to be for the poor and uneducated (Chappell & Faltis, 2007) while others see it as a welcoming connection between two cultures that prove competency in two mainstream languages (Ziółek-Sowińska, 2021). Given that the cultural values and language rules of English and Spanish are so different, along with the history of oppression in the U.S. and border disputes with Mexico, it is crucial to explore the impact of Spanglish in the U.S. Language is an expression of identity and in the case of members of the Latinx community, speaking Spanglish as opposed to standard Spanish or English creates a space for a third intercultural identity to appear where values and history of both cultures can coexist (Damak, 2018). As a result, creative writing and poetry using Spanglish allows for a different kind of expression that can fully grasp the writer's passion, meaning, and purpose, allowing them to advocate for themselves. Having been so consistently criticized as something that tarnishes the purity of standard Spanish, it is important to encourage a shift of acceptance toward Spanglish speaking as it becomes more common and a more recognized piece of the Latinx identity and expression.

Keywords: Spanglish, bilingualism, identity, interculturation, poetry

Annika Sy

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Undergraduate Research Scholarships
Mentored by Dr. Joseph Pogliano

The subcellular organization of N4-like virus vB_EamP_Frozen infections

Subcellular organization in bacteria and their viruses has not been as well characterized as that in eukaryotes. Bacteriophages, or viruses that infect bacteria, have only recently been discovered to organize the space inside the cell during infection. Studying different replication mechanisms of phage will give us a better understanding of the variety of ways phage have evolved to kill their bacterial hosts, and provide guidance for selection of phage for phage therapy. This project focuses on Erwinia phage vB_EamP_Frozen (Frozen), an N4-like podovirus that infects the plant pathogen Erwinia amylovora. Frozen was discovered to organize the interior of the cell during infection. Here, we use fluorescence microscopy and cryo-electron tomography to observe the organization of Frozen infections. Based on these data, we propose a new model for the internal organization of phage replication in Frozen. Knowing the organization of these phage infections will allow us to better understand the capabilities of phage to modify the host bacteria for more effective infections and compare the organizations of eukaryotic virus and bacteriophage infections.

Luke Sztajnkrycer

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Mentored by Dr. Marcelo Mattar

Investigating the effect of structured repetition on prediction and recall

Memory is an unequivocally important facet of human life. It grounds us in reality, modulating how we interact with others, perform daily routines, and grow as individuals. A common method of studying human memory is through free recall tasks, in which individuals are shown items (typically words) sequentially and later asked to recall them. The order in which the words are recalled can then inform us about how sequential memories are encoded and processed, including its typical patterns and biases. Thus far, free recall experiments have traditionally relied on unstructured lists, with each word being fully unpredictable and presented a single time. Thus, it remains unclear how predictability and structure affect patterns of recall. In this project, we will modify the traditional free recall paradigm to include predictable and unpredictable word repetitions. After collecting and analyzing data from a set of human participants, we will interpret the observed retrieval patterns in light of two competing computational models of memory. This will allow us to comment on the performance of such models as they are applied to

untested paradigms while tying our work back to the current zeitgeist of memory research. We hope that capturing the impact of repeated stimuli on memory will afford us more insight into how decisions are made using memory on a day-to-day basis, especially those made after weighing many different consequences.

Zoe Tait

Cognitive Behavioral Neuroscience, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Judith Fan

How well do self-beliefs and engagement predict learning outcomes in an introductory statistics course?

In the social sciences, training in quantitative methods sets the foundation for learning in future courses and is critical for answering questions in the social world. It is important to understand what predicts learning in these courses due to their challenging nature and the importance of statistical literacy for making sense of current global challenges. We explored two key factors that could impact learning: (1) what beliefs students bring to the classroom (e.g., growth mindset, math anxiety) and (2) what students do in the classroom (e.g., engagement with course material). Our initial study focuses on a sample of undergraduate students enrolled in PSYC 60, the key quantitative methods course for UC San Diego (UCSD) undergraduate psychology students. We used a pre-course survey to measure prior beliefs alongside a digital textbook embedded in Canvas to collect fine-grained measures of engagement. We fit a series of linear regression models from both survey responses and student engagement to predict average quiz scores. Preliminary results are consistent with the idea that engagement in the course was important for predicting learning outcomes, with initial student beliefs not explaining substantial variance. To understand how these findings generalize, we are currently exploring a larger sample of students from a broader group of high school and college student cohorts learning introductory statistics using a similar curriculum. Findings from such studies may potentially inform how quantitative methods courses are organized in the future to support positive experiences and learning outcomes for the diverse student population they serve.

Qianqian Tao

Marine Biology, UC San Diego
UC Scholars
Mentored by Professor Martin Tresguerres

Manipulating culture conditions to trick free-living algae into a state that mimics the coral-algae symbiosis

The symbiosis between corals and algae is essential for the functioning of coral reefs that provide shelter to a variety of marine creatures. However, this symbiosis is susceptible to

environmental change, and the lack of knowledge about the physiological mechanisms that regulate the symbiosis hampers the design of conservation approaches. Algae can live independently in water or be engulfed by coral upon establishment of symbiosis and housed in the symbiosome, a distinct intracellular compartment that separates the symbiotic algae from the cytosol of the coral host. The symbiosome is very acidic (pH~4) compared with coral cells (pH~7.4), which likely promotes the accumulation of ammonia and dissolved inorganic carbon (DIC). The chemical differences between the water column and the symbiosome can be expected to require the algae to develop specific physiological adjustments. For example, symbiotic algae express mRNA for P-type H+-ATPase (PHA) that might be involved in acidifying the symbiosome while their free-living counterparts do not. This project intends to explore chemical conditions that trigger algae into a symbiotic state indicated by the symbiosis-dependent gene–PHA. Algae will be cultured in various pH, ammonia and DIC conditions. The expression of PHA and other symbiosis-specific proteins will be traced by using RT-PCR. This information can be used for maintaining cultures of free-living algae in a symbiotic state and optimizing the design of bioink for 3D bioprinting corals containing algal cells. The printed corals can then be used for testing conservation approaches that aim to sustain the coral reef ecosystems.

Diane Thai

Human Biology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Sadler

Exploring the Pain Experience of Asian American Cancer Patients

Effective pain management is an important aspect of patient care and quality of life for cancer patients. Equally important, pain management should not be delayed because cancer-related pain can interfere with the adherence to/effectiveness of cancer treatment plans. Perceptions and expressions of pain vary among cultural groups. This narrative review of the scientific literature surveyed the pain experience of Asian American (AA) cancer patients. Articles published in English between 2008 and 2021 were identified using Google Scholar, PubMed, PsychINFO, CINAHL, and dimensions.ai databases. Search terms included: cancer, Asian American*, palliative care, palliative, pain, pain experience, pain management, pain relief, cancer pain, Chinese, Indian, Filipino, Vietnamese, Korean, Japanese, emotional distress, fatigue, nausea, symptom management, and medication*. Research showed that AA cancer patients often receive low quality/inadequate pain management during their cancer care. Four themes emerged. Negative misconceptions about medication usage play a role in opposing certain pain medications. Misunderstandings and different perceptions by healthcare providers about AAs' pain experience can lead to lower dosages of pain medication or even no pain medication. Cultural differences, such as in attitudes regarding cancer and its associated pain, may also play a role. Lower use of palliative care by AA may also contribute to less

effective pain management because the two supportive care interventions are often delivered in tandem. To date, there has been insufficient research on the pain experience of AA cancer patients. Suggestions for improvement in more effective pain management methods will be presented along with suggestions for future research.

Briana Thang

General Linguistics, UC San Diego
McNair Scholars Program
Mentored by Dr. Marc Garellek

Register in Austroasiatic Languages

All spoken languages have different vowels and many languages contrast tone. However, vowels in “register” languages differ by vowel quality (the properties that make one vowel different from another), pitch (tone), and voice quality (whether the vocal folds are more spread). Register is a prevalent feature of the Austroasiatic language family which is primarily spoken in Vietnam and Cambodia as well as other parts of South and Southeast Asia. By reviewing existing literature on each Austroasiatic language branch, data will be collected on the historical origin of register, the existence or absence of relevant sounds as well as the possible combinations or restrictions between sound and register. The objective of this study is to discern any notable patterns emerging from the data collected.

