

UC San Diego

*The Annual Summer
Research Conference*

UC San Diego

VIRTUAL CONFERENCE

AUGUST 12 & 13, 2021

DIVISION OF STUDENT AFFAIRS
STUDENT RETENTION AND SUCCESS
UNDERGRADUATE RESEARCH HUB

CONFERENCE PROGRAM

2021 Summer Research Conference at UC San Diego

Welcome to the Annual Summer Research Conference at UC San Diego, a national showcase for undergraduate research. Thanks to our virtual format, we have undergraduate presentations from across the country and international institutions.

This year's conference features four hundred fifty participants who are part of faculty-mentored summer research programs, and who attend schools ranging from local community colleges to large state universities, and small colleges. In addition to UC San Diego, institutions represented include CSU Fullerton; CSU Northridge; CSU San Bernardino; CSU San Marcos; CSU Long Beach; San Diego State University; San Francisco State University; Spelman College; UC Berkeley; UC Irvine; UC Los Angeles; UC Riverside; UC Merced; UC Santa Cruz; University of San Diego; Bowie State University; University of Southern California; New Mexico Institute of Mining and Technology; Georgia Institute of Technology; Xavier University of Louisiana; Seoul National University of Medicine; University of Delaware; Wellesley College; Morehouse College; Howard University; North Carolina A&T State University; St. Mary's University; North Carolina Central University; Hampton University; University of Houston; University of Maryland Eastern Shore; University of Minho; Farmingdale State College; Emory University; Instituto Tecnológico y de Estudios Superiores de Occidente.

We hope you will enjoy the conference and the students' presentations. We extend our thanks to our moderators for their assistance and support, and to the mentors who have provided training and guidance to their students throughout the 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. Claire Kim, Tyler Rogers, Dr. Marie Sheneman, Dr. Sophia Tsai, and Jason Avalos-Morfin who helped to organize the panels.

#2021SRCUCSD

Table of Contents

Conference Schedule.....	4
Zoom Room Registration Links – Thursday.....	5
Zoom Room Registration Links – Friday.....	6
Presentation FAQs	7
Panel Presentation Schedule	10
Student Spotlights	16
Conference Participants and Sponsoring Programs	29
Panel Details	36
Abstracts	101
Undergraduate Research Hub Staff.....	356

Conference Schedule

Thursday, August 12th

8:15 AM – 8:45 AM	Welcome and Opening Remarks
9:00 AM – 10:00 AM	Morning Session I
10:10 AM – 11:10 AM	Morning Session II
11:20 AM – 12:20 PM	Morning Session III
12:20 PM – 1:20 PM	Lunch Break
1:30 PM – 2:30 PM	Afternoon Session I
2:40 PM – 3:40 PM	Afternoon Session II
3:50 PM – 4:50 PM	Afternoon Session III

Friday, August 13th

8:15 AM – 8:45 AM	Plenary Session with Dr. Mireille Kamariza
9:00 AM – 10:00 AM	Morning Session I
10:10 AM – 11:10 AM	Morning Session II
11:20 AM – 12:20 PM	Morning Session III
12:20 PM – 1:20 PM	Lunch Break
1:30 PM – 2:30 PM	Afternoon Session I
2:40 PM – 3:40 PM	Afternoon Session II

Zoom Room Registration Links – Thursday

Thursday Zoom Rooms		Registration Links
Welcome and Opening Remarks		https://ucsd.zoom.us/webinar/register/WN_-NpfvyUJROmHuJb7-Sci1w
Student Panel Rooms	Angela Davis	https://ucsd.zoom.us/meeting/register/tJAlceCujstEtdGwgJzP2EQDfqNvhnE2SMF
	Eleanor Mariano	https://ucsd.zoom.us/meeting/register/tJwrf-iurTliGdyetKlcZHa30W8rHrIrIKDp
	Flossie Wong-Staal	https://ucsd.zoom.us/meeting/register/tJEqc-ysrTMjHNSUkMoW0w3dWmsxbQ5hsuRb
	K. Megan McArthur	https://ucsd.zoom.us/meeting/register/tJcsc-CtqDwtHdJCML9SOA7k7GBNT-Nsd2N-
	Kathleen Rubins	https://ucsd.zoom.us/meeting/register/tJAuf-gqqT8sH9cu6UwkwOsTEnQ4Cz2JfPRH
	Khaled Hosseini	https://ucsd.zoom.us/meeting/register/tJYkce6upzwwE9NuE-u3Yru0pZV43BY463xl
	Kim Stanley Robinson	https://ucsd.zoom.us/meeting/register/tJcudu6srDgtHtQmmCqWQg1yTKCJTzysGGzK
	Linus Pauling	https://ucsd.zoom.us/meeting/register/tJMofu6qrTwjGd3QoczwliKEfiFix0SZGILU
	Mario Molina	https://ucsd.zoom.us/meeting/register/tJlqcOyqqDouHtQzW4TPVcncv6FRDav1AJHb5
	Rachel Axler	https://ucsd.zoom.us/meeting/register/tJUucOitrzlvG9BBfSYdVxacNPcMWZyY8JQC
	Jimmy Yang	https://ucsd.zoom.us/meeting/register/tJ0lde mrrzMoHtFYDjGbLN6sfw4Dy_C-Sx4U
Vernor Vinge	https://ucsd.zoom.us/meeting/register/tJYkd-2sqz8vE9HSC4dNa_VsZWTxc2wMe06X	

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/password to enter the room multiple times throughout the day.

Zoom Room Registration Links – Friday

Friday Zoom Rooms		Registration Links
Welcome and Plenary Speaker		https://ucsd.zoom.us/webinar/register/WN_UMllgeyoR8StoY0mMThTZg
Student Panel Rooms	Æbleskiver	https://ucsd.zoom.us/meeting/register/tJAtf-2ppj0uHdT8-5mlvAazmLG2yK2Cwqwu
	Ajiaco	https://ucsd.zoom.us/meeting/register/tJwucuChpz8sG9RqhSLytdZ8BMS8ZhoR2MIC
	Biryani	https://ucsd.zoom.us/meeting/register/tJ0ocuiurz4tE9BO9RR4qIrUGmzG0S2ESh9J
	Boba	https://ucsd.zoom.us/meeting/register/tJwrd-6rpjsrGtZx_nO_wOTFABOd2l1Zy8EU
	Chiles en Nogada	https://ucsd.zoom.us/meeting/register/tJctdOiqrT4vGtPxS5nC2hFgZJrDvOdWIJYo
	Gatsby	https://ucsd.zoom.us/meeting/register/tJAvdOqsrTgvHtN7KHNeumEdturWw2HQtPRr
	Harira	https://ucsd.zoom.us/meeting/register/tJcqcuqrrTkuHdXSIn_qhxwBsKQBSP_bzxSJ
	Lumpia	https://ucsd.zoom.us/meeting/register/tJctc-GogD8pH9DurxATBPAZy-JvxgGVqEIC
	Pastelón	https://ucsd.zoom.us/meeting/register/tJcvf-2hrjktHdCytXOKziqMNOelhlaluELP
	Pho	https://ucsd.zoom.us/meeting/register/tJYkcu2hqj8pE9crJiT3E5xXa5wGbn80ne41
	Poutine	https://ucsd.zoom.us/meeting/register/tJcqduuhqjstHNFh4f942H4zTd2EC4cm-X7M
Succotash	https://ucsd.zoom.us/meeting/register/tJMqdu2orjliEtXEPRI tqCDSd66Abfm3uZgv	

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/password 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 panelists present. 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 good questions during a panel 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 to presenters, engage with the topic and framework of their project. Ask 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?"

Here is another example of a good question: "Thank you for sharing your research about representations of women in eighteenth-century Japanese art. I appreciate the ways in which your research emphasizes the various power dynamics at play in the creation and circulation of visual culture. This got me thinking about all of the presentations on this panel. Each of you are analyzing aspects of visual culture from various places and time periods. To all of the panelists: what have you observed about the relationship between power and artistic production in your own research?"

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

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

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

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 can register for free as an "Attendee/Guest" on the conference registration page, which can be found by visiting src.ucsd.edu. They will not pay any registration fee to attend. They will also need to register through the zoom links (pgs. 5 & 6 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 of these types of audience members.

Panel Presentation Schedule

Thursday: Morning Session I, 9:00 AM

Panel #	Panel Name	Location
1	Marine Ecology & Biodiversity	Angela Davis
2	Reproductive Medicine II	Eleanor Mariano
3	Reproductive Medicine I	Flossie Wong-Staal
4	Literature & Critical Theory	K. Megan McArthur
5	Metabolic Syndrome and Eating Disorders	Kathleen Rubins
6	Material Science and Nanoengineering	Khaled Hosseini
7	Chemistry and Biochemistry	Kim Stanley Robinson
8	Developmental Psychology and Cognitive Science I	Linus Pauling
9	Molecular Biology and Biochemistry	Mario Molina
10	Mechanical and Aerospace Engineering	Rachel Axler
11	Memory and Learning	Jimmy Yang
12	Aerospace Engineering	Vernor Vinge

Thursday: Morning Session II, 10:10 AM

Panel #	Panel Name	Location
13	Aquatic Microbiomes	Angela Davis
14	Gene Drive Applications	Eleanor Mariano
15	COVID-19 in Medicine	Flossie Wong-Staal
16	Performances of Gender, Grief, & Horror	K. Megan McArthur
17	Compassion and Mindfulness in Medicine	Kathleen Rubins
18	Bioinformatics, Computation, and Biological Science	Khaled Hosseini
19	Drug Delivery and Medicine	Kim Stanley Robinson
20	Developmental Psychology and Cognitive Science II	Linus Pauling
21	Organic Chemistry	Mario Molina
22	Nanomaterials and Energy Storage	Rachel Axler
23	Neuroscience, Computation, and Technology	Jimmy Yang
24	Medical Applications of Electrical and Computer Engineering	Vernor Vinge

Thursday: Morning Session III, 11:20 AM

Panel #	Panel Name	Location
25	Conservation and Environmental Science	Angela Davis
26	Cancer: Risk and Screening Disparities	Eleanor Mariano
27	Hormones	Flossie Wong-Staal
28	Storytelling through Dance, Clothing, & Video Games	K. Megan McArthur
29	Molecular Studies in Cancer I	Kathleen Rubins
30	Nanoengineering	Khaled Hosseini
31	Plant Biology	Kim Stanley Robinson
32	Language and Communication	Linus Pauling
33	Structure and function in Biochemistry	Mario Molina
34	Topics in Engineering	Rachel Axler
35	COVID-19, Mental Health, and Social Interactions	Jimmy Yang
36	Educational Technology	Vernor Vinge

Thursday: Afternoon Session I, 1:30 PM

Panel #	Panel Name	Location
37	Neuroscience I	Eleanor Mariano
38	Health Care, Disparities, and Inclusivity	Flossie Wong-Staal
39	Neuroscience III	K. Megan McArthur
40	Molecular Studies in Cancer II	Kathleen Rubins
41	Physics and Applied Mathematics	Khaled Hosseini
42	Nanoengineering and Medicine	Kim Stanley Robinson
43	Biochemistry and Nanomedicine	Linus Pauling
44	Crime and Punishment	Mario Molina
45	Nanoengineering and Chemical Engineering	Rachel Axler
46	Cancer, Mental Health, and Disparities	Jimmy Yang
47	Computer and Data Science in the Study of Environment and Species Populations	Vernor Vinge

Thursday: Afternoon Session II, 2:40 PM

Panel #	Panel Name	Location
48	Parasitic Drug Design	Angela Davis
49	Neurobiology	Eleanor Mariano
50	Political Science, Voting, and Representation	Flossie Wong-Staal
51	Neuroscience II	K. Megan McArthur
52	Cancer Treatment Effects	Kathleen Rubins
53	Health Disparities in Cancer	Khaled Hosseini
54	Materials Science and Engineering	Kim Stanley Robinson
55	Medical Applications of Nanoengineering	Linus Pauling
56	Latinx Lived Experiences	Mario Molina
57	Nanoengineering and Materials Science	Rachel Axler
58	Potpourri I	Jimmy Yang
59	Biomedical Engineering	Vernor Vinge

Thursday: Afternoon Session III, 3:50 PM

Panel #	Panel Name	Location
60	Ecology & Agriculture	Jimmy Yang

Friday: Morning Session I, 9:00 AM

Panel #	Panel Name	Location
61	Oceanography and Earth Sciences	Æbleskiver
62	Potpourri III	Ajiaco
63	Computer and Data Sciences	Biryani
64	Education and Diversity I	Boba
65	Cancer Outcomes Disparities	Chiles en Nogada
66	Molecular Mechanisms of Microbial Interactions	Gatsby
67	Animal Behavior and Social Organization	Harira
68	Perceptions of Risk	Lumpia
69	Biological Tissue Analysis	Pastelón
70	Medicine in LatinX populations	Pho
71	Mechanical and Materials Science Engineering	Poutine
72	Cell Biology	Succotash

Friday: Morning Session II, 10:10 AM

Panel #	Panel Name	Location
73	Climate Science	Æbleskiver
74	Machine Control, Sensing, and Communication	Biryani
75	Education and Diversity II	Boba
76	Molecular Basis of Cardiovascular Disease	Chiles en Nogada
77	Disparities in Cancer	Gatsby
78	Addiction and Substance Use	Harira
79	Sociology, Culture, and Political Science	Lumpia
80	Cigarettes and Cancer	Pastelón
81	Health Disparities: A Tale of Two Populations	Pho
82	Electrical Engineering and Computer Science	Poutine
83	Cell Cycle: Mitosis Spotlight	Succotash

Friday: Morning Session III, 11:20 AM

Panel #	Panel Name	Location
84	Atmospheric and Environmental Chemistry	Æbleskiver
85	Bias, Cognitive Science, and Stereotype Threat	Biryani
86	Education and Diversity III	Boba
87	Molecular Biology II	Chiles en Nogada
88	Race, Ethnicity, and Health	Gatsby
89	Science and Public Understanding COVID-19 Misinformation	Harira
90	Stress, Trauma, and Allostatic Load	Lumpia
91	Inflammation and Imaging	Pastelón
92	Health Disparities in Minority Populations	Pho
93	Biomedical Informatics	Poutine
94	Neuroscience IV	Succotash

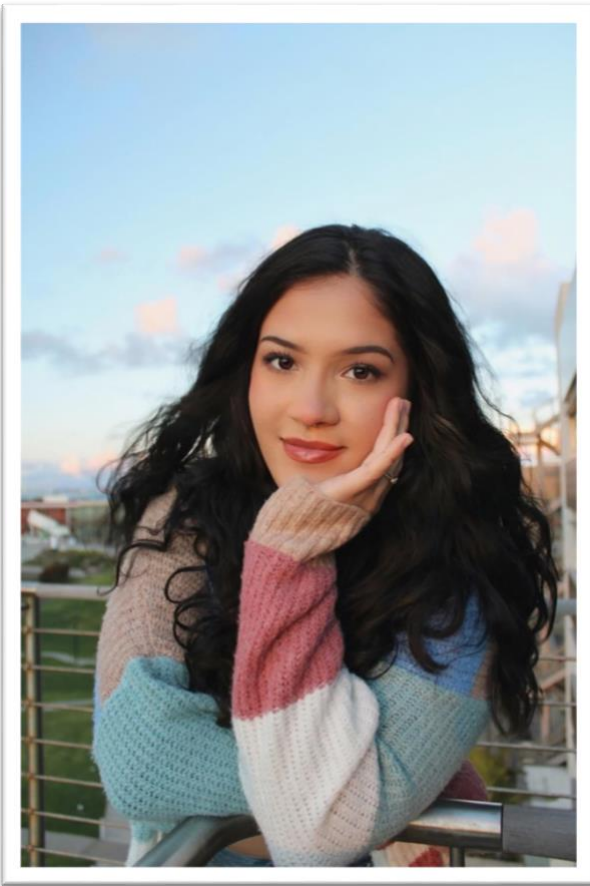
Friday: Afternoon Session I, 1:30 PM

Panel #	Panel Name	Location
95	Student Life	Æbleskiver
96	Molecular Biology I	Biryani
97	Addiction and Microbiome Studies in Medicine	Boba
98	Topics at the Intersection of Social Science and STEM	Chiles en Nogada
99	Economics, Commerce, and Business	Gatsby
100	Geophysics and Astrophysics	Lumpia
101	Viruses and Microbes	Pastelón
102	Climate Change	Pho
103	Wearable Sensor Technology and Medical Applications	Poutine
104	Decolonizing Museums & Art	Succotash

Friday: Afternoon Session II, 2:40 PM

Panel #	Panel Name	Location
105	COVID-19 and Impact on Communities	Æbleskiver
106	Science -- Perceptions of Scientists	Boba
107	Mental Health	Chiles en Nogada
108	Public Policy, Housing, and Environment	Lumpia
109	Potpourri II	Pho
110	Computer and Data Sciences	Poutine

Student Spotlights



Angelina Lopez

Pronouns: She/They

Summer Program: Triton Research & Experiential Learning Scholarships (TRELS)

Class Standing and College: Sophomore, Seventh College

Major(s): International Business, Critical Gender Studies

Field of Research: Anthropological Climate Communications

Presentation Title: Investigating the Climate Consciousness Among Adolescents in Salinas, California

Mentor: Professor Jill Gladstein, Director of Synthesis Program, Seventh College

What's the best piece of advice your research mentor has given you?

Of the many lessons I have received from my research mentor, Professor Gladstein, the piece of advice I value the most is to commend detail in research more than anything else. She has taught me to always ask further questions, to explore every alcove, to never leave a stone unturned, because you'll never know what answers lie in the unasked question. With this advice, I plan with a broader perspective in mind, which closely benefits the targeted community of my research, my community, Salinas, California. As climate communications and climate awareness have not yet been studied in my community, my mentor has pushed me to think larger, about every last detail, to pave the way for future projects.