Daniel Tran

Electrical and Computer Engineering: Computer Engineering, University of San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Siavash Mirarab

Sequence Embedding for Phylogenetics

With the advancement in data collection such as sequencing, the scale of sequence data is growing dramatically. This also brings in the challenge of combining information from different data sources (e.g., sequences from different marker genes). While there already exists many methods for specific tasks, such as supertree construction and species tree inference, here we ask a more general question, is it possible to put the sequences from any of the sources to the same space so that any downstream application such as clustering, tree inference, and phylogenetic placement can directly benefit from. More specifically, the distances of the sequences in the space can give information about their corresponding species' evolutionary relationships. In 2021, Jiang et al. developed a machine-learning based method called DEPP that attempts to resolve the discordance between gene trees and species trees on the phylogenetic placement task. It embeds the sequences into Euclidean space and estimates the evolutionary distances of species by the embedding distances. Inspired by DEPP, we propose a method based on sequence embedding for combining sequences data from any source. Given sequences from

different marker genes, we embed them into the Euclidean space with embedding distances corresponding to the species tree distances. Like DEPP, we would use neural networks to build the encoder. Therefore, the model is also capable of handling novel data by applying the model to unseen sequences.

Joshua Tran

Human Biology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Sadler

Exploring the Interface Between Cancer and the Microbiome

The role of microbes in cancer diagnosis, progression, and prognosis is a rapidly expanding new field of research. Advances in next-generation sequencing technology have expanded the awareness and understanding of the human microbiome and afforded the opportunity to make predictions about the role these microbes might play in preventing, causing, and/or influencing cancer survival. Recent studies have drawn preliminary associations related to the presence of bacteria, viruses, and/or fungi found within the body and various cancers. However, despite these findings, the vast number of microbes that have the potential to directly influence carcinogenesis still remains unclear. In this review, the delineation between the concurrence and implications of microbes is discussed to establish what Sepich-Poore et al. define as the "immuno-oncology-microbiome axis." Recent research is beginning to furnish a more robust perspective on the interface connecting cancer and the microbiome. Still, a substantial gap separates clinical observations from the development of potential clinical interventions that might directly engage microbiota as a means for cancer therapeutics. Murine immunotherapy models have provided alluring results in the modulation of gut microbiota, but are just beginning to progress into applications for animal or human therapeutic interventions. This microbiome research will advance more quickly as scientists, clinicians, public health researchers, and epidemiologists make more "microbially-conscious" observations worthy of further analysis and scientific exploration. Educational presentations at conferences and publications for scientific and lay audiences will help to expand the scientists' interest in this field.

Khoa Tran

Biochemistry, UC San Diego
McNair Scholars Program
Mentored by Dr. Colleen McHugh

Identifying binding region(s) of the long non-coding RNA DUBR to NuRD complex proteins and DNMT1

Non-coding RNAs (ncRNAs) differ from mRNA in that they don't code for protein, despite this, non-coding RNAs have diverse functional roles in cells. Non-coding RNAs

greater than 200-nucleotides are termed long non-coding RNAs (lncRNA) and have been shown to contribute to cellular regulation by controlling gene expression pre- and post-transcriptionally. Additionally, mis-regulation of lncRNAs is present in cancer. The lncRNA DUBR (DPPA2 Upstream Binding RNA), which is also known as linc00883, has been identified to be mis-regulated in several types of cancer. However, the functions of DUBR in normal and diseased cells have not been well explored. Kaplan-Meier survival analysis has indicated that high expression of DUBR in human colon cancer is predictive of poor patient outcome. And, previous research in the McHugh Lab has shown that DUBR is required for normal colon cancer cell growth. Furthermore, RNA antisense purification coupled with mass spectrometry (RAP-MS) from the McHugh Lab has shown that DUBR binds to proteins in the nucleosome remodeling and deacetylase (NuRD) complex and DNA methyltransferase DNMT1. To identify the region(s) in which these epigenetic regulators are binding to this lncRNA, I will perform in vitro RNA pulldown with fragments of DUBR. This study of the binding partners of DUBR will expand our understanding of this functional long non-coding RNA DUBR.

Daniella Tu

Molecular and Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Carlisle Bascom Jr.

Determining the role of auxin-activated transcription factors in development and drought response of Physcomitrium patens

The phytohormone auxin regulates plant growth and development by controlling gene transcription via the degradation of transcriptional repressors. Many different families of proteins form this auxin response signaling pathway. One of these protein families is a class of transcription factors called Auxin Response Factors (ARFs). A subclass of ARFs, the activating ARFas, turn on gene expression in response to rising auxin levels. The model bryophyte P. patens has seven ARFas. The relative contribution to gene regulation of any ARFa is understudied. We sought to determine the effect that activating ARFs have on plant growth and response to abiotic stress, such as drought. To test for a role for ARFas, we generated higher-order arfa mutants in Physcomitrium patens. To assess ARFa contribution to plant development, we challenged double, triple, and quintuple arfa mutants to exogenous auxin. In doing so, we observed several developmental phenotypes when compared to wild-type. Interestingly, both developmental and auxin resistance phenotypes scale with the number of ARFas deleted, suggesting a high degree of genetic redundancy. To assay the role ARFas play in abiotic stress resistance, arfa mutants were challenged with media with varying salt concentrations to determine drought tolerance, as well as elevated temperatures. The results indicate that ARFas do not play a role in the drought response. However, preliminary data suggests that arfa quintuple mutants are more heat tolerant that wild-type. Taken together, ARFas play a key role in development as well as the ability to withstand heat, but not elevated salt levels.

Vincent Tu

Computer Science, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Talmo Pereira

Contrastive Self-Supervised Re-Identification in Tracking

Multi-instance pose tracking, the task of recovering a set of landmarks for each subject in an image, requires solving the sub-tasks of landmark localization, part grouping and subject (re-)identification, or re-ID. This is made particularly challenging due to the laborious nature of annotating subject identities, in addition to pose, across frames of a video – a requirement for combined detection and tracking models. An emerging class of approaches termed self-supervised learning may provide a solution to addressing this issue by leveraging contrastive structure in the data itself without requiring human annotations. In this project, we will explore how contrastive methods for self-supervised image feature representation learning could be employed to facilitate appearance-based re-ID. We will evaluate this framework against fully supervised approaches, both using contrastive and direct classification methods, as well as benchmark its performance across diverse data domains such as humans and animals.

Logan Tucker

Chemistry & Biology, University of San Diego
USD Summer Undergraduate Research Experience (SURE)
Mentored by Dr. Joan Schellinger

Microwave-Assisted Reversible Addition-Fragmentation Chain Transfer Polymerization of Cationic Monomers for the Development of Antimicrobial Polymers

Antibiotic-resistant microorganisms are one of the world's most urgent public health crises as it has been estimated, by WHO, to be the cause of approximately 10 million deaths, each year, by 2050. Synthetic antimicrobial polymers are an attractive alternative to antibiotics for their enhanced efficacy, reduced toxicity, minimized environmental problems, and low likelihood for resistance. This report is focused on investigating the use of microwave heating in the reversible addition-fragmentation chain transfer polymerization of functional monomers utilized as antimicrobial agents. Initially, N-(3-aminopropyl) methacrylamide hydrochloride (APMA) and N-[3-(dimethylamino)propyl] methacrylamide (DMAPMA) were used to optimize the microwave-mediated polymerization conditions. Under comparable polymerization conditions, the microwave-assisted reaction achieves increased rate enhancement over the conventional oil-bath mediated reaction. Linear relationship observed between number average molecular weight and monomer conversion for different target degrees of polymerization to give low- to high-molecular weight cationic polymers. Conclusion: methodology developed

will be used to efficiently polymerize different monomers to allow for systematic structure-activity relationship studies of antimicrobial polymers.