Daria MacAuslan



Pronouns: She/Her

Summer Program: UCSD MRSEC
REU – Summer School for Silicon
Nanotechnology

Class Standing and College: Rising
junior, UCLA

Major(s): Neuroscience with Russian
Language Minor

Field of Research: Nanotechnology,
drug delivery and neuroscience

Presentation Title: Development of
Mesoporous Silicon Microparticle-
Hydrogel Composites for Delivery of
Therapeutic Agents to Aid in
Peripheral Nerve Repair

Mentor: John Zuidema, PhD

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

The most meaningful part of this program so far has been the ability to connect with my peers and my mentor. I have gotten to learn so much from the individuals around me, working together on experiments, or even simply offering advice or a mind to brainstorm with when I come across a confusing or difficult part of my research. Having never conducted hands-on research at this level before, learning to run experiments and use complicated equipment seemed daunting, but being passionate about the promises of the applications of the research outcomes and being surrounded by other passionate and dedicated individuals has made it so exciting. Working with these incredibly bright people has allowed me to learn so much and develop so many new skills (both technical and personal), and I am lucky to be in such a collaborative and supportive laboratory.



Cristian Fuentes-Hernandez

Pronouns: He/Him/His

Summer Program: URS

Class Standing and College: Rising Sophomore, Marshall College

Major(s): Political Science and Chincanx Latinx Studies Minor

Field of Research: Chincanx Latinx Studies

Presentation Title: San Ysidro as a Case Study of the Border Community

Mentor: Luis Alvarez, PhD

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

Doing research about my community is very meaningful to me because it gives me the opportunity to showcase the value that it has to the rest of the world. As I read different books about my topic, I noticed the ways in which many injustices become normalized, justified, and part of the system. Now, with this knowledge,

I get to apply it to understand the issues that happen in the same community where I live and put my part to fix them. I would like to dedicate my research to all the people that helped me in my way including my community, family, and mentors.



Natalia Berrios-Rivera

Pronouns: She/Her/Hers

Summer Program: McNair Scholars

Class Standing and College: Junior, Warren

Major(s): Mechanical Engineering

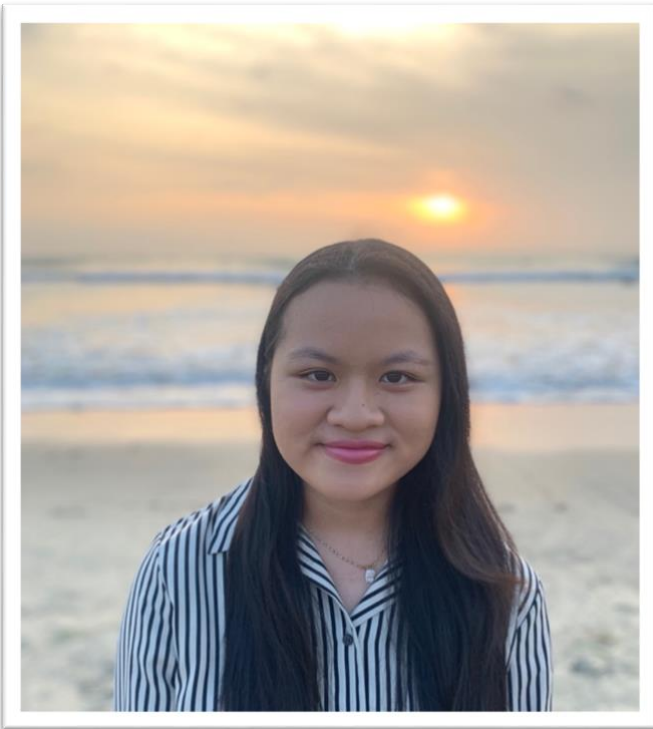
Field of Research: Geophysics

Presentation Title: Analyzing marine magnetic anomalies at the northern East Pacific Rise using an autonomous underwater vehicle

Mentor: Dr. Jeff Gee

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

The most fun experience I've had while conducting research this summer has been meeting all the other students who are also working on summer research projects. I've enjoyed seeing what other students are working on, and it's been interesting to learn about the different methods they use when collecting and analyzing data for their research. After a year of online classes and conducting research remotely, I'm so grateful that I've been able to spend the summer working on a research project in person. Anytime I feel confused or lost while working on my project, there are always other undergrads, grad students, and professors who are around and are willing to help.



Anny Lam

Pronouns: She/Her/Hers

Summer Program: Genentech
Scholars Program

Class Standing and College:
Senior, Thurgood Marshall
College

Major(s): Pharmacological
Chemistry

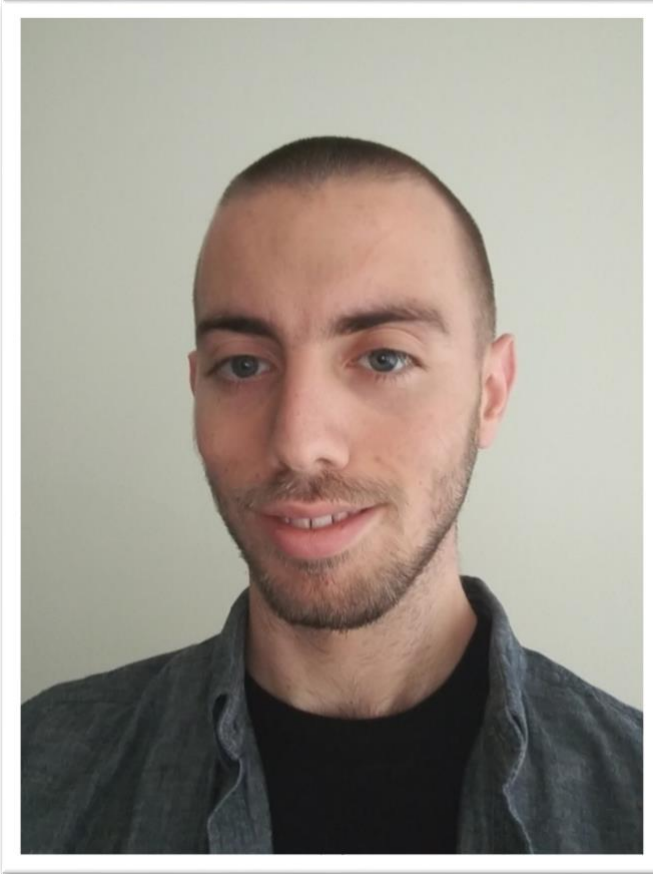
Field of Research: Medicinal
Chemistry

Presentation Title:
Phenylpyrimidines as Candidate
Molecules for Anti-schistosomal
Treatment

Mentor: Dr. Carlo Ballatore

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

Building community, especially after more than a year in quarantine, has been one of the most meaningful experiences for me this summer. To be surrounded by individuals who make me feel confident and supported, I am sincerely grateful to be a part of the summer research experience. Additionally, it has been enjoyable learning new laboratory techniques with the guidance of my mentor. I find my work to be meaningful in how I am able to intertwine these laboratory techniques with concepts learned in the classroom. Together, they are what guide me to what makes my project fulfilling.



Justin Burzachiello

Pronouns: He/Him/His

Summer Program: UC San Diego STARS through UC LEADS

Class Standing and College: University of California, Riverside / Junior

Major(s): Applied Physics and Engineering with a focus on Computer Science

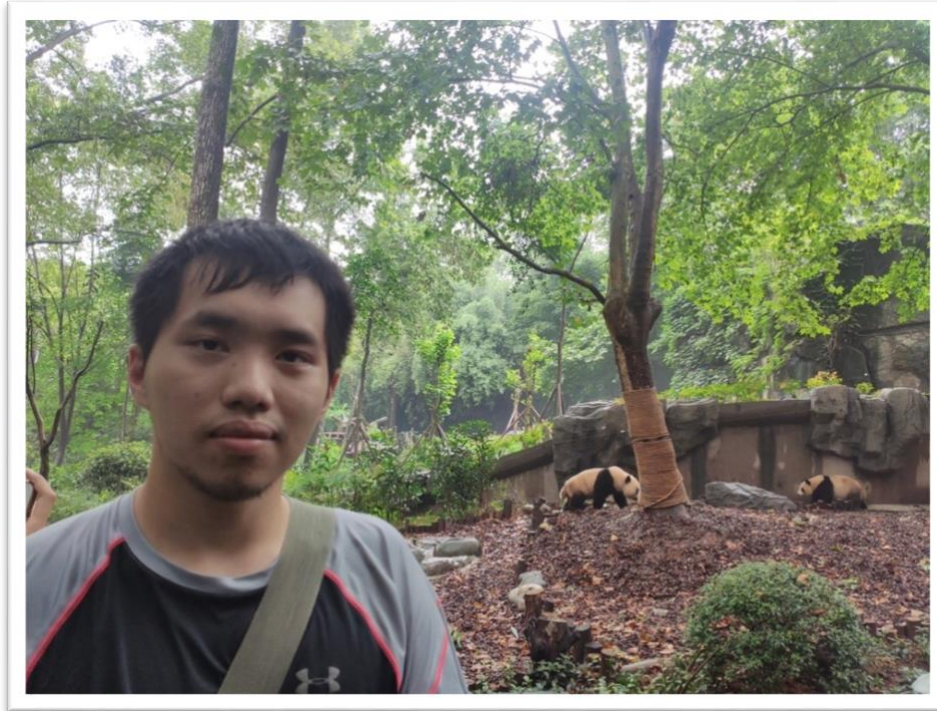
Field of Research: Model Order Reduction

Presentation Title: Model Order Reduction for Lagrangian Mechanical Systems

Mentor: Dr. Boris Kramer

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

Working on my research project has provided me the opportunity to learn about and apply scientific tools alongside the field's innovators. Doing this at such a rapid pace has shown me that I am not only able to learn this content, but that it is also something that I'd enjoy doing in a future career. Furthermore, I am grateful that this has boosted my confidence in learning new, complex topics in mathematics, computer science, and engineering, as this helps construct a sturdy foundation for future study.



Dawei Tang

Pronouns: He/Him/His

Summer Program: UC Scholars

Class Standing and College: Revelle College / junior

Major(s): Neurobiology

Field of Research: Neuroscience, Vision

Presentation Title: Explore the spatial relationships between functional maps and neuronal clustering in macaque primary visual cortex

Mentor: Dr. Edward Callaway

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

Prior to my summer project, I would never think of working so closely with computational methods from a System Neuroscience perspective. I am very grateful to have smooth communications with my research mentors and program peers so I can get much helped and supported on my questions. The boxful of emails from my research mentors (Dr. Callaway and Dr. Peichao Li) and the program coordinator (Dr. Kirsten Kung) oversee my growth as an undergraduate researcher. Eventually, the harsh hours and days that I spent on learning and manipulating computation methods turned out to be the most rewarding periods of this summer.



Mary Taylor

Pronouns: She/her/hers

Summer Program: UC-HBCU
Pharmacy

Class Standing and College:
North Carolina A&T State
University / Senior

Major(s): Chemistry

Field of Research:
Pharmaceutical Sciences

Presentation Title: Congeners
Derived from Microtubule-Active
Phenylpyrimidines Produce a
Potent and Long-Lasting Paralysis
of *Schistosoma mansoni* In Vitro

Mentor: Dr. Conor Caffery

What's the best piece of advice your research mentor has given you?

Always choose a project that you are truly passionate about because you will always produce high quality work. This resonated with me because the new research experiences that I have gained from this program are helping to define my future career goals



Kimberly Mundy

Pronouns: She/Her/Hers

Summer Program: UC-HBCU Pharmacy

Class Standing and College: North Carolina Central University / 2nd year
Graduate Student

Major(s): Pharmaceutical Science

Field of Research: Pharmaceutical Science

Presentation Title: Profiling the degradome of the parasite responsible for
Human African trypanosomiasis

Mentor: Dr. Conor Caffrey

What's the best piece of advice your research mentor has given you?

The best piece of advice my mentor has given me is when you are thinking about conducting an experiment, always research every angle of your topic, so at any turn if you run into a problem you will have a potential solution.



Besma Chaudry

Pronouns: She/Her/Hers

Summer Program: Ahmadian Fellowship

Class Standing and College: Muir College / Senior

Major(s): General Biology Major, Political Science Minor

Field of Research: Endocrinology, Metabolism, Antipsychotics, Cancer

Presentation Title: Efficacy of Kv1.3 Antibody in Cancer-Induced Cachexia

Mentor: Professor Olivia Osborn

What's the best piece of advice your research mentor has given you?

The best advice that Professor Osborn has given me is if data is unexpected or does not support our hypothesis, then we are simply one step closer to uncovering the answer to our question. Even the collection of unanticipated data is useful in molding our hypothesis and discovering new branches of the now-elaborate research question itself. Conducting research with integrity should always be prioritized, and second nature, as it not only benefits the scientific community through reproducibility success, but also humanity when successful therapeutics are developed. This invaluable advice has shaped how I conduct research and I will continue to uphold these values throughout my research career.



Alyssa Mugavero

Pronouns: She/Her/Hers

Summer Program: McNair Scholars Program

Class Standing and College: University of San Diego / Senior

Major(s): Sociology and Interdisciplinary Humanities

Field of Research: The Intersection of Sociology and the Humanities

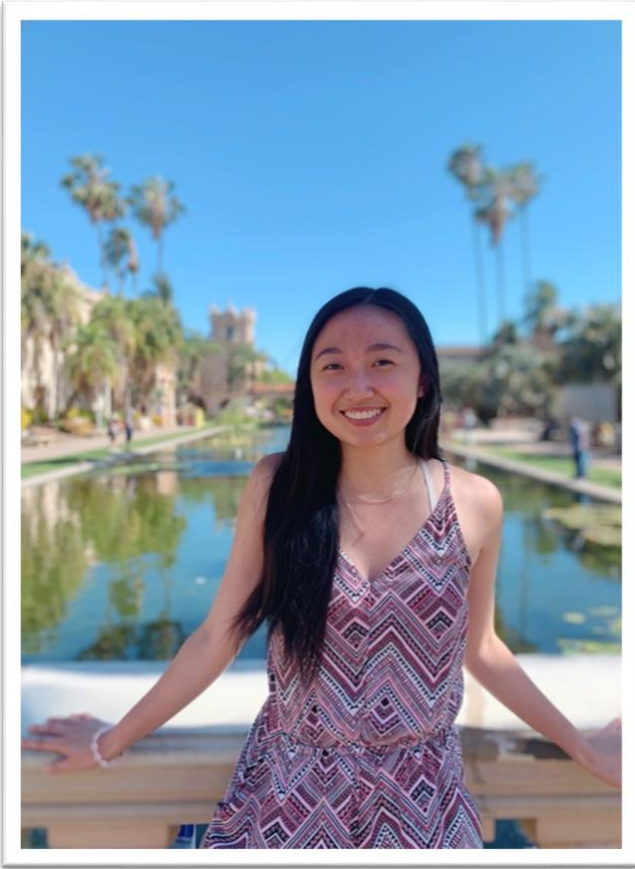
Presentation Title: Framing What We See and Know: Empathy as a Socio-Cultural Solution to Indifference

Mentor: Dr. Carlton Floyd

What's the best piece of advice your research mentor has given you?

When thinking about the best piece of advice my mentor, Dr. Floyd, has given me, the list becomes endless. I have worked with Dr. Floyd my whole undergraduate career, and I think the best way to encapsulate the plethora of wisdom and advice would be to say that he embodies and radiates a kind of patiently engaged thoughtfulness that encourages his students and others to embrace the complexities and contradictions of life by seeking to critically explore them. Seemingly, in a way, we are all looking for answers of some sort, and we would prefer to obtain these answers fast and without too much trouble.

By example, Dr. Floyd has taught me to slow down to find understanding, answers of some means, that have always emphasized our human ability to connect with each other. Through this, Dr. Floyd has shown me the importance of being thoughtfully empathetic and understanding to others.



Shiantel Chiang

Pronouns: She/her/hers

Summer Program: Maryam Ahmadian Fellowship

Class Standing and College: ERC / Junior Standing

Major(s): Neurobiology

Field of Research: Women's Health, Gut Microbiome

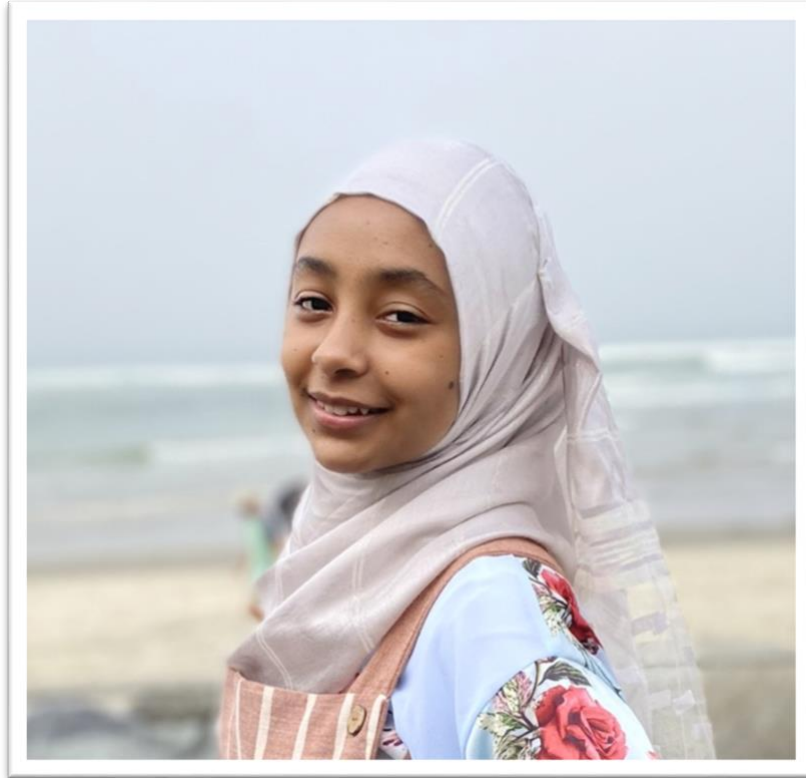
Presentation Title: The Role of Gut Microbial Bile Acid

Deconjugation on PCOS

Mentor: Dr. Amir Zarrinpar

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

The most challenging yet meaningful experience I've gained is learning to respond to unexpected obstacles and unfamiliar circumstances throughout this research project. My undergraduate courses generally equip me with established facts, but I realize it is never so clear-cut when you work with the unknowns and unanswered questions. Yet pursuing answers to those questions is so exciting, and I am grateful for the overwhelming support of the people in our lab who walk me through it and support my growth as a scientist.



Eman Abdulkadir

Pronouns: She/Her/Hers

Summer Program: CoB-KIBM Scholars Program

Class Standing and College: ERC / Junior Standing

Major(s): Cognitive and Behavioral Neuroscience

Field of Research: Cognitive and Behavioral Neuroscience

Presentation Title: Role of Orbitofrontal Cortex in Action Shifting

Mentor: Dr. Christina Gremel and Christian Cazares

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

The most meaningful experience for me was the overall opportunity to work with my mentors who are as invested in my academic growth as I am. They helped me to develop new skills which I will carry through my life. I remember, specifically, how dedicated they were in teaching me how to use MatLab and similar data analysis programs. My mentors make it a point to demonstrate while teaching, which was extremely effective in my growth process.

Conference Participants and Sponsoring Programs

Undergraduate Research Hub, Summer Research Program

UC San Diego

Ahmadian Fellowship

Besma Chaudry

Shiantel Chiang

Biorepository Student Assistant

Ryan Park

Pauline Tran

California Alliance for Minority Participation (CAMP)

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Jennifer Mendez

Alexander Perez de Leon

Sheemrun Ranjan

California Sea Grant

Jair Cortes

Center for Research Computing & iSURE at UND

Tzu-chien Lin

CoB-KIBM

Eman Abdulkadir

Colors of the Brain

Marissa Evans

Khoa Nguyen

Lauren Valdez

Corr lab

Chao-Chin Hsu

Gwendalynn Stilson

Creating Scientists to Address Cancer Disparities Program

Stefani Acosta

Ailyn Alicea

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Jenna Balingit

Anthony Cirilo

Andrea Contreras

Elisa Dephilippis

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Jordan Gomezpadilla

Geenee Gonzales

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Megan Korhummel

Viena Le

Amy Loeber

Hiela Manely

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Amaya Mendez-Molina

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Martin Montiel

Tin Nguyen

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Amber O'Brien

Brenda Ochoa

Gabriela Ortega-Arvizu

Mitchell Pernia

Antonia Esmeralda Sajche Sapon

Bettina Suarez Davila

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Pixie Rose

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Asim Mohiuddin

Kevin Caden Memorial Diversity Research Grant

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Purnima Qamar

Louis Stokes California Alliance for Minority Participation (CAMP)

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McNair Scholars Program

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Allyson Teague
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Alex Zhao

Moores Cancer Center Biorepository

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Oscar Calzada
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Multidisciplinary Educational Approach to Reducing Cancer Disparities Program

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Angelina Lopez
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Marianne Alonzo
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Mina Balen
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Brandon Bourassa
Kaimana Bright
Olivia Bryan
Yueyang Cai
Diana Calderon
Dylan Calvao
Juancarlos Cancilla
Jonathan Carreon
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Evan Clark
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Joseph Tsai
Matthew Uzelac
Garret Wang
Cameron Wang

Farsamin Warisha
Benjamin Werb
Katherine Wong
Sophia Wynn
Yasmin Yacoubian
Emmie Yao
Dongmin Yoon
Claire Zhang

UROC

Evelyn Rodarte
Lindsey Sanchez

**Walker Lab, Department of Biomedical
Sciences**

Sadie Barbee

Youth Enjoy Science (YES)

Nicolette Le
Yilin Xu

Panel Details

Thursday: Morning Session I

Panel 01: Marine Ecology & Biodiversity

Zoom Room: Angela Davis

Thursday 9:00-10:00

Moderator: Melissa Carter

Angelica Dimas - UC San Diego

Mentor: Dr. Jennifer Smith

Do competitive interactions predict demographic outcomes for common corals on Rarotonga?

Barbara Saucedo - UC San Diego

Mentor: Dr. Douglas Bartlett

Optimizing fluorescent tagging of active microbial cells in deep-sea seafloor sediments

Maria Angst - University of San Diego

Mentor: Drew Talley

Update of ichthyofaunal utilization of created versus natural salt marsh creeks in Mission Bay, CA

Emma Smith - UC San Diego

Mentor: Melissa Carter

Differences between biofouling communities underneath Southern California piers

Panel 02: Reproductive Medicine II

Zoom Room: Eleanor Mariano

Thursday 9:00-10:00

Moderator: Dr. Cole Ferguson

Celine Bojo - UC San Diego

Mentor: Dr. Pamela Mellon

Effects of SOX2 Mutations on Kisspeptin Expression

Jessica Jang - UC San Diego

Mentor: Dr. Kellie Breen Church

**A new Kiss1hrGFP x Sun1GFP crossed transcriptomic mouse model to analyze arcuate
Kisspeptin neurons**

Farsamin Warisha - UC San Diego

Mentor: Dr. Heidi Cook-Andersen

Deciphering Mechanisms of Global Transcriptional Silencing in the Mammalian Oocyte

Beatriz Martinez-Martin - University of San Diego

Mentor: Dr. Nicole Danos

Effects of Pregnancy On A Woman's Musculoskeletal System

Panel 03: Reproductive Medicine I

Zoom Room: Flossie Wong-Staal

Thursday 9:00-10:00

Moderator: Dr. Jason Kreisberg

Shawn Ogden - San Diego State University

Mentor: Dr. Scott Kelley

**Effects of the gut microbiome on polycystic ovarian syndrome: relationship to endometrial
cancer deaths in African American women**

Michelle He - UC San Diego

Mentor: Dr. Pamela Mellon

**Circadian regulation of female fertility by projections of suprachiasmatic nucleus
neuromedin-S neurons onto the neuroendocrine reproductive axis**

Shiantel Chiang - UC San Diego

Mentor: Dr. Amir Zarrinpar

The Role of Gut Microbial Bile Acid Deconjugation on PCOS

Eric Boone - UC San Diego

Mentor: Dr. Heidi Cook-Andersen

Regulation of mRNA in Early Embryo

Panel 04: Literature & Critical Theory

Zoom Room: K. Megan McArthur

Thursday 9:00-10:00

Moderator: Dr. Tera Reid

Fartoon Hagi-Mohamed - UC San Diego

Mentor: Dr. Stephanie Jed

Memoir Writing and Intergenerational Trauma: the Reparative Power of the Personal Narrative

Elisa Ady - UC San Diego

Mentor: Dr. Andrea Mendoza

Empire and Indigeneity in Magical Realism: A Colonial Unraveling

J Martin - UC San Diego

Mentor: Professo Sal Nicolazzo

Trans Romanticism

Bethelihem Gebremeske

Menotr: Dr. Dennis Trinidad

Child Marriage in Ethiopia: Too young for Marriage

Panel 05: Metabolic Syndrome and Eating Disorders

Zoom Room: Kathleen Rubins

Thursday 9:00-10:00

Moderator: Olvia Osborn

Erick Macario – University of California, Merced

Mentor: Dr. Rudy M. Ortiz

5 Weeks of Oral Cannabidiol Improved Blood Glucose Tolerance in Otsuka Long-Evans Tokushima Fatty (OLETF) Rats

Jennifer Mendez - UC Merced

Mentor: Dr. Rudy M. Ortiz

5 Weeks of Oral Cannabidiol Improved Blood Glucose Tolerance in Otsuka Long-Evans Tokushima Fatty (OLETF) Rats

Juancarlos Cancilla - UC San Diego

Mentor: Pam Taub

The Effects of Time Restricted Eating on Patients with Metabolic Syndrome

Dongmin Yoon - UC San Diego

Mentor: Professor Olivia Osborn

Simulation of Binge Eating Disorder in mice

Panel 06: Material Science and Nanoengineering

Zoom Room: Khaled Hosseini

Thursday 9:00-10:00

Moderator: Mitchell Kong

Nathan Bradshaw - UC San Diego

Mentor: Dr. Andrea Tao

Clinic-Friendly Sensor: Proof-of-concept for SARS-CoV-2 Antibodies

Judy Mohamad - UC San Diego

Mentor: Dr. Mike Tolley

Pneumatic Foam Jamming Feet for Stabilizing Walking Robots

Alexander Fuqua - UC San Diego

Mentor: Dr. Andrea Tao

Simulating the Optical Properties of Ag Nanocubes Assembled in a Checkerboard Pattern

Sebastian Marroquin – California State University, Long Beach

Mentor: Tod Pascal

Exploring Phase Transitions in Nanoconfined Media From First Principles

Panel 07: Chemistry and Biochemistry

Zoom Room: Kim Stanley Robinson

Thursday 9:00-10:00

Moderator: Bryce Ackermann

Dahae Lee - Seoul National University of Medicine, South of Korea

Mentor: Michael J. Sailor

Investigation of quantitative measure of the uptake pSi fusogenic nanoparticles (FNP) in cell culture by time-gated photoluminescence.

Zainab Goawala - University of San Diego

Mentor: Dr. Lauren Benz

Defect Engineering of MOFs to Enhance Molecular Adsorption

Ju Ying Shang and Hannah Chen - UC San Diego

Mentor: Prof. Michael Sailor

Investigating ambient stability and sensitivity of chemical sensors based on photoluminescent, quantum-confined porous silicon nanoparticles

Francisco Morales - Cabrillo College

Mentor: Professor Michael Sailor

Effect of Porous Silicon Microparticle Size on HIV Pre-Exposure Prophylaxis Loading Capacity

Panel 08: Developmental Psychology and Cognitive Science I

Zoom Room: Linus Pauling

Thursday 9:00-10:00

Moderator: Emma Geller

Kelsea Jackson - Spelman College

Mentor: Dr. Lindsey Powell

Infants' Understanding of Ownership Rights

Alexandria Chargois - Spelman College

Mentor: Dr. Gail Heyman

Children's structural reasoning about social group differences

Isabel Herrera Guevara - UC San Diego

Mentor: Dr. Lindsey Powell

Emotional evaluation of others' goals

Celeste Salinas - CSU Fullerton

Mentor: Dr. Leslie J. Carver

The Early Development of Joint Attention in Autism Spectrum Disorder

Panel 09: Molecular Biology and Biochemistry

Zoom Room: Mario Molina

Thursday 9:00-10:00

Moderator: Ray Berkeley

Harriet Song - UC San Diego

Mentor: Professor Elizabeth Komives

The inhibition of the urokinase-type plasminogen activator (uPA) with and without the amino-terminal fragment (ATF)

Ashleigh Ayers - UC San Diego

Mentor: Anthony O'Donoghue

Cathepsin G and Its Role in Cistic Fibrosis and Chronic Pulmonary Obstructive Disease

Vicky Chen - UC San Diego

Mentor: Brian Zid

Translation elongation and its effect on the localization of nuclear-encoded mitochondrial mRNAs

Ziming Zhou - UC San Diego

Mentor: Dr. Michael Sailor

Harnessing the Chemistry of Mesoporous Silicon to Prepare "Armor-Clad" Enzymes with Improved Catalytic Performance

Panel 10: Mechanical and Aerospace Engineering

Zoom Room: Rachel Axler

Thursday 9:00-10:00

Moderator: Dr. Joaquin Camacho

Gerardo Ontiveros Cortes - UC San Diego

Mentor: Olivia Graeve

Thermal Conductivity of Water-Based Alumina Nanofluids

Matthew Vigil - UC San Diego

Mentor: Dr. George Tynan

Testing Steady-State Operations of The Water Cooled Plasma Source in PISCES-RF

Justin Burzachiello - UC Riverside

Mentor: Professor Boris Kramer

Model Order Reduction for Lagrangian Mechanical Systems

Kevin Hu - UC San Diego

Mentor: Dr. John T. Hwang

Efficient Sparse Matrix Solvers in Python for Large-scale Design Optimization

Panel 11: Memory and Learning

Zoom Room: Jimmy Yang

Thursday 9:00-10:00

Moderator: Dr. Ece Bayram

Roshni Choksi - CSU Long Beach

Mentor: Dr. Timothy Brady

Visual Long term Memory can replace Active Maintenance in Visual Working Memory

Sheemrun Ranjan - UC Merced

Mentor: Dr. Kristina Backer

Using Informative and Uninformative Retro-Cues to Observe the Interaction Between Auditory Attention and Working Memory

Akemi Ito and Michelle Zaichik - University of San Diego

Mentor: Dr. Jena Hales

Using DREADDs to Examine the Role of the Hippocampus in Processing Elapsed Time

Panel 12: Aerospace Engineering

Zoom Room: Vernor Vinge

Thursday 9:00-10:00

Moderator: TBA

Taeho Jeong - UC San Diego

Mentor: Professor John T. Hwang

Design optimization of lithium-ion batteries for eVTOL aircraft to improve cycle life under safety constraints

Tanner Ragan - UC Merced

Mentor: Dr. Oliver Schmidt

Flow Characterization of Plasma Actuated Flat Plate

Yidi Gao - UC San Diego

Mentor: Dr. Carlos Coimbra

Thermal Switch Design for Lunar/Martian Rovers

Daniel Maldonado Naranjo - UC San Diego

Mentor: Dr. Sylvia Herbert

**Integrating Simulink Models to Reachability Analysis for Safe Control of Novel Aerial Vehicles
from NASA**

Thursday: Morning Session II

Panel 13: Aquatic Microbiomes

Zoom Room: Angela Davis

Thursday 10:10-11:10

Moderator: Melissa Carter

Keeley Lanigan - UC San Diego

Mentor: Professor Jonathan Shurin

**Zooplankton microbiomes: how their adaptation to food quality changes is essential to
ecosystem services of alpine lakes**

Zachary Daniel - UC San Diego

Mentor: Jack Gilbert

Oyster and Abalone Microbiomes and the Effects of Associated Diseases

Samantha Hanauer - UC San Diego

Mentor: Professor Bradley S. Moore

The Marine Sponge Microbiome

Ryan Koch - UC San Diego

Mentor: Dr. Sara Jackrel

**Studying the Algal Microbiome to Help Predict and Mitigate the Impact of Harmful Algal
Blooms Amidst Global Environmental Change**

Panel 14: Gene Drive Applications

Zoom Room: Eleanor Mariano

Thursday 10:10-11:10

Moderator: Dr. Cole Ferguson

Katya Marchetti - UC San Diego

Mentor: Dr. Paul Grossfeld

Investigating the Role of Erythroblast Transformation Specific (ETS1/ETS2/ETV2) Genes in Hypoplastic Left Heart Syndrome

Tevykah Pouv - UC San Diego

Mentor: Dr. Omar Akbari

Generating Dengue Resistant Transgenic Aedes Aegypti Mosquitoes Using HomeR Drive System

Ximena Gonzalez - UC San Diego

Mentor: Dr. Trey Ideker

Role of CDK1 gene in cancer progression

Yasmin Yacoubian - UC San Diego

Mentor: Dr. Shyamanga Borooah

Optimizing CRISPR-Cas9 Gene Editing in Retinal Pigment Epithelial Cells Expressing Autosomal Dominant Inherited Retinal Dystrophy

Panel 15: COVID-19 in Medicine

Zoom Room: Flossie Wong-Staal

Thursday 10:10-11:10

Moderator: Dr. Jason Kreisberg

Steven Luong - UC San Diego

Mentor: Dr. Michael David

The effects of Human Schlafen-11 Protein on SARS-CoV-2 Viral Replication

Matthew Uzelac - UC San Diego

Mentor: Dr. Weg Ongkeko

ER stress associated gene expression among COVID-19-infected adipose tissue

Daniel John - UC San Diego

Mentor: Dr. Weg Ongkeko

The Immune Landscape of COVID-19 and Cardiovascular Disease

Anjali Iyengar - UC San Diego

Mentor: Dr. Weg Ongkeko

Analysis of long-haul COVID-19 symptoms based on clinical variables

Panel 16: Performances of Gender, Grief, & Horror

Zoom Room: K. Megan McArthur

Thursday 10:10-11:10

Moderator: Dr. Tera Reid

Justin Savage - UC San Diego

Mentor: Professor Todd Salovey

Le Théâtre du Grand-Guignol: Its Practice, Themes, and Importance to a Modern World

Zion Igwe - UC San Diego

Mentor: Professor Matthew Herbst

Women in Nollywood vs Hollywood

Denia Marquez - UC San Diego

Mentor: Monique Wonderly

Addiction, Attachment, and the Ethics of Grief in Recovery

Panel 17: Compassion and Mindfulness in Medicine

Zoom Room: Kathleen Rubins

Thursday 10:10-11:10

Moderator: Olivia Osborn

Alessandra Serrano - UC San Diego

Mentor: Dr. Hemal Patel

Visualizing and Analyzing the Effects of Meditation in Blood Physiology

Serly Tomas - UC San Diego

Mentor: Hemal Patel, PhD

Analysis of plasma metabolites, lipids and proteins changes due to meditation

Nkechinyere Iroanusi - UC San Diego

Mentor: Dr. Tanaka

What Does Compassion Mean to Uninsured and Under-Resourced Communities of Color?