Imanol Ulloa

Aquatic Biology, UC Santa Barbara
UC LEADS
Mentored by Dr. Jeff S. Bowman

Impacts of pH on Alkaline Phosphatase Activity in the coastal waters of Southern California

Carbon enrichment in the surface ocean affects the function and distribution of many marine organisms. The current pH of the Pacific Ocean is at an average of 8.06 ± 0.03 (Jiang et al., 2019) with a reduction in pH units (0.2-0.3) expected to occur this century (Haugan et al., 1996). In the Southern California Bight, modeling studies suggest long term reductions in pH in the upcoming decades, (Hauri et al., 2013) -which directly impact microbial communities and nutrient cycling in the euphotic zone. The onset of acidification can have critical impacts on the enzyme activity of Alkaline Phosphatase (APase), which has known differences in pH optimums for different marine microbes, (Sharifian et al., 2018). To further understand the effects of pH on APase activity, seawater incubations will be performed with varying pH conditions (8.24, 7.99, 7.81) with samples collected from the Scripps Pier. In situ pH measurements from the Southern California Coastal Ocean Observing System (SCOOS) observed pH ranges from 7.94 to 8.21. It is hypothesized that with decreasing pH values, APase activity (nM/min) will decrease linearly. Impacts of decreasing pH on APase activity will be quantified with an enzymatic assay using 4-methylumbelliferyl phosphate (MUF-P) fluorometry. DOP (dissolved organic phosphorus) and SRP (soluble reactive phosphorus) concentrations will be measured alongside flow cytometry for microbial abundance. By looking at (APase) activity in response to pH stressors, we can further understand phosphorus cycling under changing environmental conditions in the surface waters of Southern California.

Matthew Uzelac

Neurobiology (B.S.) & Biochemistry (B.S.), UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Weg M. Ongkeko

Archaea Microbial Landscape as an Indicator of Lung Adenocarcinoma and Squamous Cell Carcinoma

Due to proprietary information this abstract has been redacted.

Marysol Valdez

Ethnic Studies and Public Policy, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Luis Alvarez

Decolonizing San Diego: How Colonialism and Tourism Impact America's "Finest City"

This project focuses on the history and storytelling of San Diego's "Old Town," known as "the location of the first European settlement in California". The purpose of this research is to critically analyze the colonial and patriotic narratives embedded in Old Town and how it is presented to the public. I have analyzed various plaques, statues, video films, and buildings to show how these narratives obscure, limit, and otherwise silence diverse perspectives and experiences. The patriotic and colonial narratives presented at the Old Town historical site are interconnected with contemporary issues related to racism, border detention, gentrification, and racial wealth gaps present in San Diego. The methodologies used in this research are based on qualitative methods, including content analysis, archival research, and interviews. I also use the theoretical frameworks of decolonial praxis to reveal the effect of Old Town's racial and stereotypical implications towards communities of color. In addition, I investigate how the lack of diverse perspectives in the Old Town site further promotes white supremacy and ethnic & indigenous erasure. This research can be used for historical and classroom teachings for all levels of learning as it exposes individuals to learn about the diversity of historical experiences and the systematic inequality in America's "Finest City".

Leslie Vallejo-Avila

Political Science: International Relations, UC San Diego
Undergraduate Research Scholarships
Mentored by Gerardo Arellano

Analyzing gentrification: its impact on the Latinx experience in San Francisco's Mission district

Gentrification is the cultural, economic, and social transformation of a neighborhood that derives from the wealth disparities between long-term working-class residents and new wealthier residents. The 1997 dot-com boom created a profitable industry for technology that led to an influx of tech-workers. These incoming tech-working residents migrated around the Bay Area from Silicon Valley and eventually made their way to San Francisco. The growing population of San Francisco's wealthier residents have led to dramatic increases in rent prices and evictions, significant socioeconomic and ethnic demographic changes, and a growing tension between the gentrifiers and the gentrified. The Mission district is San Francisco's oldest neighborhood and home to the city's largest Latinx population. Gentrification has contributed to the ongoing decline in the presence of Latinx within the Mission district, exemplifying how socioeconomic statuses

have made the difference between who is displaced and placed in today's Mission district. The Mission is home to multi-generational, undocumented, immigrants, and residents of differing educational and socioeconomic backgrounds. Using pláticas as my research method, this study will analyze my conversations with current Mission district residents who self-identify as Latinx. Using this collection of oral histories will contribute to exemplifying how gentrification has diversely impacted the Latinx population within San Francisco's Mission district.

Marie Vaughan

Global Health, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Research Associate & Instructor Juli Beth Hinds

Relationships between Food Swamps and Adolescent Obesity Rates In San Diego County

National Centers for Disease Control (CDC) data indicate 16.7% of the calories a typical adolescent aged 12-19 consumes on a given day are from fast food. In California, 15.2% of those aged 10-17 are obese, according to the CDC's 2019 Youth Risk Behavior Surveillance System. This study investigates the association between geographic "food swamps" with high densities of fast-food sources, with adolescent obesity rates in areas across San Diego County. Geospatial analysis was used to examine the distribution of fast food establishment densities and their proximity to public, private, and charter high schools to assess the association of calorie-rich food environments with adolescent obesity rates across communities of varying socioeconomic status in San Diego County.

Kameswari Vedula

Microbiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Weg Ongkeko

Analyzing clinical and genomic data from smoking-related HNSCC patients to examine smoking-influenced changes in tRNA expression

Transfer RNAs, or tRNAs, are part of the process of protein synthesis: they serve as a molecular link between mRNA and the amino acid it codes for. The activation of carcinogens can lead to the development of DNA adducts in the human body, causing DNA to miscode during replication. Such genomic mutations can result in abnormal cellular growth, and eventually carcinogenesis. Smoking-induced carcinogenesis has been researched thoroughly and found to be a cause of many genomic alterations that eventually lead to the progression of head and neck squamous cell carcinoma (HNSCC). The goal of this project is to analyze tRFs, a type of enzymatically cleaved ncRNA produced from tRNA when subjected to stress. Raw RNA-seq data was extracted from TCGA and aligned with Slidebase's tRF reference file. In this study, 4 patient cohorts were compared: HNSCC HPV(-) smokers vs HNSCC HPV(-) nonsmokers, HNSCC

HPV(-) smokers vs solid tissue normals, and HNSCC HPV(+) smokers vs HNSCC HPV(-) smokers, and significantly dysregulated tRFs between the cohort's two groups were determined using a differential expression analysis pipeline. These tRF dysregulations were then correlated to clinical variables such as patient survival and cancer stage, using a Kruskal-Wallis test to determine the tRF dysregulation's clinical relevance.

Yalila Vega

Masters in Science, Biology w/ Specialization in Biology Education, UC San Diego
STARS
Mentored by Dr. Claire Meaders

Have you heard about this? An exploration of faculty communication about campus resources to students in biology courses

Campus resources that are designed to offer academic, community, wellness, and career support may have positive impacts for all students, in particular for underserved students. However, little is known about how these campus resources are communicated in STEM courses by faculty members and how this communication relates to student sense of belonging, resource use motivation, and course performance. In this study, we set out to explore the following research questions: (1) To what extent do biology faculty communicate about various campus resources with students?; (2) Are there common ways biology faculty communicate about campus resources with students?; (3) To what extent does faculty communication about campus resources relate to student sense of belonging, resource use motivation, and course performance? To address these questions, we collected student responses to closed ended survey questions. Our data set includes over 3000 student responses from 23 course sections during the 2021-2022 academic year at a large research intensive university. Our quantitative analysis suggests that when faculty communicate about various on-campus resources in their course sections, this is associated with increased student sense of belonging. The study findings may provide guidance for biology faculty seeking to support students in the classroom and on campus.

Yuliza Venegas

Biology/medicine, San Diego City College
MRSEC REU or RIMSE
Mentored by Oscar Vasquez

Quantum Dots as light sensitizers for Graphene

Graphene is the thinnest material and the fastest electrical conductor material, making it a promising material for compact electronic devices. However, its one-atom thick nature makes it practically transparent, limiting its applications for sunlight energy harvesting and light detecting applications. In this project, we use quantum dots to enhance the light response of graphene. Quantum Dots are 5 nm diameter semiconducting nanoparticles

with strong and tunable light absorption. In this project we add quantum dots to graphene, and show that the electrical response to light is significantly enhanced for graphene devices with quantum dots than with bare graphene devices. This is a clear example of synergistic nanoengineering, in which combinng two nanomaterials provide a performance boost well beyond their individual capabilities.