Carolina Lopez - UC San Diego

Mentor: Dr. Fadel Zeidan

The effects of compassion-based mental training on brain mechanisms that support pain-relief, the cultivation of empathy, and the development of compassion

Panel 18: Bioinformatics, Computation, and Biological Science

Zoom Room: Khaled Hosseini

Thursday 10:10-11:10

Moderator: Mitchell Kong

Aditi Gnanasekar - UC San Diego

Mentor: Dr. Weg Ongkeko

Integrating clinical, genomic, and transcriptomic data to determine the influence of transfer RNA expression on head and neck cancer progression

Shoh Mollenkamp - UC San Diego

Mentor: Dr. Yatish Turakhia

Real-time SARS-CoV-2 phylogenetics

Kanksha Patel - UC San Diego

Mentor: Dr. Karsten Zengler

Genome-Scale Metabolic Modeling of Picochlorum Renovo

Jasmine Castellanos -

Mentor: Dr. Graham McVicker

PMachine learning model predicts the level of open chromatin from genetic variants

Panel 19: Drug Delivery and Medicine

Zoom Room: Kim Stanley Robinson

Thursday 10:10-11:10

Moderator: Bryce Ackermann

Ana Raquel Carvalho Bertao - University of Minho

Mentor: Dr. Michael J. Sailor

Approach for cancer therapy based on mesoporous silicon nanoparticles delivering a combination of chemotherapeutic and antibiotic agents

Rachel Lee and Rachel Myers - UC San Diego

Mentor: Professor Michael Sailor

Improving Drug Loading of Rifampicin in Porous Silicon Nanoparticles for Tuberculosis Treatment

Aline Irafasha - Wellesley College

Mentor: Akif Tezcan

Entrapment of Macromolecular Cargo Within Polymer-Integrated Crystals (PIX)

Anny Lam - UC San Diego

Mentor: Dr. Carlo Ballatore

Phenylpyrimidines as Candidate Molecules for Anti-schistosomal Treatment

Panel 20: Developmental Psychology and Cognitive Science II

Zoom Room: Linus Pauling

Thursday 10:10-11:10

Moderator: Emma Geller

Marianne Alonzo - UC San Diego

Mentor: Professor Gedeon Deak

Early Maternal Speech Influence on Later Infant Language Development

Rosalba Bonilla - University of San Diego

Mentor: Dr. Kristen McCabe

The relation of parenting style to treatment rationale preference in Behavioral Parent Training interventions

Purnima Qamar - UC Riverside

Mentor: Dr. Kalina Michalska

Parental negative emotionality moderates the relationship between affective empathy and depressive symptoms in Latina girls

Panel 21: Organic Chemistry

Zoom Room: Mario Molina

Thursday 10:10-11:10

Moderator: Ray Berkeley

Danielle Etiel - University of San Diego

Mentor: Jessica Bell

Phosphorylation as a Regulatory Mechanism of Protein-Protein Interactions

Rebeca Lopez - UC San Diego

Mentor: Dr. Erik Romero

Activation of Aminoboranes using Lewis Bases

Jacob Kelber - UC San Diego

Mentor: Professor Joshua Figueroa

Synthesis of Trianilinophosphines Via Phosphorus Trichloride and Lithium Anilide Precursors

Erick Cervantes - UC San Diego

Mentor: Dr. Dionicio Siegel

Synthesis of Anti-Cancer Chemical Groups

Panel 22: Nanomaterials and Energy Storage

Zoom Room: Rachel Axler

Thursday 10:10-11:10

Moderator: Dr. Joaquin Camacho

Juliana Foley - UC San Diego

Mentor: Darren Lipomi

Degradation Rate of Perovskite Solar Cells with Multi-Layer Graphene Barriers

Jose Figueroa Jr - St. Mary's University

Mentor: Dr. Shirley Meng

Fluorinated Graphite as High Energy Density Cathode for Primary Lithium Battery

Simon Danitz - UC San Diego

Mentor: Dr. Zheng Chen

Characterization of Stretchable Hydrogel Electrolytes for Zinc-Air Batteries

Panel 23: Neuroscience, Computation, and Technology

Zoom Room: Jimmy Yang

Thursday 10:10-11:10

Moderator: Dr. Ece Bayram

Noura Mohamed - UC San Diego

Mentor: Dr. Gulcin Pekkurnaz and Haoming Wang

Spatial Regulation of Glycolytic Enzymes on Mitochondria in Neurons

Ayanna Horn - Xavier University of Louisiana

Mentor: Dr. Chengbiao Wu

Neuropathy in Degenerative Diseases

Thandiwe Bush - Xavier University of Louisiana

Mentor: Dr. Chengbiao Wu

Axonal Dysfunctions in Tauopathies

Maxime Ghesquiere - UC San Diego

Mentor: Professor Mark Ettenhofer

Eye tracking in VR for diagnosis of neurological conditions

Chao-Li Wei - UC San Diego

Mentor: Professor Vikash Gilja

Unsupervised Channel Compression Methods in Motor Prosthesis Design

Panel 24: Medical Applications of Electrical and Computer Engineering

Zoom Room: Vernor Vinge

Thursday 10:10-11:10

Moderator: Cheolhong An

Neelay Joglekar - UC San Diego

Mentor: Professor Michael Yip

Simulation and Control of Continuum Catheter Robot

Darell Chua Yun Da - UC San Diego

Mentor: Professor Karcher Morris

Development of visual-based sensor system for detecting head and neck motion of a surgeon

Eric Wang - UC San Diego
Mentor: Professor Tina Ng
Objective assessment of motor disorder

Daniel George, Derek Chen, and Xiaoye Zuo - UC San Diego
Mentor: Dimitri Schreiber
Breathing Lung Phantom for CT-guided Needle Biopsy

Thursday: Morning Session III

Panel 25: Conservation and Environmental Science

Zoom Room: Angela Davis
Thursday 11:20–12:20
Moderator: Melissa Carter

Dylan Calvao - UC San Diego
Mentor: Melissa Carter
Biofouling Reduction System for Moored Ocean Sensors

Frederick Rajasekaran - UC San Diego
Mentor: Jane Teranes
Engineering a Smart Irrigation System at UCSD

Melissa Lepe - UC Irvine
Mentor: Dr. Ingrid Tomac
Hydrophobic particle-air-water mixtures in post-wildfire mudflows

Jonathan Carreon - UC San Diego
Mentor: Professor Qiang Zhu
Achieving Sustainability in the Aviation Industry

Panel 26: Cancer: Risk and Screening Disparities

Zoom Room: Eleanor Mariano
Thursday 11:20–12:20
Moderator: Dr. David Artis

Hiea Manely - UC San Diego

Mentor: Georgia Sadler

Barriers to Breast Cancer screening faced by Immigrant Muslim women in the United States

Bettina Suarez Davila - UC San Diego

Mentor: Dr. Sadler

Factors Explaining Higher Rates of Breast Cancer in Hispanic Women in the United States than Hispanic Women in Mexico

Amaya Mendez-Molina - UC San Diego

Mentor: Dr. Georgia Sadler

Cultural barriers of diagnosing and treating cancer within the indigenous Hispanic community

Tin Nguyen - UC San Diego

Mentor: Dr. Georgia Sadler

Factors explaining higher cancer rates in Vietnamese immigrants in the United States

Panel 27: Hormones

Zoom Room: Flossie Wong-Staal

Thursday 11:20–12:20

Moderator: Jason Kreisberg

Kaimana Bright - UC Santa Cruz

Mentor: Professor Amit Majithia

Effects of Hormone Replacement Therapy on Adipocytes

Kaelyn Ford - UC San Diego

Mentor: Dr. Varykina Thackray

Role of hyperandrogenism in the auto-regulation of androgen receptor expression

Theresa Slaiwa - UC San Diego

Mentor: Dr. Pamela Mellon

Investigating the Regulation of FSHB Transcription by Novel 5' Upstream Enhancers

Sadie Barbee - UC Riverside

Mentor: Dr. Ameae Walker

Prolactin upregulates SF3 Prolactin Receptor Expression in the Mouse Liver

Panel 28: Storytelling through Dance, Clothing, & Video Games

Zoom Room: K. Megan McArthur

Thursday 11:20–12:20

Moderator: Dr. Tera Reid

Faiza Qureshi - University of San Diego

Mentor: Maria Kniazeva

From a Garment to a Piece of Art: Heritage & Enchantment in the Fashion Marketplace

Thomas Lim - UC San Diego

Mentor: Dr. Dayna Kalleres

Alternative Salvations: Final Fantasy and Its Critique on Institutional Religion

Eden Evans - UC San Diego

Mentor: Professor Amy Alexander

Stories in Motion: Exploring the Intersections of Movement, Narrative, and Computer Vision

Panel 29: Molecular Studies in Cancer I

Zoom Room: Kathleen Rubins

Thursday 11:20–12:20

Moderator: Olivia Osborn

Jeffrey Liu - UC San Diego

Mentor: Dr. Jessica Wang-Rodriguez

Characterizing the fungal microbiome for thyroid cancer prognosis

Besma Chaudry - UC San Diego

Mentor: Professor Olivia Osborn

Efficacy of Kv1.3 Antibody in Pancreatic Cancer-Induced Cachexia

Andres Espinoza - Other

Mentor: Dr. Evan Snyder

Changes in HCC827 cancer signaling between 2D and 3D models

Ronald Horne - UC San Diego

Mentor: Dr. Tannishtha Reya

Determining Molecular Dependencies in Pancreatic Tumor Initiation and Regulation

Panel 30: Nanoengineering

Zoom Room: Khaled Hosseini

Thursday 11:20–12:20

Moderator: Mitchell Kong

Erick Alvarado and Junlin Wu - UC San Diego

Mentor: Tod Pascal

Directed self-assembly of metal nanocrystals using complementary strand of DNA

Everbrook Zhou – UC San Diego

Mentor: Professor Tod Pascal

Monte Carlo Simulations of the Self Assembly of DNA – Ag Nanoparticle systems

Jason Wu, Yazmin Hernandez, and Lauren Waggoner – UC San Diego

Mentor: Professor Michael J. Sailor

Synergistic effects of antibiotic payloads co-loaded in porous silicon nanoparticles against *Pseudomonas aeruginosa*

Danielsen Moreno, Alexander Boakye, and Freddy Garcia - New Mexico Institute of mining and Technology, Howard University, Farmingdale State College

Mentor: Oscar Vazquez Mena

Handling the thinnest material: How to transfer graphene from a Cu foil to a Silicon chip

Panel 31: Plant Biology

Zoom Room: Kim Stanley Robinson

Thursday 11:20–12:20

Moderator: Benjamin Dadpey

Jada Bezue - Xavier University of Louisiana

Mentor: Dr. Julian Schroeder

CO₂ Regulation of Stomatal Movement and Development

Wai Lam Hong - UC San Diego

Mentor: Dr. Joanne Chory

Identifying Mutations of PPC₃ in *Arabidopsis thaliana*

Destiny Parker - University of Maryland Eastern Shore

Mentor: Dr. Zhao Yunde

**Influence of growth regulator concentrations on in vitro rooting and plant regeneration in
Vitis**

Sabrina Lin - UC San Diego

Mentor: Dr. Julian Schroeder

Identifying Putative Candidates Involved in Stomatal Movement

Panel 32: Language and Communication

Zoom Room: Linus Pauling

Thursday 11:20–12:20

Moderator: Emma Geller

Jeffrey Xing - UC San Diego

Mentor: Dr. Timothy Gentner

**Songbirds as Composers: Understanding Animal Communication with Music and Auditory
Aesthetics**

Evelyn Rodarte - UC Merced

Mentor: Dr. Heather Bortfeld

Known-Word Facilitation Effect of Artificial Speech Segmentation in Spanish-English Bilinguals

Kasandra Barajas and Alexair Gonzalez - CSU San Marcos

Mentor: Dr. Victor Ferreira

Are mental events structured propositionally?

Daisy Santana - CSU San Marcos

Mentor: Dalia Garcia

**Who Converts: Examining Speech Patterns in Older Adults that predict the Development of
Alzheimer's Disease.**

Panel 33: Structure and function in Biochemistry

Zoom Room: Mario Molina

Thursday 11:20–12:20

Moderator: Ray Berkeley

Jacqueline Leon - UC Merced

Mentor: Dr. Liang Shi

Modeling Amide-I Vibrational Circular Dichroism of Peptides

Elanor Sievers - UC San Diego

Mentor: Professor Debelouchina

Determining the structure of a cysteine-less intein and improving its splicing efficiency using NMR spectroscopy and splicing assays.

Jay Golden - UC San Diego

Mentor: Dr. Melissa Gymrek

Exploring the Structure of Transmembrane Protein Helical Bundles using Computational and Laboratory Methods

Panel 34: Topics in Engineering

Zoom Room: Rachel Axler

Thursday 11:20–12:20

Moderator: Dr. Joaquin Camacho

Clara Medina - UC Merced

Mentor: Dr. Colleen Naughton

Equity of Wastewater Monitoring of SARS-CoV-2 in California

Nikhil Dange - UC San Diego

Mentor: Professor Karcher Morris

Improving CircuitPython Development Environments

Jacqueline Puga - University of San Diego

Mentor: Dr. Gordon Hoople

Sculpture Ideation Process

Anthony Palazzolo - UC San Diego

Mentor: Professor Prasad Gudem

Orientation Tracking of Boomerang Flight Behavior Using Onboard IMU Technology

Panel 35: COVID-19, Mental Health, and Social Interactions

Zoom Room: Jimmy Yang

Thursday 11:20–12:20

Moderator: Dr. Ece Bayram

Ryan Hajj - UC San Diego

Mentor: DR. Robert Rissman

COVID-19 survivors and long term neurological problems

Nancy Mendoza Estrada - CSU Northridge

Mentor: Dr. Lisa Eyer

**The Examination of the Relationship Between Levels of Loneliness and Cognitive Performance
During the Coronavirus Pandemic in Older Adults**

Kaitlin Williams - University of San Diego

Mentor: Dr. Jennifer Zwolinski

**Influence of Fears of COVID-19 and Overall Psychological Distress on Willingness to Use
Telemental Health**

Isabel Tate - UC San Diego

Mentor: Professor John H. Evans

**Examining the Factors Behind the Facilitation of Social Cohesion Through Online Interactions
During the Covid-19 Pandemic**

Panel 36: Educational Technology

Zoom Room: Vernor Vinge

Thursday 11:20–12:20

Moderator: Anvita Komarla

Laura Vlahakis - UC San Diego

Mentor: Professor Karcher Morris

Developing Educational Tools to Integrate Circuits and Python

Shantelle Megan Serafin - UC San Diego

Mentor: Professor Shannon Ellis

GEM - Mobile Application Game for Female Self-Development

Christian Cruz - California State University Northridge
Mentor: Dr. Thomas Bussey
Augmented Reality as a Visual Learning Tool in Biochemistry

Kendrick Nguyen - UC San Diego
Mentor: Professor Karcher Morris
Appealing to High School Students in Developing Early ECE Technical Skills: Pairing ECE with Creativity

Thursday: Afternoon Session I

Panel 37: Neuroscience I

Zoom Room: Eleanor Mariano
Thursday 1:30–2:30
Moderator: Dr. Timothy Machado

Anna Hakimi - UC San Diego
Mentor: Nicholas Spitzer
Effect of Running-induced Neurotransmitter Switching in Adult Mouse Hilus on Episodic Memory

Jan Hsiao - UC San Diego
Mentor: Dr. Sreekanth Chalasani
Identification of Ultrasound-sensitive Ion Channels in Bioluminescent Dinoflagellates

Qilin Zhao - UC San Diego
Mentor: Brenda Bloodgood
Experience Dependent Visual Cortex Development

Kaylauni Cisneros - UC San Diego
Mentor: Christina Sigurdson
The Effect of Prion Protein Charge Residues on Neuronal Dendritic Beading

Panel 38: Health Care, Disparities, and Inclusivity

Zoom Room: Flossie Wong-Staal
Thursday 1:30–2:30
Moderator: Miss Ruby Oasoria

Amy Loeber - UC San Diego

Mentor: Dr. Sadler

Exploring the Impacts of Cis-normative Structures on Transgender Men with Breast Cancer

Brooklyn Moore - UC San Diego

Mentor: Dr. Stephen Rawling

Changing Treatment : A look into the advancement for transgender healthcare procedures

Geenee Gonzales - San Diego State University

Mentor: Dr. Vanessa Malcarne

Reasons for the Greater Adverse Effects of Obesity on Breast Cancer Risk and Survival Among Asian American Women

Panel 39: Neuroscience III

Zoom Room: K. Megan McArthur

Thursday 1:30–2:30

Moderator: Dr. Shelley Warlow

Vanessa Barragan - CSU Fullerton

Mentor: Dr. Lara Rangel

Oscillatory patterns in the dentate gyrus of the hippocampus during the evaluation of visual cues in a delayed-match-to-sample task

Pixie Rose - UC San Diego

Mentor: Dr. Christina Gremel

Measuring Activity of Mediodorsal Thalamic Inputs into Dorsomedial Striatum During Decision-Making

Athena Leisching - UC San Diego

Mentor: Dr. Lara Rangel

Dynamic dentate gyrus recruitment during the formation of distinct memories

Christopher Creighton - California State University, Fullerton

Mentor: Dr. Lara Rangel

Assessing the Function of the Dentate Gyrus Using a Spatial Associative Learning Task

Panel 40: Molecular Studies in Cancer II

Zoom Room: Kathleen Rubins

Thursday 1:30–2:30

Moderator: Benyamin Dadpey

Shruti Magesh - UC San Diego

Mentor: Dr. Jessica Wang-Rodriguez

Pan-cancer characterization of the fungal microbiome and immune associated elements across five gastrointestinal cancers

Phillip Pham - UC San Diego

Mentor: Dr. Kathleen Curtius

Determining whole genome doubling in low-pass sequencing of ulcerative colitis

Wei Ji Chen - UC San Diego

Mentor: Stephanie Fraley

Assessing the Effects of Collagen Mutations on Cancer Cell Migration

Panel 41: Physics and Applied Mathematics

Zoom Room: Khaled Hosseini

Thursday 1:30–2:30

Moderator: Rui Liu

Hollywood Banayad - San Francisco State University

Mentor: Dr. Monica Allen

Utilizing MATLAB Interface to Communicate with Hardware (Lock-in Amplifier)

Tai Nguyen - UC San Diego

Mentor: Javier Duarte

Finn/hls4ml merge

Yixuan Peng - UC San Diego

Mentor: Professor Alexander Cloninger

Analysis of Return Time in Diffusion Maps

Maya Bocanegra - CSU Northridge

Mentor: Dr. Shaochen Chen

Mathematical analysis of coral algae photosynthesis efficiency under varying architecture and optical properties

Panel 42: Nanoengineering and Medicine

Zoom Room: Kim Stanley Robinson

Thursday 1:30–2:30

Moderator: Dr Zheng Chen

Lenny McCline - UC Los Angeles

Mentor: Professor Jon Pokorski

Materials Optimization for Painless, Self-Administered, Injection-Molded, and Non-Refrigerated Microneedle Vaccine Devices

Sachel Jetly and Ulises Gutierrez Nunez

Mentor: Professor Michael Sailor

“Study of Silicon: Calcium Fluoride core:shell Nanoparticles as a Potential Imaging Agent for Positron Emission Tomography”

Jerry Wu - UC San Diego

Mentor: Dr. Shaochen Chen

3D Bioprinted hiPSC-derived Cardiac Micro-Tissues to Investigate Nanoparticle Cardiotoxicity

Erica Peng - UC San Diego

Mentor: Liangfang Zhang

Nanotechnology for Universal Influenza a Vaccination

Panel 43: Biochemistry and Nanomedicine

Zoom Room: Linus Pauling

Thursday 1:30–2:30

Moderator: Dr. Michael Sailor

Bailly Happi - UC San Diego

Mentor: Dr. Michael Sailor

Porphyrin-based porous Si nanoparticles for photocatalytic detoxification of nerve agents.

Nicholas Dorn - UC San Diego

Mentor: Dr. Nisarg Shah

Epigenetic Modulation of T cells in Inflammatory Disease

Gabriella Stark and Helen Zhang – UC San Diego

Mentor: Dr. Michael Sailor

Toward the Targeted Delivery of Imatinib to Gastrointestinal Stromal Tumors Using Aptamer-Conjugated Porous Silicon Nanoparticles

Emerson Chin - UC San Diego

Mentor: Samuel Edmunds

Metallic Nanoisland Sensor Arrays for the Measurement of Cardiomyocyte Contractility

Panel 44: Crime and Punishment

Zoom Room: Mario Molina

Thursday 1:30–2:30

Moderator: Kwai Ng

Gonzalo Rocha-Vazquez - UC San Diego

Mentor: Professor Simeon Nichter

How Prisons Contribute to the Expansion of Criminal Activity in Brazil

Alfredo Santiago - CSU Northridge

Mentor: Dr. Lane Kenworthy

Law and Order: The Impact of Policing on Crime

Sukham Sidhu - UC San Diego

Mentor: Dr. Kwai Ng

California Punitive Damages Appeals: Award Reduction and Wealth

English Hills - Spelman College

Mentor: Professor: Pablo Pardo-Guerra

Black Mental Health and Youth Criminalization in Schools.

Panel 45: Nanoengineering and Chemical Engineering

Zoom Room: Rachel Axler

Thursday 1:30–2:30

Moderator: Dr Debika Datta

Erica Hild - University of Delaware

Mentor: Dr. Jonathan Pokorski

**Structural characterization of naturally derived polymeric scaffolds encapsulated with
Cyanobacteria**

Kris Li - UC San Diego

Mentor: Dr. Kenneth Loh

Detecting Impact Location Using Nanocomposite Sensors

Alexander Perez de Leon - UC San Diego

Mentor: Dr. Sheng Xu

Efficient Quasi-2D/3D Perovskite Light Emitting Diode

Victor Cortez – UC San Diego

Mentor: Dr. Michael Sailor

**Preparation and Stabilization of Silicon Quantum Dots and Integration into New Identification
System**

Panel 46: Cancer, Mental Health, and Disparities

Zoom Room: Jimmy Yang

Thursday 1:30–2:30

Moderator: Gail Heyman

Jaden Huynh - UC San Diego

Mentor: Dr. Sadler

Does psychiatric illness predict lower cancer survival rates?

Sydney Olfus - San Diego State University

Mentor: Vanessa Malcarne

Suicidality Concerns in Women with Gynecologic Cancers

Jocelyn Quiroz - UC San Diego

Mentor: Georgia Sadler

**Mastectomy tattoos as a form of emotional healing following breast cancer treatment: a
review of the literature**

Diane Tran - UC San Diego

Mentor: Veronica Cardenas

Disparities in End-of-Life (EOL) Care for Asian American Cancer Patients

**Panel 47: Computer and Data Science in the Study of Environment and Species
Populations**

Zoom Room: Vernor Vinge

Thursday 1:30–2:30

Moderator: Dr. David Artis

Ravi Johnson - UC San Diego

Mentor: Dr. Reza Esmaili

Wind Turbine Off-grid System

Nishant Balaji - UC San Diego

Mentor: Curt Schurgers

Acoustic Species Identification, machine learning, data labeling

Nicholas Rowlett and Valli Nachiappan - UC San Diego

Mentor: Nathan Hui

Smartfin

Romain Vergniault - UC San Diego

Mentor: Professor Curt Schurgers

Baboon Tracking

Thursday: Afternoon Session II

Panel 48: Parasitic Drug Design

Zoom Room: Angela Davis

Thursday 2:40–3:40

Moderator: Dr. Anjan Debnath

Kimberly Mundy - North Carolina Central University

Mentor: Conor Caffery

Profiling the degradome of the parasite responsible for Human African Trypanosomiasis

Mary Taylor - North Carolina A&T State University

Mentor: Connor Caffery

Congeners derived from microtubule-active phenylpyrimidines as a basis for a novel treatment of the neglected disease, Schistosomiasis

Mina Balen - UC San Diego

Mentor: Brian J Shing/ Dr. Anjan Debnath

The effectiveness of Isavuconazonium Sulfate against Acanthamoeba castellanii.

Panel 49: Neurobiology

Zoom Room: Eleanor Mariano

Thursday 2:40–3:40

Moderator: Dr. Timothy Machado

Lauren Valdez - UC San Diego

Mentor: Brenda Bloodgood

Gene Regulation Through NPAS4 Induced by an Enriched Environment

Leya Ledvin - UC San Diego

Mentor: Dr. Cole Ferguson

Regulation of Heterochromatin by Ubiquitin Signaling during Brain Development

Grant Reeves - UC San Diego

Mentor: Dr. Susan Ackerman

Synaptic Localization and Upstream Regulation of GTPBP1 in Primary Hippocampal Neurons

Caitlyn Callaway - UC San Diego

Mentor: Dr. Kuo-Fen Lee

Pathological Mechanism of Resting Tremor in Cdk5 Parkinson's Disease Mouse Model

Panel 50: Political Science, Voting, and Representation

Zoom Room: Flossie Wong-Staal

Thursday 2:40–3:40

Moderator: Miss Ruby Oasoria

Aiyana Edwards - Spelman College

Mentor: Dr. Pamela Ban

Descriptive Representation and the Legislative Agenda in Texas

Adrianna Ferguson - Spelman College

Mentor: Professor Thad Kousser

Gender Validation and Politics

Panel 51: Neuroscience II

Zoom Room: K. Megan McArthur

Thursday 2:40–3:40

Moderator: Dr. Shelley Warlow

Dawei Tang - UC San Diego

Mentor: Dr. Edward Callaway

Explore the spatial relationships between functional maps and neuronal clustering in macaque primary visual cortex

Anahi Salazar - University of San Diego

Mentor: Dr. Jena Hales

Effects of Medial Prefrontal Cortex Lesions in Rats on the Traveling Salesperson Problem

Eman Abdulkadir - UC San Diego

Mentor: Dr. Christina Gremel

Role of Orbitofrontal Cortex in Action Shifting

Khoa Nguyen - UC San Diego

Mentor: Dr. Richard Daneman

Blood brain barrier regulation of neurotransmitter metabolism and behavior.

Panel 52: Cancer Treatment Effects

Zoom Room: Kathleen Rubins

Thursday 2:40–3:40

Moderator: TBD

Elisa DePhillippis - San Diego State University

Mentor: Vanessa Malcarne

The intersection of breast cancer and cardiovascular disease in African American women

Priscila Chagolla - San Diego State University

Mentor: Dr. Malcarne

Disparities in fertility preservation discussions with cancer patients prior to treatment

Martin Montiel - UC San Diego

Mentor: Dr. Sadler

Moving with the times: alternative cancer treatments for children.

Paola Cancino - UC San Diego

Mentor: Dr. Georgia R. Sadler

Psycho-oncology care for breast and cervical cancer patients in Mexico

Panel 53: Health Disparities in Cancer

Zoom Room: Khaled Hosseini

Thursday 2:40–3:40

Moderator: TBA

Jordan Gomezpadilla - UC San Diego

Mentor: Dr. Georgia Sadler

Factors Associated With The Higher Incidence Rate And Lower Survival Rate Of Non-hispanic White Males Diagnosed With Glioblastomas

Sally Trinh - UC San Diego

Mentor: Dr. Georgia Sadler

The Key Determinants of a Cancer Survivorship Needs Model

Viena Le - UC San Diego

Mentor: Georgia Sadler

Factors Explaining High Cervical Cancer and Low Screening Rates Among Victims of Sexual Abuse

Eduardo Gonzalez - UC San Diego

Mentor: Dr. Georgia Robins Sadler

Geographical provinces and cancer prevalence in Ecuador

Panel 54: Materials Science and Engineering

Zoom Room: Kim Stanley Robinson

Thursday 2:40–3:40

Moderator: Dr Zheng Chen

Keanu Ray Masga - UC San Diego

Mentor: Dr. Jinhye Bae and Dr. Tod Pascal

Swelling and Deswelling Kinetics of Poly(N-isopropylacrylamide) Hydrogels

Rachel Luu - UC San Diego

Mentor: Dr. Marc Meyers

Bioinspired Modeling of Horse Hooves for Material Characterization

Capalina Melentyev - UC San Diego

Mentor: Dr. Frank E. Talke

Optimal Active Material Concentrations on Antimicrobial Coatings for Inhibiting Biofilm Formation on Urinary Catheters

Panel 55: Medical Applications of Nanoengineering

Zoom Room: Linus Pauling

Thursday 2:40–3:40

Moderator: Dr. Michael Sailor

Madison Kane and Daria MacAuslan – UC San Diego

Mentor: Professor Dr. Michael J. Sailor

Development of Mesoporous Silicon Nanoparticle-Hydrogel Composites for Delivery of Therapeutic Agents to Aid in Peripheral Nerve Repair

Emmie Yao - UC San Diego

Mentor: Dr. Shaochen Chen

3D Bioprinting of Corneal Stem Cells

Kyle Skelil - UC San Diego

Mentor: Dr. Darren Lipomi

A Synthetic Microrobot to Regrow Severed Neurons

Oscar Calzada -

Mentor: Dr. Mike Sailor

Approach to augment surgical repair of the anterior cruciate ligament using hybrid polymer mesoporous silicon nanoparticle scaffolds delivering a vascular growth factor.

Panel 56: Latinx Lived Experiences

Zoom Room: Mario Molina

Thursday 2:40–3:40

Moderator: Gail Heyman

William O'Farrill Colon - San Francisco State

Mentor: Amy L. Non

A New Public Health issue: The Anti-Vaxxer Era An analysis of Vaccine Hesitancy among Mexican Descent living in Southern California

Ailyn Alicea - UC San Diego

Mentor: Georgia Sadler

Why are Hispanic smokers less likely to be advised to quit compared to white smokers? Cultural and institutional factors.

Diana Calderon - UC San Diego

Mentor: Professor Jose Fuste

Sexual Discourses Embodied through Latinx Lived Experiences

Cristian Fuentes Hernandez - UC San Diego

Mentor: Professor Luis Alvarez

San Ysidro as a Case Study for Cultural Resistance against the Border

Panel 57: Nanoengineering and Materials Science

Zoom Room: Rachel Axler

Thursday 2:40–3:40

Moderator: Dr Debika Datta

Brian Xi - UC San Diego

Mentor: Professor Jon Pokorski

Co-melt extrusion of bacterial spores with poly-caprolactone

Dafina Sopi - UC San Diego

Mentor: Dr. Oscar Vazquez Mena

Designing of Acoustic Metamaterial for Enhanced Ultrasound Transmission Through the Skull for Non-Invasive Brain Stimulation.

Eberardo Camorlinga-Ruiz - University of California, Merced

Mentor: Jinhye Bae

Study Stimuli-responsive hydrogel materials to understand how to program their shape transformations.

Jonathan Lane and Arturo Baza – UC San Diego

Mentor: Yubin Huang

Optimizing the Hydrolysis of Organophosphorus Nerve Agents by Using Nonvolatile Polymer Bases

Panel 58: Potpourri I

Zoom Room: Jimmy Yang

Thursday 2:40–3:40

Moderator: TBA

Gabrielle Gomez - University of San Diego

Mentor: Michael Eptein

Cognitive and Neurophysiological Impacts of Autoimmune Diseases of the Thyroid

Angela Chapman - UC San Diego

Mentor: Dr. Savita Bhakta

Event-Related Potential Measures in Schizophrenia Patients: A Systematic Review

Zoe Adelsheim – UC San Diego

Mentor: Michael McCarthy

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

Panel 59: Biomedical Engineering

Zoom Room: Vernor Vinge

Thursday 2:40–3:40

Moderator: Anvita Komarla

Antonio Loaiza - UC San Diego

Mentor: Dr. Aitana Castro

Single-Cell Transcriptomes

Claire Zhang - UC San Diego

Mentor: Dr. Kevin King

Longitudinal characterization of periodic breathing in heart failure via a non-contact home health monitor

Sophia Warlof - UC San Diego

Mentor: Dr. Ester Kwon

Bioresponsive Nanoparticles for the Inhibition of Calpain Activity After Traumatic Brain Injury

Kyle Hunady - Georgia

Mentor: Ester Kwon

Novel targeting and delivery approach using in vivo click chemistry to treat traumatic brain injury

Thursday: Afternoon Session III

Panel 60: Ecology & Agriculture

Zoom Room: Jimmy Yang

Thursday 3:50–4:50

Moderator: Charlotte Seid

Brice McKane - UC San Diego

Mentor: Professor Greg Rouse

Two New Deep-Sea Species of Worms (Sabellariidae, Annelida)

Alina Shahin - California State University, Northridge

Mentor: Dr. Diana Rennison

Associations Between Morphology and the Gut Microbiome in Threespine Stickleback Fish

Jair Cortes - UC San Diego

Mentor: Dr. Theresa Talley

Assessing San Diego's Native Clam Aquaculture Market

Nika Redburn - UC San Diego

Mentor: Dimitri Deheyn

Microgreens

Friday: Morning Session I

Panel 61: Oceanography and Earth Sciences

Zoom Room: Æbleskiver

Friday 9:00-10:00

Moderator: Daniel Rudnick

Briana Prado - University of California, Santa Cruz

Mentor: Dr. Lihini Aluwihare

Discovering Organic Chemical Indicators of Environmental Conditions at the Scripps Pier

Grant Castaneda - UC San Diego

Mentor: Sarah Gille

Impacts of topographic flows on surface ocean ecosystem dynamics

Natalia Berrios-Rivera - UC San Diego

Mentor: Dr. Jeffrey Gee

Analyzing seafloor magnetic anomalies at the northern East Pacific Rise using an autonomous underwater vehicle

Cameron Wang - UC San Diego

Mentor: Wenyuan Fan

Dynamic Triggering at Geothermal Fields in California

Panel 62: Potpourri III

Zoom Room: Ajiaco

Friday 9:00-10:00

Moderator: Dr. David Artis

Nia Dumas - Spelman College

Mentor: Dr. LaGina Gause

How has racial segregation influenced voter suppression in Georgia?

Naomi Pineda - UC San Diego

Mentor: DR. Christina Jamieson

Indoor Air Pollution as a Cancer Risk Factor Among Lower Socioeconomic Urban Populations

Tiffany Murga Duarte - UC Merced

Mentor: Roberto Andresen Eguiluz

Optimization of ECM Ligands Patterning on Polyacrylamide Hydrogels

Mianjel Jack - Xavier University of Louisiana

Mentor: Dr. Lindsey Powell

The Neural Basis of Infants' Preference for Helpers

Panel 63: Computer and Data Sciences

Zoom Room: Biryani

Friday 9:00-10:00

Moderator: TBA

Shubham Kumar and Gaopo Huang - UC San Diego

Mentor: Dr. Pamela Cosman

Virtual Physical Therapist with Monocular Camera: Real-Time Assessment and Feedback

Michael Tang - UC San Diego

Mentor: Professor Cheolhong An

OCT-Angiography processing for disease detection and classification

Chiara Frank, Dana Steinberg, and Yuntae Lee - UC San Diego

Mentor: Dr. Mateusz Gola

EEG-VR to Treat Eating Disorder

Panel 64: Education and Diversity I

Zoom Room: Boba

Friday 9:00-10:00

Moderator: Michel Estefan

Imani Shell - Howard University

Mentor: Dr. Richard Pitt

Race Differences in College Major Perceptions

Ashley Marshall - Xavier University of Louisiana
Mentor: Dr. Frances Contreras
UC Doctoral Programs: The African American Experience

Nicolette Le - UC San Diego
Mentor: Dr. Georgia Robins Sadler
**The Impacts of Financial Barriers Among Underrepresented College Students on Cancer
Disparity in the US**

Harjot Dhaliwal - UC San Diego
Mentor: Dr. Stanley Lo
First Generation Student vs Traditional Students

Daisy Gomez-Fuentes - San Diego State University
Mentor: Dr. Frances Contreras
The Longitudinal Impact of PUENTE on Students

Panel 65: Cancer Outcomes Disparities

Zoom Room: Chiles en Nogada
Friday 9:00-10:00
Moderator: Elaine Tanaka

Paola Anguiano Quiroz - UC San Diego
Mentor: georgia sadler
**Factors Explaining Why Hispanic Women Diagnosed with Breast Cancer in the United States
Have a Higher Risk of Mortalit**

Xiomara Gaeta Agreda - UC San Diego
Mentor: Dr. Sadler
Factors contributing to poor cervical cancer outcomes in Hispanic/Latina women

Yilin Xu - UC San Diego
Mentor: Dr. Georgia Sadler
**A review of cultural and survival disparities in end-of-life care among African American breast
cancer patients**

Amber O'Brien - UC San Diego

Mentor: Dr. Georgia Sadler

Investigating the existence of disparities in the quality of life among pediatric brain cancer survivors of low socioeconomic status

Panel 66: Molecular Mechanisms of Microbial Interactions

Zoom Room: Gatsby

Friday 9:00-10:00

Moderator: Dr. Vikram Shende

Alicia Amamoto - UC San Diego

Mentor: Dr. Soumita Das

The role of ELMO1-SifA-Rab9 interactions in pathogenic bacteria infection

Avani Mylvara - UC San Diego

Mentor: Dr. Joe Pogliano

Investigating CasPhi Infiltration of the Phage Nucleus

Angel Sarabia - UC San Diego

Mentor: Dr. Rachel Dutton

Characterization of Host-Phage Interactions in Cheese Microbial Communities

Panel 67: Animal Behavior and Social Organization

Zoom Room: Harira

Friday 9:00-10:00

Moderator: Sara Sandoval

Kirk Richard Dolar - CSU Northridge

Mentor: Dr. James Nieh

Analysis of hygienic behavior and toleration of Varroa destructor in feral and managed honey bees *Apis mellifera*.

Emma Palmer - UC San Diego

Mentor: Daniel Metz

Social Organization in the Freshwater Trematode, *Haplorchis pumilio*

Cindy Tran - UC San Diego

Mentor: Professor Jonathan Shurin

Behavioral Syndromes in Tui Chub and Its Ecological Impacts

Panel 68: Perceptions of Risk

Zoom Room: Lumpia

Friday 9:00-10:00

Moderator: Daniel Cardenas

Brianna Angulo - UC San Diego

Mentor: Dr. Ivan Evans

Prevention work in combatting human trafficking on a local and global scale

Varvara Gulina - California State University Fullerton

Mentor: Dr. Lianne Urada

Abuse and sexual exploitation of Russia's unrecognized victims: Analysis of women's appraisal of victimization using frameworks of cognitive dissonance and Sexual Scripts.