Christina Vialva

Chemistry, San Diego State University
Undergraduate Research Scholarships
Mentored by Dr. Maurice Retout/Dr. Jesse Jokerst

SARS-CoV-2 enzyme detection with a matrix insensitive nanoplasmonic platform

Due to proprietary information this abstract has been redacted.

Julissa Villalobos Valencia

Aerospace Engineering, UC San Diego
STARS
Mentored by Dr. Adam J. Burgasser

Using Infrared Spectral Analysis Tools to Study an Ultra-cool Dwarf Benchmark Companion

A brown dwarf is an object that has characteristics intermediate between a star and a giant planet. They differ from stars by their lack of hydrogen fusion, causing them to cool to low temperatures, requiring infrared detectors on telescopes to find and characterize them. In my project, I analyzed archival near-infrared spectra from the SpeX spectrograph using software tools contained in the SpeX Prism Library Analysis Toolkit (SPLAT). In particular, I report the classification and spectral characterization of an ultracool dwarf companion to the bright star Mu Virginis, including characterization of temperature, surface gravity, metallicity, and magnetic activity. This source serves as a new benchmark source in the study of ultracool dwarfs throughout the Milky Way.

Laurel Wagner

Chemical Engineering, University of Nebraska - Lincoln
MRSEC REU or RIMSE
Mentored by Dr. Stephen Mayfield

Purifying and Testing Potential Polyurethanases

Over seven billion tons of plastic waste pollute the Earth worldwide, posing a threat to humans and wildlife. Unfortunately, only 10% of plastics are actually recycled. Polyester polyurethanes (PUs) are plastics composed of ester and urethane bonds. Identifying enzymes capable of cleaving these bonds could propose a new means to degrade

polyester PU waste. Previous research has identified bacteria that survived in minimal media enriched with PU as a sole carbon source. Bacteria secrete enzymes that break down materials into their basic components, consuming the nutrients they need to survive. The enzymes secreted by the bacteria in the media are believed to be responsible for the breakdown of the PU foam. In this study, we hypothesize that these proteins will have enzymatic activity. In order to test this, each protein will be purified with IMAC chromatography using a gravity column. First, E. coli will be transformed with a plasmid (circular DNA) encoding our Histidine-tagged protein of interest. The cells will be chemically lysed and pelleted by centrifugation to separate soluble from insoluble bacterial components. Using nickel chromatography, the over-expressed proteins bind to Ni-NTA Agarose resin lining a gravity column, isolating them from the total soluble protein. The proteins of interest are expected to elute from the column into one of six fractions, as varying concentrations of Imidazole out-compete the Histidine tags' affinity for nickel. SDS-PAGE gels will provide a method to visualize our protein and deduce its solubility, as well as where it elutes amongst the purification steps.

Zhangwen Wan

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Sujit Dey

Virtual Physical Therapy

Physical therapy is a medical treatment used to restore functional movements for patients. However, many patients do not fully complete the training due to low efficacy or motivation. In order to address these issues, this project is focused on building a virtual physical therapy system in a form of a mobile application that is able to track, evaluate, and provide feedback to patients performing their prescribed PT exercises. This allows patients to perform exercises without an actual physical therapist around. The system uses machine learning algorithms to skeletonize and analyze patients' motions. The results and feedback of each exercise repetition would be stored in an online database so that the physical therapist is able to see the scores and progress of the patients and can use this data to update the exercises as needed.

Anqi Wang

Neurobiology / Data Science, UC San Diego
UC Scholars
Mentored by DR. Stacey Glasgow

Effect of NUAK2 Kinase-dead Mutation on Glioma Tumorigenesis

Glioma is the most common and deadliest type of primary malignant brain tumor. Despite the severity of the disease and decades of research on glioma, very few effective treatments have been developed. Thus, it is crucial to unravel the key players in glioma

tumorigenesis that can potentially affect disease progression. From a screen to identify novel regulators of gliomagenesis we identified a putative candidate gene NUAK2. Additionally, NUAK2 plays an important role in the Hippo-YAP signaling pathway that is related to tumorigenesis in liver cancer. Specifically, overexpression of NUAK2 promotes tumor generation in liver cancer while the knock-out model of NUAK2 has the opposite effect, reducing tumor growth. We aim to determine if NUAK2 has a similar role in glioma cells. To address this we will generate NUAK2-knockout glioma cell lines using CRISPR-CAS9 technology. To establish these cell lines we generated guide RNAs to NUAK2 and expressed them in the glioma cell line U87. We validated knockdown using Western Blot to confirm that endogenous NUAK2 protein is downregulated or depleted in U87 cells. In addition, to confirm the importance of the kinase activity of NUAK2 in glioma tumorigenesis site-directed mutagenesis was conducted to produce two different point mutations of NUAK2 that should lead to kinase-dead versions of NUAK2 protein, thereby affecting the downstream proteins and the Hippo-YAP signaling pathway. The plasmids with mutated NUAK2 were transfected into glioblastoma cell lines. Then, Western Blot was used to confirm that the new NUAK2 proteins were indeed kinase-dead.

Xuan Wang

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Yatish Turakhia

Tiling Technique for large Dynamic Programming (DP) Matrices

Due to proprietary information this abstract has been redacted.

Yuqi Wang

bioinformatics, UC San Diego
Ahmadian Fellowship
Mentored by Amit Majithia

Identifying NAFLD associated genes by genomic characterization through hepatic steatosis simulation

Non-Alcoholic Fatty Acid Disease (NAFLD) is a multi-stage disease ranging from simple steatosis (NAFL) to nonalcoholic steatohepatitis (NASH), which is characterized by fat accumulation and inflammation. It is one of the most pervasive liver diseases, affecting more than 25% of the adult populations. Despite its prevalence, there exists no FDA approved drugs, thus it is imperative to identify genes and cellular pathologies associated with hepatic fibrosis with the goal to identify therapeutic targets. The Majithia lab created a cellular model of hepatic steatosis by treating human hepatocyte cells (HUH7s) with different concentrations of oleate (0-1200 uM). RNA was collected and sequenced at each concentration, with five replicates per dose. I hypothesize that there

will be different patterns of gene expression in response to fatty acid stimulation, and the categorization of such trends can enable us to identify genes and the underlying pathways driving hepatic fibrosis. Therefore, I will perform differential analysis using edgeR and limma-voom and employ linear and spline models to capture genes with both linear and nonlinear responses to oleate stimulation. Using a linear model, 8240 out of 20500 genes were significantly differentially expressed, but this model missed many genes that have a nonlinear expression in oleate simulation. Thus, a natural cubic spline model was employed in which 8264 out of 20500 genes were significantly differentially expressed. Further clustering still needs to be performed on those 8264 genes to identify genes that have similar responses under fatty acid treatment and denote them as either enhancer, suppressor, or regulator of hepatic fibrosis.

Kevin Wei

Biology w/ Specialization in Bioinformatics, UC San Diego
Genentech Scholars Program
Mentored by Arianna Brevi

Dissecting the role of bacterial bile acid metabolism in colorectal cancer

BACKGROUND

Correlational studies have linked the microbiome and diets rich with red meat and saturated fatty acids (e.g. western diet, WD) to colorectal cancer (CRC). These diets have elevated levels of fecal secondary bile acids (BAs). However, whether certain bacterial species in the gut microbiome, or specific bacterial functions, promote or prevent tumorigenesis is still unknown.

HYPOTHESIS

We hypothesize that biotransformation of bile acids (BA) by gut microbiota can prevent and treat CRC.

AIM

Our aim is to determine whether Escherichia coli engineered to express BSH colonizes and reduces tumor number and size in colitis-induced CRC mouse model.

EXPERIMENTAL DESIGN

The azoxymethane (AOM)/dextran sodium sulfate (DSS) model of CRC will be used to test the activity of BSH and BA deconjugation in CRC. Briefly, one week after bacteria gavage, 8 weeks old C57BL/6 mice will receive a single injection of AOM followed by three cycles of DSS in drinking water. Mice health and weight will be recorded daily. We will euthanize the mice one week after the last DSS cycle to assess the tumor load and the colitis score.

EXPECTED RESULTS

We anticipate our engineered native bacteria can perpetually colonize the intestine of our mice. Mice that are colonized with BSH expressing bacteria are expected to show significantly fewer tumors and/or smaller tumor sizes than those who are not.