Natale Rahmon and Kiara Summers - University of San Diego

Mentor: Dr. Anne Koenig

How Gender Affects Perceptions of Safety Following Information About Sexual Assault

Hsu Lin - UC San Diego

Mentor: Dr. Emanuel Vespa

Searching for a Risk Parameter

Panel 69: Biological Tissue Analysis

Zoom Room: Pastelón

Friday 9:00-10:00

Moderator: Dr. Molly Matty

Pauline Tran - UC San Diego

Mentor: Dr. Sharmeela Kaushal

Assessment of DNA and RNA Quality of Human Autopsy Tissue for Genomic Analysis

Noah Gaitan - UC San Diego

Mentor: Dr. Antoine Chaillon

Investigating prominent death biomarkers and effects of the dying process on HIV reservoirs in Last Gift participants via rapid autopsy

Ryan Park and Marcella Ku - UC San Diego

Mentor: Dr. Sharmeela Kaushal

Assessment of RNA Quality and Quantity in relation to Tumor vs. Stromal presence in Formalin Fixed paraffin embedded (FFPE) Breast Cancer Tissue for Sequencing

Negin Samandari - UC San Diego

Mentor: Dr. Mark Hepokoski

Characterization of Circulating, Cell-Free Mitochondrial DNA in ARDS due to Sepsis

Panel 70: Medicine in LatinX populations

Zoom Room: Pho

Friday 9:00-10:00

Moderator: Yanjia Cao

Luisa Taverna - Emory University

Mentor: Dr. Lucila Ohno-Machado

Genetic Diversity and Association Studies in LatinX populations using All of Us Research Cohort

Gabriela Ortega-Arvizu - UC San Diego

Mentor: Dr. Georgia Sadler

Leaf blowers linked to lung cancer in Hispanic men landscape workers

Stefani Acosta - UC San Diego

Mentor: Dr. Georgia Sadler

Reasons why Hispanic Communities in Border Cities Have Higher Rates of Blood Cancer Diagnosis vs. Non-Border Cities

Brenda Ochoa - UC San Diego

Mentor: Dr. Georgia Sadler

Addressing Environmental Health Disparities in Hispanic Children of Farmworkers Diagnosed With Pediatric Acute Lymphoblastic Leukemia

Panel 71: Mechanical and Materials Science Engineering

Zoom Room: Poutine

Friday 9:00-10:00

Moderator: Michael Davidson

Eduardo Montano - UC Irvine

Mentor: Dr. Michael Frazier

The use of the stable metamaterials to create the Morei effect with the use of magnetic interaction.

Alexander Mosser - UC San Diego

Mentor: Ping Liu

Potential of Reinforced Solid Electrolyte in Solid-State Batteries

Sydney Hemenway - University of California, Berkeley

Mentor: Professor Paul Braun

Characterization of Coated and Textured LiCoO₂ Cathodes under Extreme Conditions

Ananya Thridandam - UC San Diego

Mentor: Professor Michael Davidson

Renewable Energy Resource Assessments in the Western United States

Panel 72: Cell Biology

Zoom Room: Succotash

Friday 9:00-10:00

Moderator: Dr. Sonia Kim

Jasmine Jung - UC San Diego

Mentor: Dr. Sonya Neal

Uncovering the Novel Cellular Stress Response to Misfolded Membrane Proteins

James Holcomb - UC San Diego

Mentor: Dr. Samara Reck-Peterson

Pex14 and Pex14/17's role in peroxisome localization

Bowen Li and Vince Ly - UC San Diego

Mentor: Dr. Luis Arturo Medrano Soto / : Dr. Milton Saier

Characterization of ECF Type ABC Transporters

Ola Hatem Mohamed Elmoatasem Mostafa - UC San Diego

Mentor: Dr. Enfu Hui

Investigating the Driving Factors of PD-1 Clustering

Friday: Morning Session II

Panel 73: Climate Science

Zoom Room: Æbleskiver

Friday 10:10-11:10

Moderator: Daniel Rudnick

Sophia Wynn - UC San Diego

Mentor: Professor Amato Evan

Salton Sea Dust Aerosols

Brandon Bourassa - UC San Diego

Mentor: Jennifer Haase

Airborne radio occultation instrument requirements for real-time forecasting of atmospheric rivers

Benjamin Werb - UC San Diego

Mentor: Professor Daniel Rudnick

Climate Variability in the California Current System

Ashton Domi - UC San Diego

Mentor: Amato Evan

Climate Modeling and Dust Storm Prediction

Panel 74: Machine Control, Sensing, and Communication

Zoom Room: Biryani

Friday 10:10-11:10

Moderator: Nicole Friend

Allen Cheung - UC San Diego

Mentor: Professor Nuno Vasconcelos

3D Object-induced Action Decision for Autonomous Vehicles

Zijia Guo - UC San Diego

Mentor: Professor Sujit Dey

Deep Learning Enabled Millimeter Wave Beam Management for Outdoor Networks

Merve Kilic - UC San Diego

Mentor: Sujit Dey

Learning Hardware Invariant Downlink, Uplink, and Sidelink Beam Management Policies in Community mmWave Networks

Stuart Boynton - UC San Diego

Mentor: Dr Yang Zheng

Advanced Control and Optimization for Autonomous Vehicles in Mixed Traffic Systems

Dallas Dominguez - UC San Diego

Mentor: Dr. Saharnaz Baghdadchi

UCSD evGrandPrix Autonomous Racing Vehicle Project

Panel 75: Education and Diversity II

Zoom Room: Boba

Friday 10:10-11:10

Moderator: Michel Estefan

Guadalupe Marmolejo - UC San Diego

Mentor: Thandeka Chapman

Bilingualism in the Latino Student Population

Melissa Cabrera - University of San Diego

Mentor: Dr. Jennifer Nations

Student's Experiences with their University's Diversity Initiatives

Ivette Martinez - UC San Diego

Mentor: Dr. Makeba Jones

'I Wish I Would Have Taken More Advantage of GEAR UP': Looking at the Impact of Federal Educational Intervention Programs on Latinx Students

Panel 76: Molecular Basis of Cardiovascular Disease

Zoom Room: Chiles en Nogada

Friday 10:10-11:10

Moderator: Dr. Ana Navarro

Vivian Phan - UC San Diego

Mentor: Dr. Sebastian Preissl

Single Nucleus Multiomic Profiling of Heart Tissue

Anh Nguyen - UC San Diego

Mentor: Dr. Xi Fang

The role of Taffazin in mitochondrial architecture

Brian Dinh - UC San Diego

Mentor: Dr. Calvin Yeang

Defining the Inflammatory Monocyte and Cytokine Changes Associated with Lipoprotein Apheresis in Patients with Elevated Lipoprotein(a)

Panel 77: Disparities in Cancer

Zoom Room: Gatsby

Friday 10:10-11:10

Moderator: Dr Vikram Shende

Jenna Balingit - San Diego State University

Mentor: Dr. Christal Sohl

Asian Glow: Genetic Variant Aldehyde Dehydrogenase-2 Enzyme deficiency in the Asian Population and Its Link to Hepatocellular Carcinoma

Victoria Herrera - UC San Diego

Mentor: Dr. Georgia Sadler

How issues in dermatology education and literature may cause disparities in skin cancer patients of Hispanic and African American descent.

Nicholas Monroe - San Diego State University

Mentor: Dr. Malcarne

Disparities pertaining to Wilms Tumor patients in different cultures and socioeconomic backgrounds

Megan Korhummel - San Diego State University

Mentor: Dr. Vanessa Malcarne

Barriers to genetic testing in men with an increased risk for prostate cancer associated with BRCA1 and BRCA2 mutations

Panel 78: Addiction and Substance Use

Zoom Room: Harira

Friday 10:10-11:10

Moderator: Jennifer Ngolab

Angie Santos - UC San Diego

Mentor: Dr. Olivier George & Dr. Lieselot Carrette

Alcohol Dependence and Withdrawal: Effects on Whole-Brain Functional Connectivity

Shannon Arias Ortega - California State University, Northridge

Mentor: Dr. Chitra Mandyam

Alcohol use disorder and endothelial insult: Review of the current literature and future prospects

Celine Yang - UC San Diego

Mentor: Dr. Michael Taffe

Behavioral effects of nicotine and alcohol on crayfish

Garret Wang - UC San Diego

Mentor: Eric Zorrilla, Dr. Marisa Robeto, Dr. Bryan Cruz, Dr. Valentina Vozella and Dr. Sarah Wolfe

PTSD, Alcohol Abuse, and Brain Chemistry in Rats

Panel 79: Sociology, Culture, and Political Science

Zoom Room: Lumpia

Friday 10:10-11:10

Moderator: Daniel Cardenas

Imani Bennett - Spelman College

Mentor: Dr. Margaret (Molly) Roberts

Monetization of Misinformation Websites

Emmanuelle Scott - UC San Diego

Mentor: Dr. Margaret Roberts

Memes and Misinformation on Twitter during the 2020 US Presidential Election

Alyssa Mugavero - University of San Diego

Mentor: Dr. Carlton Floyd

Framing What We See and Know: Empathy as a Socio-Cultural Solution to Indifference

Maya Changaran Kumarath - UC Merced

Mentor: Dr. Tyler Marghetis

Are religious conversions like scientific insights? Similarities and differences in critical transitions across domains of human belief

Panel 80: Cigarettes and Cancer

Zoom Room: Pastelón

Friday 10:10-11:10

Moderator: Dr. Molly Matty

Joseph Tsai - UC San Diego

Mentor: Dr. Weg Ongkeko

Tobacco smoke and electronic cigarette vapor alter enhancer RNA expression that can regulate the pathogenesis of lung squamous cell carcinoma

Scott Garcia - UC Merced

Mentor: Dr. Wei-Chun Chin

Effects of Electronic Cigarettes Liquid Components on Airway Mucus Swelling Kinetics

Mitchell Pernia - San Diego State University

Mentor: Dr. Eunha Hoh

Oral Microbiome of Non-smoking Children Exposed to Thirdhand-Smoke Compared to Adult Smokers and How it Could Ultimately Lead to Oral Cancer

Panel 81: Health Disparities: A Tale of Two Populations

Zoom Room: Pho

Friday 10:10-11:10

Moderator: Yanjia Cao

Andrea Contreras - UC San Diego

Mentor: Dr. Georgia Sadler

Survival Rate Disparities between Osteosarcoma and Ewing's Sarcoma in Pediatric Patients

Rowan Ustoy - UC San Diego

Mentor: Dr, Georgia Sadler

Examining diet change as a contributing factor of higher cancer rates in Puerto Rican U.S Immigrants

Helen Hernandez - UC San Diego

Mentor: Dr. Georgia Sadler

Identifying the protective factors for pediatric brain cancer within minority versus white non-Hispanic infants and children.

Dalia Koujah - UC San Diego

Mentor: Dr. Georgia Sadler

Barriers to Breast Cancer Screening for Arab-American Women

Panel 82: Electrical Engineering and Computer Science

Zoom Room: Poutine

Friday 10:10-11:10

Moderator: Michael Davidson

Jason Vega - UC San Diego

Mentor: Dr. Lily Weng

Promoting Certified Interpretability Robustness for Neural Networks

Stephen Kim - UC San Diego

Mentor: Professor Bill Lin

Parallel Data Center Circuit Switching

Akshit Agarwal - UC San Diego

Mentor: Professor Patrick Mercier

Wifi Backscatter

Napasorn Phongphaew - UC San Diego

Mentor: Professor Tse Nga Ng

pH Sensor Using Organic Electrochemical Transistors

Panel 83: Cell Cycle: Mitosis Spotlight

Zoom Room: Succotash
Friday 10:10-11:10
Moderator: Dr. Sonia Kim

Hai Pham - University of Houston

Mentor: Dr. Alon Goren

Characterizing The Roles of Mitotic Associated Histone Deacetylation

Yueyang Cai - UC San Diego

Mentor: Dr. Veronica Gomez

**Examining the role of phosphorylation in maintaining tether elasticity between chromosomes
in PTK2 Cells**

Smriti Variyar - UC San Diego

Mentor: Arshad Desai

MAD-1 recruitment in the spindle assembly checkpoint

Maia Kirkegaard - UC San Diego

Mentor: Dr. Karen Oegema

**Understanding the Relationship between TPXL-1-based Regulation of Aurora A, Interphase
Microtubules, and Cortical Contractility**

Friday: Morning Session III

Panel 84: Atmospheric and Environmental Chemistry

Zoom Room: Æbleskiver
Friday 11:20–12:20
Moderator: Daniel Rudnick

Samson Hui - University of San Diego

Mentor: David DeHaan

What is the uptake of catechol / guaiacol into aerosol particles containing Fe and/or sulfate?

Aakash Davasam - UC San Diego

Mentor: Dr. Rommie Amaro & Dr. Vicki Grassian

Surface Activity of Amino Acids and Proteins in Sea Spray Aerosols

Veronica Berta - UC San Diego

Mentor: Dr. Lynn Russell

Detecting Amine within Single Particle AMS Measurements

Anastacia Carrick-Gonzales - UC San Diego

Mentor: Dr. Amina T. Schartup

Influence of Trace Metal Concentrations on Phytoplankton Community Dynamics in La Jolla Coastal Waters

Panel 85: Bias, Cognitive Science, and Stereotype Threat

Zoom Room: Biryani

Friday 11:20–12:20

Moderator: Jamie Amemiya

Sydney Washington - California State University, Fullerton

Mentor: Dr. Celeste Pilegard

Does the testing effect reduce the negative influence of stereotype threat on learning?

Luke Sztajnkrzyer - UC San Diego

Mentor: Dr. Angela Yu

Exploration of the Effects of Individuation Training on Explicit Face Perception-based Bias

Maya Phillips - Spelman College

Mentor: Dr. Mary Blair-Loy

Roads to the Top

Panel 86: Education and Diversity III

Zoom Room: Boba

Friday 11:20–12:20

Moderator: Michel Estefan

Chloe Le - UC San Diego

Mentor: Professor Christoforos Mamas

Inclusivity at UCSD: Exploring the relationship between teacher identity and course content

Patricia Almaraz - UC San Diego

Mentor: Dr. Gerardo Arellano

A Critical Approach to the U.S.' Education System: Immigrants Navigating Higher Education in the United States

Malia Henry - UC San Diego

Mentor: Dr. K. Wayne Yang

Promoting Cultural Awareness on Campus

Caesar Aceituno - UC San Diego

Mentor: Dr. Abigail Andrews

Bridging the Connectivity Gap: The Impact of Faculty and Institutional Practices on the Academic Success of Latinx Students at UCSD

Panel 87: Molecular Biology II

Zoom Room: Chiles en Nogada

Friday 11:20–12:20

Moderator: Dr. Auke Otten

Allison Delehoy - UC San Diego

Mentor: Dr. Bryan Sun

The Role of Non-coding RNAs in Psoriasis

Katherine Wong - UC San Diego

Mentor: Dr. Isaac Alexander Chaim

Investigating Cellular and Pathway Composition in ASD Cortical Organoid Models

Sylas Eckhart - UC San Diego

Mentor: Tatum Simonson

Epigenetic Adaptations to High Altitude in Andean Populations

Panel 88: Race, Ethnicity, and Health

Zoom Room: Gatsby

Friday 11:20–12:20

Moderator: Dr Vikram Shende

Michael Skipworth - UC San Diego

Mentor: Dr. Georgia Robins Sadler

Released from smoking: Can a tailored smoking cessation program encourage smoking abstinence before and after release?

Joshua Tran - UC San Diego

Mentor: Jack Gilbert

Could the cumulative effect of environmental exposures negatively impact the gut microbiome of African American women with breast cancer? A narrative literature review.

Joshua Hartman - UC San Diego

Mentor: Dr. Leslie Crews

Factors associated with an increased risk of multiple myeloma in the African American community

Matyas Hanna - San Diego State University

Mentor: Dr. Alfredo Molinolo

Patient participation in a research study at UC San Diego, Moores Cancer Center Biorepository after Covid-19 vaccination

Panel 89: Science and Public Understanding

COVID-19 Misinformation

Zoom Room: Harira

Friday 11:20–12:20

Moderator: Jennifer Ngolab

Dylan Martirano - California State University, Northridge

Mentor: Dr. Melinda Owens

What do College Biology Students Know or Misunderstand About the COVID-19 Vaccine's Content, Function, and Side-Effects?

Rahul Sehgal - UC San Diego

Mentor: Professor Michael Burkart

Science vs. the World: Breaking Down the Knowledge Barrier between Science Researchers and the General Public

Panel 90: Stress, Trauma, and Allostatic Load

Zoom Room: Lumpia

Friday 11:20–12:20

Moderator: Daniel Cardenas

Jehan Ezzulddin - UC San Diego

Mentor: Sandra Daley

Social Determinants of Health and Allostatic Load

Anthony Cirilo - UC San Diego

Mentor: Dr. Georgia Sadler

Allostatic Load in Pediatric Cancer Survivors: Predicting Future Adverse Health Outcomes

Panel 91: Inflammation and Imaging

Zoom Room: Pastelón

Friday 11:20–12:20

Moderator: Dr. Eshani Hettiarachchi

Asim Mohiuddin - UC San Diego

Mentor: Dr. Maripat Corr

Drivers of Chronic Symptoms In Mouse Arthritis

Gwendalynn Stilson and Chao-Chin Hsu - UC San Diego

Mentor: Professor Mary Corr

Cell specific TLR4 regulation of inflammatory arthritis

Khang Hoang - UC San Diego

Mentor: Dr. Lingyan Shi

Stimulated Raman Spectroscopy Imaging of Lipid Metabolism Alteration in Amyotrophic Lateral Sclerosis

Romina Shirazi - UC San Diego

Mentor: Shamim Nemati

Predicting the Outcome of Spine Surgeries using Image Processing and Machine Learning

Panel 92: Health Disparities in Minority Populations

Zoom Room: Pho

Friday 11:20–12:20

Moderator: Yanjia Cao

Ida Nikjeh - UC San Diego

Mentor: Dr. Georgia Sadler

Racial/Socioeconomic Exclusions and Disparities in Stem Cell Medicine

Stephanie Barajas - UC San Diego

Mentor: Dr. George Hightower

Low Income Community Support with Pollution

Andrea Padilla - UC San Diego

Mentor: Dr. Veronica Cardenas

The Power Religion and Spirituality Hold in the Dying Process for Latinx Advanced Cancer Patients and their Loved Ones

Panel 93: Biomedical Informatics

Zoom Room: Poutine

Friday 11:20–12:20

Moderator: Michael Davidson

Steven Swee - UC San Diego

Mentor: Dr. Jejo Koola

Evaluating the Elevated Accuracy of Time Series vs. Standard Bootstrap Analysis on Implantable Medical Device Adverse Outcomes

Armin Nouri - UC San Diego

Mentor: Dr. Tsung-Ting Kuo

Blockchain Usage in Efficient Patient Preference Data Logging and Verification

McKenna Lewis - UC San Diego

Mentor: Dr. Kathleen Curtius

Quantifying epigenetic drift in gastrointestinal pre-cancers to predict age of premalignant onset in patients for improved early cancer detection

Stephany Alonso - University of California, Irvine

Mentor: Dr. Rodney Gabriel

Effects of Obesity on Subjects Undergoing Ambulatory Surgery.