Claire Wellenkamp

Marine Biology, UC San Diego
STARS
Mentored by Carolyn Kurle

Counting Calories: California Current Ecosystem Prey Fish Quality through the Marine Heat Wave

The 2014-2016 Pacific marine heat wave, dubbed “The Blob," was a period of anomalously warm ocean conditions that developed in Alaska and spread down the West Coast of North America. This event disrupted marine food webs, causing starvation and reproductive failure of many marine species. According to the junk food hypothesis, a shift from high to low quality prey (i.e. caloric content) can impact predator population parameters. Previous studies conducted in Alaska determined that prey species did decrease in caloric value during these warm years. The junk food hypothesis has not been tested for species affected by “The Blob” within the California Current Ecosystem (CCE). This study aims to determine the caloric density of prey species that serve as food for large predators in the CCE, and whether these values declined during the warm years of the marine heat wave. Prey species were collected from fisheries surveys and port landings during 2014-2019. Freeze dried and homogenized samples of were combusted in a Parr Bomb Calorimeter to determine the amount of calories in a sample. Preliminary data show lower caloric densities during the Marine Heat Wave, indicating that prey quality declined and could have been a contributing factor to the malnutrition of marine predators during this period. These findings demonstrate that marine heatwaves, which are expected to increase with climate change, could disrupt trophic interactions and lead to declines in the reproductive success of marine predators.

Angelica Whisnant

Physics, California State Polytechnic University, Pomona
STARS
Mentored by Dr. Adam Burgasser

Atmosphere and Evolutionary Models for Stellar Populations in 47 Tuc

Brown dwarfs are stellar objects that are too light to fuse hydrogen in their cores and are difficult to observe due to their intrinsically cool temperatures. Despite this, brown dwarfs remain important to understanding the features of our galaxy; in particular, observing brown dwarfs in globular clusters will allow us to better constrain the chemical composition and age of the cluster, which are key metrics in galactic archaeology. The James Webb Space Telescope (JWST) will be the first telescope to observe brown dwarfs

in globular clusters due to its increased sensitivity to infrared light. We aim to generate a set of atmosphere and evolutionary models for stellar populations in 47 Tuc using ATLAS (for stars where Teff > 4000 K), PHOENIX (for stars where Teff < 4000 K), and MESA code, in preparation for observations to be made by JWST. The abundance of metals in 47 Tuc will be obtained from previous literature, which used spectroscopic analysis to determine the abundances of giant stars in the globular cluster (Cordero et al., 2014; Thygesen et al., 2014; Marino et al., 2016; Rennó et al., 2020). The spectra obtained from the models will be converted to colors and magnitudes to be compared with JWST data.

Tiffany Widjaja

Clinical Psychology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Emma Geller

Effects of Combining Refutation and Self-Explanation on Belief Revision in Emotionally Charged Misconceptions

A large literature suggests that refutational text leads to conceptual change in science learning (Tippett, 2010) and that this effect is enhanced when students are prompted to self-explain while reading refutational texts (Allen et al., 2015). However, most recent studies of refutation and self-explanation have focused on science concepts that have little emotional weight (eg., objects in freefall, or the cause of the seasons). Other misconceptions are more emotionally charged and may be harder to change using these instructional techniques. For example, the idea of "learning styles" continues to be a widely-held misconception despite considerable empirical evidence that contradicts this popular belief. Our experiment explores whether refutation and self-explanation can effectively address learning styles misconceptions among college students. Participants will be randomly assigned to read an expository or refutation paragraph about personal learning styles and then be asked to self-explain, think aloud, or re-read the instructional material. We hypothesize that (1) the refutation text will lead to more belief revision than the expository text, (2) individuals prompted to self-explain will revise their beliefs more than those prompted to think aloud or reread the text, and (3) individuals prompted to self-explain the refutation text will show a greater change in belief than those prompted to self-explain the expository text. This study will help us understand whether effective instructional techniques from the classroom can be used to change real-world beliefs that are more strongly and personally held than typical classroom misconceptions.

Alejandra Williams

Neurobiology, UC San Diego
Summer CAMP
Mentored by Professor Chih-Ying Su

Neuromodulatory impact of protein-rich diet on the behaviors of female Drosophila

This project will address the neuromodulatory mechanism of how high-protein diets can facilitate receptivity recovery. Specifically, I aim to determine if the sensitization of Or67d olfactory receptor neurons (ORNs) in mated female Drosophila is required for the receptivity recovery assisted by protein-rich diets.

The receptivity in mated female fruit flies decreases immediately after mating; although it recovers gradually in a few days, high-protein diets are known to facilitate the recovery. The facilitation is mediated by a peptide hormone, termed MIP (myoinhibitory peptide), released from gut enteroendocrine (EE) cells in response to ingested amino acids. When mated females are fed with a high-protein diet, the amount of ingested amino acid increases which leads to an increased release of MIP, thereby resulting in a faster receptivity recovery. Female receptivity is regulated by pheromone cues, notably the male-released aphrodisiac pheromone cVA, which is detected by Or67d ORNs. Interestingly, Or67d ORNs' sensitivity to cVA increases in mated females on high-protein diet, and when the MIP receptor SPR is downregulated in Or67d ORNs, the neurons no longer show sensitization induced by protein-rich diets. These observations lead to the hypothesis that Or67d ORN sensitization is required for high protein-assisted receptivity recovery. To test this hypothesis, I will conduct behavioral assays to determine whether knocking down SPR in Or67d ORNs prevents protein-assisted receptivity recovery in mated females. Specifically, I will compare the remating rates of SPR knockdown females to the parental control groups fed with either a high or low-protein postmating diet.

Ashai Williams

Neuroscience, Xavier University of Lousina
STARS
Mentored by Alon Goren

Mitotic H3K9ac is controlled by phase-specific activity of HDAC2, HDAC3 and SIRT1

In eukaryotes, mitosis requires precise control of gene expression in order to maintain cellular identity. During mitosis, there is a decrease in histone acetylation, which regulates epigenetic memory. We aim to determine the role of specific histone deacetylases (HDACs) in the modulation of acetylation. To assess the modulation of chromatin associated histone H3K9 acetylation (H3K9ac) in HeLa-S3 cells, synchronized cells were exposed to various HDAC inhibitors (TSA,NAM, RGFP966, and EX-52). Changes in acetylation were observed using immunofluorescence, immunoblot (Western

blot), and ChIP sequencing. Each HDAC inhibitor is selective for certain deacetylases, and were used to determine which deacetylases are most active during mitosis. Immunoblotting allows us to visualize the changes in acetylation by separating proteins based on relative size then visualizing with antibodies targeting the protein of interest. In this study, the immunoblot was helpful in indicating which inhibitor contributed the most to the increase in acetylation as compared to non-treated cells. A key limitation of immunoblotting however, is that it is only semi-quantitative and does not yield precise data about the amount of antigen presented. Cells treated with TSA generated a greater signal on the immunoblot, indicating that TSA was the most successful in increasing H3K9ac. This finding in combination with the results of immunofluorescence and ChIP-seq., indicated that HDAC2, HDAC3, and SIRT1 play key roles in deacetylation during mitosis. These results will help us to better understand the role of histone modifications in the development of congenital disorders and diseases.

Oshin Wilson

Biomedical Engineering, University of the District of Columbia
STARS
Mentored by Dr. Hyoduk Shin

Standard for Sustainability Disclosure

Sustainability reports can be characterized as voluntary disclosures made by many corporations to inform important stakeholders of their sustainability strategy and objectives. Recently, an increasing number of businesses have made an attempt to include sustainability-related reports in their annual reports. Companies can better manage risk and prepare for shifting market demands for Environmental, Social and Governance (ESG) transparency by implementing a structured and reliable sustainability reporting and disclosure program using a recognized framework. The purpose of this study is to compare voluntary sustainability disclosures made by three major companies—Gilead Sciences, Bristol-Myers Squibb, and Regeneron Pharmaceutical—all of which operate in the biopharmaceutical industry. Some of the details we anticipate seeing include how these businesses have been advancing sustainability. For example, information on the methods the firm uses to lessen the amount of waste it produces for the environment, whether diversity and inclusion are practiced at work, the laws in place that support sustainability inside the organization, and other aspects. To get the information required to correctly examine each company's report and progress toward the sustainability goal, literature research will be conducted utilizing various web sources. This information will be beneficial for stakeholders as well as investors. We intend to carry out more research on these businesses to learn more about what they are disclosing in their reports and to work toward the potential creation of a standard for sustainability reports. This will help to benefit our society because sustainability contributes to building a better and safer future.