Panel 94: Neuroscience IV

Zoom Room: Succotash

Friday 11:20–12:20

Moderator: Dr. Sonia Kim

Hira Ali - UC San Diego

Mentor: Dr. Mark Tuszynski

A Drug-Activatable Neurotrophin Receptor for Controlled Gene Therapy

Michelle Liu - UC San Diego

Mentor: Dr. Anne Hiniker

Optimizing a chemical-genetic approach to define substrates of PKC α in Alzheimer's Disease

Gautam Narayan - UC San Diego

Mentor: Dr. Stefan Leutgeb

Evaluating the role of theta oscillations in the activation of hippocampal time cell sequences

Marissa Evans - UC San Diego

Mentor: Dr. Sreekanth Chalasani

Using *C. elegans* to study how serotonin signaling affects anxiety-related behaviors

Friday: Afternoon Session I

Panel 95: Student Life

Zoom Room: Æbleskiver

Friday 1:30–2:30

Moderator: Jeff Haydu

Esmeralda Salas - UC San Diego

Mentor: Dr. Amy Bintliff

Impacts of Social and Emotional Learning at Akanksha Foundation

Elizabeth Ingram - UC San Diego

Mentor: Dr. Leslie Carver

**Increased Use of Inclusionary Language and Coordination in Bias Reporting Mechanisms
Creates Better User Experience**

Vianey Valdez - UC San Diego

Mentor: Professor Megumi Naoi

Identifying the Barriers UCSD Undergraduate Students Face in Obtaining Basic Needs Support

Deisy Martinez - UC San Diego

Mentor: Karen Dobkins

**Who are the People who Engage in Dishonest Behavior at UC San Diego and Why do They Do
It?**

Panel 96: Molecular Biology I

Zoom Room: Biryani

Friday 1:30–2:30

Moderator: Anne Lynch

Martin Casas Maya - UC San Diego

Mentor: Dr. Robin Knight

**Long-read Nanopore sequencing of diverse environmental samples from the Earth
Microbiome Project**

Sara Barcik Weissman - UC San Diego

Mentor: Professor Stephen Mayfield

Improving Genetic Tools for High Value Protein and Biofuel Production in Green Algae

Evan Clark - UC San Diego

Mentor: Professor Galia Debelouchina

**Insight into the Effect of Heterochromatin Protein 1 on Chromatin Remodelers in
Mononucleosome and Multi Nucleosome Environments**

Jeffrey Keller - UC San Diego

Mentor: Dr. Xin Sun

**Mutation of Phenylalanyl tRNA Synthetase Subunit Beta (FARSB) Causes Non-translational
Disease**

Panel 97: Addiction and Microbiome Studies in Medicine

Zoom Room: Boba

Friday 1:30–2:30

Moderator: Dr. David Artis

Etchi Ako - UC Riverside

Mentor: Dr. Graham McVicker

The Pseudotemporal Ordering of Oligodendrocytes in Cocaine Addiction

Andrew Truong - UC San Diego

Mentor: Dr. Tanya Nguyen

The Microbiome and Mental Health Disorders

Hanna Gootin - UC San Diego

Mentor: Amir Zarrinpar

The Role of Microbial Bile Acid Biotransformations in Obstructive Sleep Apnea- Associated Atherosclerosis

Abby Lee - UC San Diego

Mentor: Dr. Jessica Wang-Rodriguez

Intratumor archaea microbiome influence on gastrointestinal cancer progression

Panel 98: Topics at the Intersection of Social Science and STEM

Zoom Room: Chiles en Nogada

Friday 1:30–2:30

Moderator: Alma Santana

Ankeen Arestakesyan - UC San Diego

Mentor: Professor Karcher Morris

Tailoring ECE 5 College Class to High School Students: Developing Technical Skills and Promoting Creative Thinking

Rishaan Kenkre - UC San Diego

Mentor: Dr. Olivier Harismendy

Racial, Ethnic and SocioEconomic Disparities to Access Cancer Targeted Therapies Using Real-World Evidence Analysis

Alan Tram - UC San Diego

Mentor: Professor Elizabeth Eikey

Using a Digital Mental Health Intervention to Improve Student Social Endeavors

Ameya Mandale - UC San Diego

Mentor: Dr. Pragathi Balasubramani

Relationship Between Gastric Signal Dynamics and Brain Profiles and Behavior

Nakhul Kisan - UC San Diego

Mentor: Pragathi Balasubramani

Mapping Cognitive Brain Functions at Scale

Panel 99: Economics, Commerce, and Business

Zoom Room: Gatsby

Friday 1:30–2:30

Moderator: Jaylin Stevenson

Olivia Bryan - UC San Diego

Mentor: Dr. Simeon Nichter

Divergence in Postcolonial Development Outcomes: A Historical Examination

Ricardo Cardoza Bejarano - University of San Diego

Mentor: Dr. Eileen Daspro

Global Readiness of U.S. SMEs' E-Commerce towards the Mexican Market

Shengmin Sun - UC San Diego

Mentor: Professor. Luz Chung

Why Tax Me?

Marcellus Kirkland - Morehouse College

Mentor: Lane Kensworthy

Capitalism, Socialism, & Communism: Are They All Doomed to Fail?

Panel 100: Geophysics and Astrophysics

Zoom Room: Lumpia

Friday 1:30–2:30

Moderator: Dr. Adam Burgasser

Desiree Harvell - Cal State University San Bernardino

Mentor: Saavidra Perera

An Analysis on the Efficiency of a Shack Hartmann Wave Front Sensor

Carissa Avina-Beltran - SF State University

Mentor: Dr. Carl Melis

Characterizing dimming events of Sun-like star TYC 8830 410 1

Christian Aguirre - California State University, Northridge

Mentor: Dr. Dayanthie Weeraratne

Fluid dynamic study of a film layer entrained by iron drops descending to the core during segregation of iron.

Panel 101: Viruses and Microbes

Zoom Room: Pastelón

Friday 1:30–2:30

Moderator: Dr. Eshani Hettiarachchi

Jina Lee - UC San Diego

Mentor: Dr. Joseph Pogliano

Profiling jumbo phages through bioinformatics

Melissa Guereca - UC San Diego

Mentor: Dr. Katherine Petrie

Evolutionary Pathways of Biofilm Populations

Kit Fong Cheung - UC San Diego

Mentor: Manon Morin / Dr. Rachel Dutton

Using cheese rind microbiome as a model to study microbial interactions in different community compositions

Miles Corley - UC San Diego

Mentor: Dr. Matthew Daugherty

Characterizing a new host-virus arms race between Interferon Stimulated Genes and viral proteases

Panel 102: Climate Change

Zoom Room: Pho

Friday 1:30–2:30

Moderator: Megan Machamer

Angelina Lopez - UC San Diego

Mentor: Professor Jill Gladstein

Investigating the Climate Consciousness Among High School Students in Salinas, California

Tajairi Brown-Neuson - UC San Diego

Mentor: Dr. Adam Aron

The UC System Tackling the Climate Crisis: How are we doing?

Katrina Wanner - UC San Diego

Mentor: Professor Nancy Postero

Climate Refugees and Accountability

Marinelle Villanueva - UC San Diego

Mentor: Dr. Tarik Benmarhnia

The Impact of Climate Shocks & Women's Empowerment on Child Undernutrition in Mozambique

Panel 103: Wearable Sensor Technology and Medical Applications

Zoom Room: Poutine

Friday 1:30–2:30

Moderator: Yatish Turakhia

Christina Mai – UC San Diego

Mentor: Professor Karcher Morris

Quantifying surgeon ergonomics through use of inertial measurement units and nonintrusive mask-extender

Esmeralda Marquez - San Diego State University

Mentor: Dr. Hakan Toreyin

Wearable Technology in Cancer Prevention and Care.

Xunhao Yang – UC San Diego

Mentor: Professor Patrick Mercier

Wearable physiochemical sensor technologies

Liam Fernandez – UC San Diego

Mentor: Professor Karcher Morris

Using accelerometer sensors to develop wearable medical devices that can objectively assess and report ergonomic risk in surgeons during operations.

Panel 104: Decolonizing Museums & Art

Zoom Room: Succotash

Friday 1:30–2:30

Moderator: TBA

Irene Gonzalez - UC Merced

Mentor: Professor Robin DeLugan

Re-designing Cultural Institutions through Indigenous Voices

Sara Santibanez - UC San Diego

Mentor: Leslie Carver

Access Art San Diego

Kristina Stahl - UC San Diego

Mentor: Professor Grant Kester

Museums & Justice: An Exploration of Power, Privilege, & Protest

Kira Kawano - UC San Diego

Mentor: Dr. Octavio Aburto

Using Art to Bridge the Gap Between the General Public and Scientific World

Friday: Afternoon Session II

Panel 105: COVID-19 and Impact on Communities

Zoom Room: Æbleskiver

Friday 2:40–3:40

Moderator: TBA

Allyson Teague - University of San Diego

Mentor: Dr. David A. Shirk

The COVID-19 Crisis in the San Diego-Tijuana Region: Public Health, Economic, and Social Impacts

Jovaan Volcy - Hampton University

Mentor: Dr. Sally Sadoff

A New Dataset: Small Business Owners and Whether They Received The PPP or EIDL Loan

Alex Zhao - UC San Diego

Mentor: Dr. Kirk Bansak

How a public health crisis reveals how governance is approached?

Samantha Flores - UC San Diego

Mentor: Dr. Amy Non

Determining the clinical impact of race adjustment on pulmonary function tests

Panel 106: Science -- Perceptions of Scientists

Zoom Room: Boba

Friday 2:40–3:40

Moderator: Dr. Jen Jin

Jillian Harris - Xavier University of Louisiana

Mentor: Dr. Claire Meaders

"What do scientists look like?" The impacts of a STEM intervention on student perceptions of scientists

Angelita Rivera - UC San Diego

Mentor: Dr. Melinda T. Owens

Using Qualitative Analysis to Investigate the Impact of the Scientist Spotlight Homework Assignment on Ideas about Diversity and Science Identity in Under-Served Groups in STEM

David Guirgus - CSULB

Mentor: Dr. Judith Fan

How does exposure to computer science before college increase motivation to pursue a further study in computer science and related fields?

Tzu-chien Lin - UC Los Angeles

Mentor: Drs. Teresa Ober, Ying Cheng, and Paul Brenner

The Effect of Informal STEM Experience on Interest and Career Aspiration in Computer Programming Among Middle Schoolers: A Mediation Analysis

Panel 107: Mental Health

Zoom Room: Chiles en Nogada

Friday 2:40–3:40

Moderator: TBA

Candy Witter - Bowie State University

Mentor: Dr. Rachel Gershon

Social Media Marketing for Mental Health Interventions and Suicide Prevention

Sarah Reyes - California State University Northridge

Mentor: Terry Jernigan

COVID-19 Impact on Latinx Families, Home Environments, and Youth's Socioemotional & Physical Wellbeing

Alejandro Dauguet - UC San Diego

Mentor: Dr. Jose Luis Burgos

Piloting a Stress-Reducing Mindfulness Intervention Among Migrants Seen at a Student-Run Free Clinic on the Mexico-U.S. Border

Abril King - University of San Diego

Mentor: Dr. Kristen McCabe

The Impact of Benevolent Sexism on Women's Mental Health, Romantic Relationship Satisfaction and Work Satisfaction

Panel 108: Public Policy, Housing, and Environment

Zoom Room: Lumpia

Friday 2:40–3:40

Moderator: Dr. David Artis

Ashley Gonzalez - University of San Diego

Mentor: Dr. Alberto Pulido

Community Resilience Yes, Junkyard No!

Naike Ngassam - Spelman College

Mentor: Tom Wong

Society vs. The Unhoused

Alexia Wasson - UC Merced

Mentor: Professor Tanya Golash-Boza

The Impacts of Blockbusting on Neighborhoods in Washington D.C.

Lindsey Sanchez - UC Merced

Mentor: Professor Jessica Trounstein

Housing Inequity: An Overview of How Land Use Policies Contribute to Political Inequality and Housing Segregation in the Bay Area

Panel 109: Potpourri II

Zoom Room: Pho

Friday 2:40–3:40

Moderator: Megan Machamer

Joanna Ramirez - California State University, Northridge

Mentor: Dr. Lindsey Powell

Social Inferences from Helping and Hindering

Mihaela Rascanu - UC San Diego

Mentor: Professor James Rauch

The Impact of the Egyptian Government's Energy Reforms

Solmaz Azhdari - UC San Diego

Mentor: DR. David Lake

A theoretical framework to explain enduring conflict in U.S.-Iran relations after 1979

Antonia Esmeralda Sajche Sapon - UC San Diego

Mentor: Georgia Sadler

Exploring Liver Cancer Disparity Within the Latinx Community

Nora Nickoel Ortega - CSU San Bernardino

Mentor: Dr. Miguel Villodas

Adverse childhood experiences and academic attainment: The role of future expectations among at-risk youth

Panel 110: Computer and Data Sciences

Zoom Room: Poutine

Friday 2:40–3:40

Moderator: Yatish Turakhia

Huy Nghiem - University of Southern California

Mentor: Dr. Jason Fleischer

Towards Generation of Predictive Knowledge Graphs in Biology using Machine Learning

Anthony Quiroga - UC San Diego

Mentor: Pat Pannuto

Expanding Hardware Continuous Integration on the Tock Operating System

Brandon Ho - UC San Diego

Mentor: Dr. Imanuel Lerman

A miniaturized wireless data streaming system for in-vivo vagus sentinels to detect early infection

Shunkai Yu and Qingyuan Zhang - UC San Diego

Mentor: Dr. Nuno Vasconcelos

An iterative framework for dataset collection

Abstracts

Caesar Aceituno

Sociology: Social Inequalities, UC San Diego
McNair Scholars Program
Mentored by Dr. Abigail Andrews, Sociology

Bridging the Connectivity Gap: The Impact of Faculty and Institutional Practices on the Academic Success of Latinx Students at UCSD

In this paper, using testimonials from over 40 in-depth interviews with Latinx students, we argue that the hidden curriculum at UCSD creates barriers to academic success for a growing Latinx population. We argue that these barriers take the form of two main practices: faculty and institutional. Faculty practices that create barriers for Latinx students include a lack of openness or friendliness, as well as an exclusive curriculum that limits student's ability to utilize professors as a resource. An example of faculty creating efforts to overcome this barrier is when they go the extra mile to create a more welcoming environment within their classes and offer more office hours. While these efforts have been present, students still emphasized the need for greater diversity within faculty and curriculum to increase feelings of inclusion. Institutional practices which create barriers for Latinx students include holding expectations of college prep or readiness, exclusion through limits on program availability or resources, and large student to faculty ratios. Examples of Latinx students overcoming this barrier entailed student's use or participation in programs such as CASP, TRIO, and OASIS. In conclusion, as UCSD reaches HSI status, it becomes increasingly necessary to evaluate the level of academic inclusion Latinx students experience. Through evaluating in-depth interviews we found UCSD creates barriers both at the individual faculty level and at the larger institutional level. Overcoming these barriers requires greater investment in faculty diversity and programs which support Latinx student success.

Stefani Acosta

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

Reasons why Hispanic Communities in Border Cities Have Higher Rates of Blood Cancer Diagnosis vs. Non-Border Cities

The Hispanic community is the ethnic group with the highest rates of blood cancer diagnosis in the United States. Not only do they as an ethnic group have the highest rates of diagnosis, but they also have the highest rates of diagnosis at younger ages. As the largest and fastest-growing minority group in the United States, it is important to

understand factors that explain these disparities. Research has shown that Hispanic communities closer to the border have higher rates of diagnosis than communities farther away. This could be because Hispanic people who live in border cities are more likely to belong to a lower socioeconomic community with a lack of resources. Other factors include lack of education, environmental factors, and genetic mutations. This narrative literature review identified articles using Pubmed/Medline, Google Scholar, databases applying the keywords Hispanic(s), blood cancers, diagnosis, and border cities. Reference list of key articles were reviewed. This presentation will discuss the findings from the literature review and provide suggestions for future research.

Zoe Adelsheim

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Michael McCarthy, Medicine

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

Bipolar disorder is a neuropsychiatric illness that impacts 1-2% of the global population. It is characterized by episodes of mania and depression as well as changes in sleeping patterns, activity, and appetite. There is emerging evidence of a connection between circadian rhythm abnormalities and bipolar disorder. The mammalian circadian clock has a master timekeeper in the suprachiasmatic nucleus (SCN) of the hypothalamus in which multiple “clock genes” such as BMAL1 and PER2 have oscillations in expression controlled by a transcriptional-translational negative feedback loop. Recent studies, however, indicate that the overlap must include genes outside these typical clock genes. This project aims to understand the overlap across genes with strong associations to bipolar disorder (for example ANK3, CACNA1C, RELN, and TCF4) and circadian rhythms within cells.

The overall goal of this project is to identify the contributions of these genes to circadian rhythms. Using siRNA knockdown in neuronal precursor cells (NPCs), each gene’s expression will be silenced. Circadian rhythms in NPCs will be measured to determine how the knockdown of each gene impacted circadian phenotypes. Whole-transcriptome RNA sequencing of the NPCs will be performed in 24-hour time-course studies to identify the neuronal systems that intersect with the clock through these genes. Using bioinformatics, the downstream processes most impacted by the knockdown will be determined. This summer we have been working to grow the NPCs and ensure our knockdown methods are working by optimizing BMAL1 as a positive control gene and analyzing the impact on the cells’ circadian rhythms.