Jayden Wood

Mechanical Engineering, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Michael Tolley

Soft nozzle for steering for a cephalopod-inspired swimming robot

Rigid underwater robots have shown a limited capacity to adapt to their environment (e.g., by deforming and performing complex motions). Previous work from the Tolley lab has developed a swimming robot inspired by the cephalopod's ability to create high accelerations for agile maneuvers using jet propulsion. In this work, we studied how to control the mobility of the cephalopod-inspired robot by designing and testing a steering system to allow the robot to track a given trajectory. We actuated a flexible, cylindrical nozzle with four tendons (thin strings) that ran along the length of the nozzle. We caused the nozzle to bend by pulling on the tendons with motors encased in a waterproof enclosure. To verify that the nozzle could bend to a previously calculated maximum bending angle of 34 degrees, we experimentally determined the force required to bend to the maximum angle. To test the stiffness of the chosen nozzle design, we fixed the soft nozzle in a tank of water and measured the deflection as water was pumped through it at various bend angles. Finally, we tested the tendon-actuated steering design attached to the robot to demonstrate the robot's capability of tracking a given reference trajectory. With the new nozzle design, the robot's complex maneuvering could potentially be used to monitor and collect data in delicate environments such as coral reef ecosystems as well as endangered marine ecosystems.

Adrian Woodley

Physics & Mechanical Engineering double major, University of San Diego
McNair Scholars Program
Mentored by Dr. Greg Severn

Does sheath expansion around Langmuir probes used near material boundaries depend only on the presheath ion flow affect electron density measurements for Langmuir probes near boundaries??

Langmuir probes (LPs) measure an unphysically positively plasma potential in the presheath of low temperature plasma, near conducting boundaries at which ion rich sheaths form. The difference between potential profiles measured by LPs and emissive probes (EPs), in the presheath, is consistent with the effects of ion flow, as the signature of that flow appears in the electron branch of the current-voltage characteristic.

Junyi Xu

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Jianrong Chen

Driver's State of Mind and Intent Detection using Multiple Sensors and Machine Learning

Facial expression recognition (FER) models are widely used in advanced driver assistant systems (ADAS) for the evaluation of driver's state of mind (DSoM), which incorporates emotions and indications of distraction and fatigue. Previous studies have proposed deep neural networks (DNNs)-based FER models that significantly improve the performance compared to conventional feature extraction-based models. However, most DNNs-based FER models rely on complex classifiers constructed directly from facial images, which can be challenging because of ambiguities between several expressions and are highly subjective. To create a more concise and objective FER model, visually discernible facial movements termed action units (AUs) are used as the basis for training deep neural networks. In this study, we first prepare the training data by (1) labeling AUs for images collected from in-vehicle setup under real driving circumstances and (2) converting 3D models in a public dataset into 2D images from various points of view. We further research and optimize our processing algorithm for the public dataset, including faster conversion between 3D models and 2D images, adding simulated real-world lighting conditions to 2D images, and matching existing AU labels to emotions. The desired accuracy of the model trained using the public dataset is approximately 80%. The process on the public dataset will help further analysis of performance comparison between models trained on the self-collected dataset and the public dataset. The trained AU detection model can provide a more unbiased judgment of DSoM in ADAS and further enhance traffic safety.

Sophia Xu

Gen Bio, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Scott Rifkin

Developing an in vivo System to Decipher Effects of Mutations in Transcription Regulation

Transcription regulation is integral to the proper development and functioning of all organisms, yet there are not many studies on how mutations affect the strength of interaction between transcription factors and DNA outside of in vitro studies that are limited in biological realism, protein throughput, and accessibility. Using an in vivo reporter system engineered in S. cerevisiae, I am investigating how mutations affect interactions between transcription factors and their binding sites. The system consists of 3

parts: an inducible chimeric transcription factor that drives the expression of the TF of interest, the transcription factor and its binding site, and a neon green reporter gene whose expression is under the control of the binding site, which is used as an indicator of the strength of interaction between TF and its binding site. This summer I tested whether the inducible chimeric protein and the minimal promoter used to drive the expression of the reporter gene—the designs of which are both adapted from previous publications—function properly in the yeast strain BY4741. Ultimately, after making sure both components can function properly in yeast, I will check the feasibility of using our in vivo system to study the binding affinity between TF and DNA by quantifying the strength of interaction between HOXD13 and its in vivo binding site through the use of flow cytometry.

Alexander Yang Yang

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Prabhakar Bandaru

Measurement of Thermal Conductivity of Films and Novel Materials through the Three-Omega Method

The three-omega (3w) method is a well-established technique that uses resistive heating to measure the thermal conductivity of a material. Photolithography is used to deposit a line heater and pads onto thin films, which are placed on a silicon substrate. An alternating (AC) current of frequency omega (w) is passed through the line, which heats up the substrate and creates temperature fluctuations at a frequency of two-omega (2w). The voltage output is measured once the material has reached thermal equilibrium, which will be at the frequency three-omega (3w). By isolating and analyzing the three-omega (3w) waveform, it is possible to obtain the thermal properties of the material.

To obtain the three-omega waveform (3w), multiple setups consisting of a AC voltage/current source, a custom-built wheatstone bridge analog circuit, a lock-in amplifier, a waveform generator, and a digital multimeter were designed. The sample material is connected to these setups by the use of a probe station. MATLAB and LabVIEW programs were created to control the instruments and for autonomous data acquisition and analysis.

Tests on a standard silicon substrate have yielded a thermal conductivity of 130W/mK. Further tests of thin films on silicon were characterized and the dependence of thermal conductivity on thickness was measured.

Jason Yang

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Alexander Kauffman

Investigation of the Necessity of RP3V Kiss1 Neurons during the preovulatory for GnRH/LH Surge in Female Mice

Due to proprietary information this abstract has been redacted.

Yichen Yang

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by DR. Imanuel Lerman

Respiration monitoring and classification through a non-invasive method using inertial measurement units

Respiratory rate (RR), a crucial factor of vital signs in the clinical field, is essential for physicians to make clinical decisions and treatments. There are a few ways that are commonly used to measure the RR: a) measuring the airflow through the nose, b) measuring chest or abdomen circumference during breathing, c) measuring the skin impedance pneumography during breathing, or d) indirect measurement of respiratory-induced variation through electrocardiogram (ECG). However, these widely used methods require patients to wear transducer or nasal tubing for a long time which will cause discomfort to the patients. Therefore, a wearable, lightweight, yet accurate method of monitoring respiration is of practical significance. Through research and investigation, our team decided to use the MPU6050 inertial measurement unit (IMU) Arduino module to quantify the patient's chest motion (acceleration and angular velocity); it allowed us to determine the rate and the depth of breathing. Considering that the patient's voluntary body movements (such as turning over) will affect the signal quality, we plan to use the Kalman filter to actively predict and correct abnormal data and use various signal processing techniques to improve the accuracy. We will also use the result from the nasal airflow method to validate our measurement. From corrected signals, we will train a deep learning model to determine various states of the patients (e.g. talking, motion, cough). In aggregate, we plan to create a graphical user interface (GUI) that can accurately predict a patient's respiratory state and estimate RR in real-time.

Yuanjia Yang

Data Science / Cognitive Science, UC San Diego
UC Scholars
Mentored by Dr. Jason Fleischer

EEG reveals memory formation processes

Human memory formation has baffled generations of researchers, and we are eager to understand these underlying processes. A previous study explored the electrophysiological differences during semantic and episodic memory formation by separating the confident components from familiarity (Liao et al., 2021). Liao used Linear Discriminant Analysis (LDA), which usually relies on strong mathematical assumptions such as linear separability, to classify distinct classes of memory formation processes, inferred by the confidence and familiarity measure, using electroencephalography (EEG) data. Another independent dataset gathered by Richard et al. independently measures item and source judgment coupled with the EEG recording, which might shed new light on the issue of memory recollection processes. This project aims to re-engineer the obsolete data analysis program written by Liao in python to test the replicability of their result. Furthermore, equipped with this program, we use data processing techniques to fit the model using the independent dataset from another experimental paradigm. By learning the classifier using two independent datasets, we wish to find the general rules of electrophysiological processes of memory formations. In addition, to break the strong mathematical assumption mentioned above, we also explored several other classical classifiers such as LDA and Support Vector Machine (SVM) with non-linear kernels. We hope this study can potentially help to understand the mechanisms of memory formation in human brain.

Emmie Yao

NanoEngineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Shaochen Chen

3D Bioprinted Ovarian Cancer Model for Investigation on CPMV Reconditioned Tumor Microenvironment

Ovarian cancer is the leading cause of death that stems from the female reproductive system. Recent studies of immunotherapy show that reconditioning the tumor microenvironment will boost ovarian cancer therapy. Particularly, Cowpea Mosaic Virus (CPMV) based viral nanoparticles (VNPs) have been shown to promote anti-tumor activity in the immune system of a mouse ovarian tumor model and specifically, macrophages have been identified to inhibit the ovarian cancer cell viability upon CPMV stimulation. However, this mechanism is not well understood. In this project, based on the Digital Light Printing (DLP) bioprinting platform, we develop dual cell model with

ID8-Defb29/Vegf-A (ovarian cancer cell) and RAW264.7 (macrophage) to recapitulate and dissect the in vivo cancer-macrophage reciprocal interaction. The 3D microenvironment created by DLP printing of biomaterial supports the spheroid formation of the cancer cells. The tumor necrosis factor (TNF) alpha pathway is part of the ovarian cancer tumor microenvironment (TME), and the CPMV effects on the TME will be investigated to observe how it interacts with the ovarian cancer killing. Facilitated by the DLP printed dual cell model, we identify the upregulation of TNF-alpha level induced by the CPMV treatment. We further investigate the role of CPMV in the activation of the TNF signaling pathway and the TNF mediated inflammatory cytokine network, which plays a crucial role in the ovarian cancer TME. The results will contribute to the understanding of how the CPMV functions in relation to ovarian cancer and will furthermore help with the development into ovarian cancer drug therapy.

Noura Yassir

Chemistry & Biochemistry, UC San Diego
Summer CAMP
Mentored by Dr. Johannes Schöneberg

Effects of the Ketogenic Diet on Mitochondria Morphology in Epilepsy-Associated Mutations in Human Stem Cells

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

Gordon Ye

CS with Specialization in Biomedical Computation, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Eric Zorrilla

A Genome-Wide Association Study of Problematic Alcohol Use using Whole-Genome Sequencing Data from the National Institutes of Health All of Us Research Program and UK Biobank

Due to proprietary information this abstract has been redacted.

Ethan Young

Molecular and Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Yunde Zhao

The Role of ESR Transcription Factors in Plant Growth and Development

Our research uncovers an aspect of the genetic basis behind growth and development in the model plant Arabidopsis thaliana. Normal plant growth requires the coordination of many gene products to tightly regulate cell identity and division. Transcription factors play a key role in determining which genes are expressed and are therefore essential for various processes of plant development. The ESR genes are a family of transcription factors which are shown to control both embryogenesis and floral development. They play a key role in cell division and differentiation. We investigated the function of ESR genes by using the CRISPR/Cas9 system to generate higher order mutants for phenotypic analysis. In addition, through fluorescent tagging we were able to observe the expression pattern and localization of the ESR genes. Our results demonstrate that the ESR genes are master transcriptional regulators that are required for proper growth. Because the ESR gene family is universal in all flowering plants, we can come to understand growth and development not only in Arabidopsis, but also across many different plant species.

Luowen Yu

Cognitive and Behavioral Neuroscience, UC San Diego
UC Scholars
Mentored by Dr. Lara Rangel

Investigating the Role of Dentate Gyrus in Pattern Separation

The dentate gyrus (DG), a subregion of the hippocampus, is thought to provide unique representations for similar experiences to aid in both the encoding and retrieval of distinct memories. Despite this long-standing hypothesis, little is known regarding the local circuit interactions within DG that support the recruitment of these unique representations or whether the DG exerts its greatest impact upon downstream structures during encoding, retrieval, or both. To further investigate, we acquired in vivo electrophysiological recordings of single cell and local field potential activity from rat DG as rats perform a spatial delayed-match-to-sample task. The task requires the rats to associate a location in an arena with a reward during an encoding phase, and return to the previously rewarded location in the presence of foil location during a subsequent retrieval phase. We have observed several behaviors that indicate rats critically leverage cues outside of the arena to perform the task. Specifically, rats scan (pause at the base of the arena at the start of the task to view possible reward locations in the context of environmental cues from distance) and rear (stand on hind limbs to view environmental cues at a reward location). We investigate the frequency and duration of each behavior

during encoding and retrieval phases before correct or incorrect performance, and characterize dynamic neural oscillatory activity during these behaviors. In this manner, we will determine whether the DG exhibits distinct rhythmic states during each behavior that changes across encoding and retrieval phases and across successful and unsuccessful performance.

Chengjing Yuan

Computer Enginerring, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Michael Yip

Pointcloud based collision detection

Trajectory Optimization Algorithms are used to generate optimal collision-free paths for robots. A collision checker is a module that helps a robot determine if a given state will lead to a collision with other obstacles, which is the most computationally expensive component in trajectory optimization. A proxy collision checker, DiffCo, was able to accelerate path optimization by 10-100 times with non-parametric machine learning models. However, it assumes a perfect understanding of the poses and the geometries of all obstacles in the environment, which is hard to achieve in real-world applications. In this project, we extend DiffCo to a more realistic setting, enabling it to be trained with point Clouds fetched from an RGB-D camera. We evaluate our method by performing trajectory optimization on a custom synthetic dataset and a real-world dataset. We also include a neural network-based method as a baseline to demonstrate the benefit of using a non-parametric model.

Timothy Yuan

Biochemistry, UC San Diego
Ahmadian Fellowship
Mentored by Dr. Alan Saltiel

AMPK Mediates TORC-2 Dephosphorylation and Migration into Nucleus in Response to cAMP

The glucagon signaling pathway plays a key role in maintaining glucose homeostasis by enhancing liver gluconeogenesis and glycogenolysis in response to lowered blood glucose. Glucagon triggers the production of cAMP in primary hepatocytes. Elevated intracellular cAMP triggers dephosphorylation of TORC-2 and its subsequent migration into the nucleus. TORC-2 then binds to and activates CREB, a critical transcriptional activator for gluconeogenic and catabolic genes such as PGC1α, G6Pase, PEPCK, and CPT1. Therefore TORC-2 plays a crucial role in glucagon-induced transcriptional modulation. What mediates the dephosphorylation of TORC-2 in response to cAMP is not well established.

Our previous results showed that inhibition of AMPK reduces gluconeogenesis in primary hepatocytes and results in downregulation of gluconeogenic genes. This suggests AMPK involvement in transcriptional regulation via TORC-2 and CREB. We hypothesize that AMPK regulates TORC-2 phosphorylation and mediates TORC-2 migration in response to elevated intracellular cAMP.

We will transfect AML12 cells, an epithelial cell model that replicates primary hepatocyte phenotypes, with FLAG-TORC-2 and FLAG-GFP and check that TORC-2 binding partners in AML12 cells mimic primary hepatocytes. Transfected cells will be treated with cAMP, and the effects of an AMPK inhibitor will be tested. We anticipate decreased binding of TORC-2 to CREB, an increased phospho-TORC-2 to TORC-2 ratio, and ultimately a decrease in transcription of genes regulated by CREB in response to AMPK inhibition, illustrating AMPK's role in propagating signal transduction downstream of cAMP to CREB via TORC-2 phosphorylation/dephosphorylation. These results will help elucidate the mechanism with which glucagon regulates glucose homeostasis.

Kate Zegans

Sociology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Alihan Polat

Climate Migration and Density in New Hampshire

While much attention is paid to the implications of international climate induced migration, the vast majority of climate migrants will move within their own countries, not between them (Podesta, Brookings Institute). Within the United States, areas prone to drought, heat, fires, and sea level rise, are likely to generate climate migrants in a business as usual scenario (Shaw, Propublica). New Hampshire, alongside many other New England states, is relatively less vulnerable to many of these climate impacts, and predicted to remain habitable and fertile by 2050 in a business-as-usual emissions scenario, making it a possible target for internal climate migration (Shaw, Propublica). This study maps migration flows into New Hampshire from 2011 to 2020 to test if predicted climate-migration patterns may have begun to materialize. These maps will be contextualized by climate-risk assessments of US counties created by the Rhodium Group. Furthermore, this study explores how New Hampshire may respond to the pressure of climate migrants given historical and current resistance to development and population density (Hodgetts). Density-potential mapping will be conducted to analyze the distribution of resources, including the preservation of natural resources and limitations of current infrastructure, to understand which areas may be suitable for greater population density. We hope that this project will be useful to the State of New Hampshire and further the discussions of how rural communities can adapt to the realities of climate change while maintaining local culture.

Andrew Zhang

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Gulcin Pekkurnaz

O-GlcNAcylation Flux's Effect on Glucose-6-phosphate Dehydrogenase Activity

The pentose phosphate pathway (PPP) is crucial for oxidative damage prevention and actively participates in glucose metabolism. PPP derives from the first step of glycolysis. Glucose-6-phosphate dehydrogenase (G6PD) is the first and rate limiting enzyme of PPP and relies on the glucose-6-phosphate (G6P), the product of the first glycolytic enzyme, as its substrate. The product of G6PD is important in decomposition of peroxides produced in mitochondrial ATP production, whose accumulation can lead to oxidative damage and subsequent cell death. Nutrient sensing post-translational modification O-GlcNAcylation affects cellular energy availability, increasing both glycolytic and mitochondrial ATP production rates. However, prior studies also suggested that O-GlcNAcylation of glycolytic enzyme 6-phosphofructokinase isoform L (PFKL) decreases its activity, which seems to contradict with increase glycolysis rate with up-regulating O-GlcNAcylation. Glycerol-3-phosphate, a product of PPP, can re-enter glycolysis bypassing PFKL and continue glycolysis towards its ATP producing steps. Therefore, we hypothesize that O-GlcNAcylation increases G6PD activity, directing G6P through PPP instead of the portion of glycolysis that involves PFKL and as a result mitigates oxidative damage caused by increased mitochondrial ATP production rate. The hypothesis will be tested on human embryonic kidney 293T cells (HEK293T). To increase O-GlcNAcylation level, we pharmacologically inhibit O-GlcNAcase and exogenously express O-GlcNAc transferase. Then G6PD activity will be measured through a colorimetric enzymatic assay kit. We expect to see increased PPP activity in HEK293T cells with elevated O-GlcNAcylation level.

Emily Zhang

Bioinformatics, UC San Diego
Ahmadian Fellowship
Mentored by Dr. Reuben Shaw

AMPK Mediated Proliferation of Intestinal Stem Cell Derived Organoids

The small and large intestines play a major role in the absorption of nutrients and reabsorption of water, playing essential roles in the gastrointestinal tract. AMP-activated protein kinase (AMPK) regulates biochemical pathways like glycolysis and fatty-acid oxidation and maintains homeostatic cell energy levels, which promotes proper cellular growth. LKB1 (Liver kinase B1) is an upstream activator of AMPK and previous studies have shown how mutations in LKB1 both decreases activation of AMPK and leads to the development of intestinal polyps in individuals. To examine how intestinal cells respond

to changes in metabolic signaling mediated by AMPK, intestinal organoid models were used to examine differences in proliferation rates between Wild Type (WT) and AMPK double knockout (AMPK dKO) organoids. Quantification of such differences were measured in the quantity of organoids generated from murine models and amount of organoid budding. We hypothesize AMPK dKO organoids will have lower proliferation rates than WT organoids, as a result of disruption of essential cellular processes like glycolysis, oxidative phosphorylation, and autophagy. These studies provide insight into how the master metabolic regulator, AMPK, influences stem cell proliferation and will contribute to knowledge of metabolism in the intestinal stem cell pool. These studies lay the groundwork to improve human intestinal health and possibly to aid in prevention of diseases like cancer.

Leon Zhang

Physics, UC Irvine
MRSEC REU or RIMSE
Mentored by Professor Darren Lipomi

Open-source tool for accurate modeling and simulation of conjugated polymers

Conjugated polymers such as poly(3,4 ethylene-dioxythiophene) (PEDOT) possess unique combinations of electronic, thermal, and mechanical properties that make them suitable for applications in optoelectronic devices, sensors, engineered living materials, etc. However, the impact of rigidity and structure of their backbone is not well described by conventional computation models. Recently, Kleinschmidt developed a method using computationally altered π-conjugated polymers to create more accurate models for molecular dynamics simulations [1]. Based on this approach, we demonstrate a computational tool usable on a variety of systems, requiring only minor configuration changes for a new user to apply this tool. It can decouple energies associated with electron delocalization, resulting in more accurate treatment of steric interactions, which enables smaller error from ab-initio calculations in calculating the backbone rigidity of conjugated polymers. Furthermore, the software can enable better prediction of a conjugated polymer's ability to transport electron by taking improper torsion into consideration, which is missing in conventional methods. This work can enable researchers to better understand a variety of π-conjugated polymers, and aid in further pross in designing novel polymeric materials and devices.

[1] Kleinschmidt, A. T. (2022). Calculation and Modeling of Rigidity in Conjugated Polymers. UC San Diego. ProQuest ID: Kleinschmidt_ucsd_0033D_21242. Merritt ID: ark:/13030/m57f0075. Retrieved from https://escholarship.org/uc/item/61g474s2

Zhiqi Zhang

Chemistry, UC San Diego
MRSEC REU or RIMSE
Mentored by Helen Zhang, Professor Michael J. Sailor

Mesoporous silicon nanoparticles as a delivery system to help understand the biological function of Erucamide

Erucamide, a naturally occurring hydrophobic fatty acid amide, is thought to play an important role in maintaining the function and structure of the human retina. Its biological mechanisms, however, are not completely understood. This is exacerbated by the low water solubility of the molecule, which makes systematic studies of its effect on tissues of the eye difficult. To better understand the role of erucamide, this work aims to develop a system that can deliver controlled quantities of this molecule in vivo. The approach involves synthesis of mesoporous silicon nanoparticles (pSiNPs), which are functionalized with octadecylsilane through a dehydrogenative coupling reaction to yield a hydrophobic interior pore surface. The rationale is that the hydrophobic pores will act as a host for erucamide which will allow its delivery to the eye at biologically relevant concentrations. The near-term goal is to develop the chemistry and to quantify the temporal release of erucamide in-vitro. This presentation will present the latest progress towards these goals. Nanoparticle formulation will be characterized by Fourier-transform infrared spectroscopy (FTIR), Dynamic light scattering (DLS), Thermogravimetric Analysis (TGA), and High Performance Liquid Chromatography (HPLC).

Jiayi Zhao

Mathematics - Computer Sciences & Cognitive Science spec. Machine Learning and Neural Computation, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Jason Fleischer

Advanced Analysis of Racial Equity in San Diego Criminal Justice System

Due to proprietary information this abstract has been redacted.

Ruijie Zhong

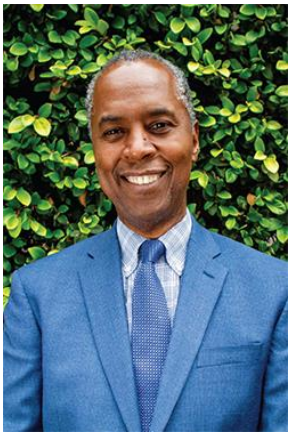
Joint Mathematics-Economics, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Juan Herreño

Comparison of Change in Housing Market After Covid-19

Houses constitute a large percentage of households' wealth, so changes in the house market directly affects households. During Covid-19, we have seen the obvious increase

in house prices due to a combination of unclear reasons. This research explores the housing market impacted by Covid-19 in specific counties through the analysis of house prices. By comparing house prices by top, middle and bottom tiers, we show how Covid-19 impacts households with different income levels. Based upon the observations, the research explains the reasons behind the cross-sectional and time-serial variation.

URH Staff



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