Elisa Ady

Literatures in English, UC San Diego
McNair Scholars Program
Mentored by Dr. Andrea Mendoza, Literature

Empire and Indigeneity in Magical Realism: A Colonial Unraveling

My research seeks to interrogate western epistemology—the theory of knowledge, specifically its assumed scope and validity—through an Indigenous and magical realist lens. Magical realism often relies on a meeting of two worlds or ways of thinking: modern and postmodern, sight and insight, the marvelous and the real. For Indigenous peoples, there is also hybridity at play, as cultures caught under colonial rule grapple with forced assimilation. Here, I join the worlds of Indigeneity and magical realism. I pay particular attention to magical realist genre elements as they succumb to and repudiate empiricism in turn; in doing so, I'm able to draw parallels between the literary movement and Indigenous scholarship from Hawaii and the Six Nations of the Grand River, for example. By conducting a comparative analysis of magical realism and Indigeneity as they contend with or come up against empire, a new understanding of sensory knowledge emerges. I apply concepts like "cultural empiricism" to contemporary magical realist works, a term coined by Kanaka Maoli scholar Manulani Meyer to describe the senses and the ways that they're informed by each culture's participation in the world. When conceptualizing "the west" and the theories of knowledge it has produced, empiricism often reigns above all, a historical fact for which magical realism always seems aware. I argue that by examining magical realism and Indigeneity, we as readers are better able to confront the ways that western-based discourse and modes of representation shape how we interact with reality.

Akshit Agarwal

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Patrick Mercier, Electrical Engineering

Wifi Backscatter

Wi-fi has proven to be one of the most common and effective tools for networking for IoT in personal and commercial settings. Conventional Wi-fi transceivers operate at 10-s of milliwatts of power and move away from the emerging standards of modern IoT devices (a few microwatts). Wi-fi Backscatter is a developing low-power communications technology that uses Radio frequency signals as power combined with the existing Wi-Fi infrastructure to provide RF powered devices with Internet connectivity. The conventional technique to achieve this is through the use of Wi-Fi

access points and wakeup receivers. The experiment proposes modifying a Van Atta retro-reflector with four RF switches (ADG-901) to perform Backscatter. For achieving these results, four digital clock signals of frequency 25 MHz can be used as control signals for the RF switches. These signals have a small initial phase shifts of 15 degrees along with additional 0, 90, 180 and 270 degree shifts as well. This setup should theoretically yield similar results to traditional backscattering but through a more efficient setup.

Christian Aguirre

Geophysics, California State University, Northridge
Independent Undergraduate Research
Mentored by Dr. Dayanthie Weeraratne, Department of Geological Sciences

Fluid dynamic study of a film layer entrained by iron drops descending to the core during segregation of iron.

There is one hallmark evolutionary event in planetary accretion that is still unclear, the segregation of the iron and silicates from chondritic meteorites and how iron was introduced to the Earth's core. The 8% destiny deficit in the iron core may be a clue to how this process evolved. We consider the hypothesis that the low-density material present in the core today is silicate magma that was transported as a film layer, entrained by iron drops created during meteorite impacts. Previous studies (Fleck et al., 2018), observed entrainment of a film layer around liquid metal drops but was not able to measure or quantify it. Here we perform laboratory fluid experiments using liquid gallium and glucose solutions showing liquid metal drops entrain 1.0 % less than solid metal spheres. To better understand this, we consider boundary layer theoretical analysis. The velocity profiles within the thin film layer are directly related to the volume of low-density materials entrained to the core. Preliminary theoretical analysis predicts that the velocity profile is variable within the thin film layer and depends directly on drop radius but depends inversely on film layer thickness, and ambient fluid viscosity. Further analysis will allow us to explore the formation of the film layer surrounding sinking iron drops as well as why and how the destiny deficit within core exists today.

Etchi Ako

Bioengineering, UC Riverside

STARS

Mentored by Dr. Graham McVicker, Bioinformatics and Systems Biology

The Pseudotemporal Ordering of Oligodendrocytes in Cocaine Addiction

Roughly 20 million Americans battle a substance use disorder, with about 4% of these cases meeting the criteria for cocaine addiction. Cocaine is an extremely addictive stimulant, and prolonged use can lead to heart failure and premature death. Previous studies have shown that chronic cocaine use can result in a decrease in oligodendrocyte density in conjunction with impaired cognitive function of the prefrontal cortex. In this study, our goal is to characterize the transcriptional patterns across stages of oligodendrocyte maturation using single-cell RNA-seq data collected from the brains of rats with prolonged access to cocaine self administration. We will use Monocle3, an unsupervised algorithm to perform pseudo-temporal ordering of cells based on their transcriptome dynamics. This method of analysis can identify cell types along a developmental pathway. We will then perform differential gene expression analysis at selected developmental time points to compare the transcriptomes of rats with high and low levels of addiction. Future studies will include further investigation into the role of oligodendrocyte impairment in addiction.

Ailyn Alicea

Public Health, UC San Diego

Creating Scientists To Address Cancer Disparities Program

Mentored by Georgia Sadler, Surgery

Why are Hispanic smokers less likely to be advised to quit compared to white smokers? Cultural and institutional factors.

Hispanics are less likely to smoke than non-Hispanic whites but those who do smoke are less likely to receive advice to quit smoking. Additionally, healthcare providers are less likely to invite Hispanic smokers to join cessation programs. While few studies regarding cessation programs in Hispanic communities have been evaluated, cultural and institutional components are currently being explored along with healthcare provider interventions. This narrative literature review identified studies that have gathered data on Hispanic smokers using PubMed, Google Scholar, and CINAHL databases. Keywords included Hispanics, smokers, cessation, quitting smoking, and healthcare intervention among Hispanics. This presentation will discuss the findings of the literature review and summarize the cultural and institutional factors that affect smoking cessation programs focused on Hispanic communities.

Patricia Almaraz

Human Developmental Sciences & Spanish Literature, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Gerardo Arellano, Ethnic Studies

A Critical Approach to the U.S.' Education System: Immigrants Navigating Higher Education in the United States

The purpose of this oral history project is two-fold: first, it aims to document the personal obstacles and limitations immigrants face whilst trying to access a higher education in the U.S. Second, it showcases how the U.S. educational system has cultural and structural deficits in its inability to leverage the cultural capital of immigrants. Immigrants are socially perceived as workers only, this historical construction and social contradiction about immigrants restraints social mobility through higher education access among this already alienated group. While some policies seek to ban immigrants from social services such as education, others policies attempt to address social disparities. My methodology employs interviews in which personal anecdotes and observations made by participants regarding their educational opportunities flush out these social contradictions. Four key findings from interviews are discrepancies such as feeling alienated in school settings; being placed in ELD and SDAIE classes with deficient academic support; total unawareness of the college application processes; and language barriers. Interviews with participants offer primary data around the social contradictions regarding the immigrant experience in the US and illustrate educational gaps they have encountered as a result of the intersections of their legal status, social marginalization, lack of adequate academic environments, and/or financial setbacks. My scholarship is grounded through the paradigm of equity studies in higher education and builds on the work of scholars such as Pérez Huber (2009), Dentler & Hafner (1997), and Yosso (2005) who emphasize the importance of having equitable access to higher education in the United States.

Stephany Alonso

Materials Science and Engineering, University of California, Irvine
STARS
Mentored by Dr. Rodney Gabriel, Biomedical Informatics; Anesthesiology

Effects of Obesity on Subjects Undergoing Ambulatory Surgery.

The prevalence of obesity has grown over the past decades making patients who are obese more prone to develop cardiac disease, diabetes, arthritis, and early mortality. Obesity is defined as excessive fat accumulation that presents a risk to health and is

determined through body mass index (BMI). Patients who are considered obese (BMI >30 kg/m²) are more prone to requiring ambulatory surgeries due to their excess body mass. While improvements in ambulatory surgery have been made to account for anesthetics and pain control, minimally invasive surgical techniques, patient expectations, and recovery period, among other factors; limitations exist when treating obese patients. Surgical guidelines implemented in most hospitals generally classify these patients as unsuitable for ambulatory surgery because the surgical health risk factors for patients who are obese are unknown. The selection for patients to undergo outpatient surgery is normally determined by BMI however, BMI by itself cannot determine the risk of postoperative complications nor the length of recovery. The limit for acceptance into ambulatory surgery has increased to allow patients with a BMI up to 50 kg/m² making them eligible for these surgeries. A study that assesses the effect of obesity on patients receiving ambulatory surgery has been conducted after noncardiac surgery but literature on the safety of these procedures is sparse. The goal of this study is to better evaluate perioperative outcomes in obese patients sustaining outpatient surgery and improve the efficiency of the perioperative process.

Marianne Alonzo

Cognitive Science and Public Health, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Gedeon Deak, Cognitive Science

Early Maternal Speech Influence on Later Infant Language Development

Language acquisition of infants occurs in their early social environments, often facilitated through interactions with caregivers. However, many variables in these interactions may play a role in early language development. In order to assess the variables of maternal linguistic input that may predict infant learning, we conducted a longitudinal study following 43 mother-infant dyads and recorded them in their homes monthly from 3 to 12 months of infant age. During these sessions, mothers completed two predetermined but unscripted episodes: periods of toy-play and attention following. We transcribed maternal speech from the acquired video data of these sessions and data analyses were performed to evaluate the quantity and quality of mothers' language use, including metrics of speech complexity and diversity and some metrics of content and meaning. These metrics were then tested as possible predictors of infants' later language skills emerging from 12 to 22 months of age, as measured by standardized tests and checklists (i.e. Macarthur-Bates Communication Development Inventory, among others). Existing literature on early language acquisition has addressed a myriad of social variables such as speech repetition, duration of social interaction, and the effects of parental socioeconomic status (SES). Such studies find a robust relation of SES to language development, partially mediated by parents' speech quantity, diversity, and complexity. By examining an SES homogeneous sample, we can factor out the multiple confounds that covary with SES. We hypothesize that dyads with

increased maternal lexical diversity and complexity will show infants with higher levels of speech ability.

Erick Alvarado and Junlin Wu

Materials Science & Engineering, UC San Diego

MRSEC REU or RIMSE

Mentored by Tod Pascal, Nanoengineering

Directed self-assembly of metal nanocrystals using complementary strand of DNA

Self-assembly of metal nanoparticles using complementary DNA as a scaffold can be precisely controlled via Watson-Crick base pairings between two DNA strands. Directed assembly of nanoscale building blocks into the desired architecture is intensely valuable to study due to their potential impact on numerous research fields, such as materials science, soft electronics, and drug-delivery nanobiotechnology. When a single DNA strand is attached to nanoparticles via either non-specific or specific molecular binding, the nanoparticle assemblies are then self-assembled through complementary pairs in DNA. However, effective fabrication process has not been discovered yet because of the complex interaction between the DNA nucleotides and nanoparticle surface. In this project, we propose a model of two silver nanoparticles, each is attached to a single DNA strand backbone and the binding energies of individual structures, and the hybrid structure are calculated using Molecular Dynamics (MD) calculation method. Our goal is to determine the lowest binding energy and the possible DNA-nanoparticles hybrid structure by using MD calculation approach.

Alicia Amamoto

Pharmacological Chemistry, UC San Diego

Undergraduate Research Scholarships

Mentored by Dr. Soumita Das, Pathology

The role of ELMO1-SifA-Rab9 interactions in pathogenic bacteria infection

Gram-negative pathogenic bacteria such as Salmonella and E. coli (Escherichia Coli) can cause enteric disease, which poses a significant global health issue. With the rise of bacterial antibiotic resistance, the study of infection pathways has been relevant to the development of alternative methods of treatment. Previous research from the Das lab has explored the interaction between ELMO1 (Engulfment and Cell Motility Protein) and SifA (Salmonella filaments A). Results have shown this interaction to be significant in bacterial clearance, while also contributing to Salmonella internalization and survival within host cells. The WxxxE (Tryptophan-xxx-Glutamate) amino acid sequence, which is shared among SifA and other effector proteins of pathogenic bacteria, was found to be

significant in SifA and ELMO1 interaction. In addition to ELMO1-SifA binding, both proteins were found to interact with the late endosomal GTPase Rab9. It has been shown that interactions between SifA and Rab9 prevent CI-MPR (Cation- independent mannose 6 phosphate receptors) recycling, preventing lysosomes from fusing to the late endosome and protecting the Salmonella containing vacuole (SCV). The discovery of binding between ELMO1, SifA, and Rab9 prompted interest in understanding the mechanisms of these late endosomal interactions. GST- and immuno-pulldown assays, western blotting, immunofluorescence and other lysosomal functional assays, will allow us to gain a deeper understanding of the significance of the interaction between ELMO1, SifA and Rab9.

Maria Angst

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

Update of ichthyofaunal utilization of created versus natural salt marsh creeks in Mission Bay, CA

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 ichthyofaunal of a created marsh (Crown Point Mitigation Site; CPMS) and an adjacent natural marsh (Kendall Frost) in Mission Bay, California, 21 years following the marsh creation. These data were compared to data collected from 1995-1998, immediately after marsh creation. Fishes trapped in both marshes conjoined included *Fundulus parvipinnis*, *Gillichthys mirabilis*, *Ctenogobius sagittula*, *Atherinops affinis*, and *Mugil cephalus*. Species richness, dominance measures, and abundances were higher in the natural relative to the created marsh. The size-structure of *F. parvipinnis* in the natural marsh was skewed towards larger sizes relative to those in the created marsh. These size differences are the opposite of those noted in the years immediately following marsh creation, and appear to arise from differences in creek morphology between the created and natural systems, with the created marsh having become shallower through time.

Paola Anguiano Quiroz

Chemistry, UC San Diego
Creating Scientists To Address Cancer Disparities Program
Mentored by Georgia Sadler, Surgery

Factors Explaining Why Hispanic Women Diagnosed with Breast Cancer in the United States Have a Higher Risk of Mortality

In the United States, breast cancer is the most common cancer among all women. While Hispanic women have one of the lowest breast cancer incidence rates in comparison to other ethnic/racial groups, they have a higher risk of mortality because their breast malignancies are being detected at more advanced stages. This narrative literature review explores possible factors to why Hispanic women are at a higher risk of fatality for breast cancer. Articles were identified using PubMed, Google Scholar, and EBSCOhost databases with keywords Hispanic, breast cancer, breast cancer disparities, screening, barriers, mortality and incidence rates. Studies suggest that this ethnic disparity can be attributed to language barriers, lack of access to health care, low education, and unfamiliarity with the healthcare system contributing to low rates in mammography screening. Recommendations for improving cancer prevention and care for Hispanic women will be provided.

Brianna Angulo

Political Science-International Relations, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Ivan Evans, Sociology

Prevention work in combatting human trafficking on a local and global scale

According to the FBI, San Diego is ranked as one of the 13 worst regions in the United States for human trafficking, with 3,000 to 8,000 victims trafficked each year. Because of the proximity to the border and since our age range is ideal for human traffickers, we are at a greater risk. In this study, we aim to gain a better understanding of Human Trafficking as a global issue and support the expansion of PCI's Human Trafficking Prevention Program. The ROOTS curriculum seeks to address these pressing issues in order to build their resilience and prevent them from becoming victims of human trafficking. However, some of the curriculum material needs editing to be more effective and engaging to today's youth. Our research will review existing research to improve the quality and efficacy of the ROOTS curriculum and mentoring. This research will consist of finding to see what language is the best appropriate language to use in a classroom setting to discuss a sensitive topic such as human trafficking. In addition, we will develop a survey instrument to conduct mixed-methods evaluations with the ROOTS

curriculum and across the United States. This approach will allow us to spread awareness about human trafficking, find ways to aid victims of human trafficking, and educate communities about those who are most vulnerable to human trafficking.

Ankeen Arestakesyan

Electrical Engineering, UC San Diego

Electrical and Computer Engineering SRIP

Mentored by Professor Karcher Morris, Electrical and Computer Engineering

Tailoring ECE 5 College Class to High School Students: Developing Technical Skills and Promoting Creative Thinking

This educational research project aims to expose high school students to STEM through designing a high school-tailored ECE 5, Introduction to Electrical Engineering, curriculum. Many of the aspiring engineers studying at UCSD have expressed how much they would have benefitted from early exposure to hands-on projects and STEM topics. This inspired the 'Bringing ECE 5 Curriculum to High School' endeavor. We hypothesize that through extending the ECE 5 coursework to a high school environment, an increased number of students will gain interest in pursuing degrees in STEM, build confidence in solving problems with new technical skills, and more likely enter STEM communities at their current or future schools. Specifically, the tailored curriculum incorporates different methods of instruction to cultivate creative thinking and problem-solving skills in the students. Alongside the labs, a combination of workshops and mini-projects are integrated into the class to deliver technical skills, professional skills, and tools for creativity to the students, which is also reinforced through the online website they would create for progress reports. The class concludes with a project which the students design themselves. The additional components to the course allow the students to expand and explore their creativity and imagination, use their hard and soft skills, and combine all that they have learned for a final project. In the presentation, the developed content will be reviewed and preliminary baseline data from undergraduate ECE 5 students will be discussed.

Shannon Arias Ortega

Cell and Molecular Biology, California State University, Northridge

STARS

Mentored by Dr. Chitra Mandyam, Health Sciences

Alcohol use disorder and endothelial insult: Review of the current literature and future prospects

Alcohol use disorder (AUD) is a public health issue affecting men and women from adolescence into adulthood. It affects one in eight American adults in the U.S., indicating that its prevalence is widespread. Studies conducted in alcoholics and preclinical models of AUD over the past few decades have indicated that it is a brain disorder. While most of the studies have focused on the effects of AUD on neuronal structure and function, emerging studies have found a correlation between the effects of alcohol and the damage to the blood-brain barrier and endothelial cells in the brain. In this review, we focus on the effects of alcohol on the structure and function of endothelial cells. We discuss the effects of alcohol on various biomarkers of endothelial cell damage, which are defined as characteristics of the cells that can be measured, such as cell adhesion molecules (CAMs), markers of coagulability, markers of oxidative stress, and chemokines. We also discuss the effect of alcohol on proteins that work on endothelial cells such as vascular endothelial (VE) cadherin, fibronectin, and elastin. Based on the review of the literature, there is a wide amount of information on alcohol and endothelial damage. Understanding this information and having it accessible allows for insight into where we are in the process of understanding the damages of AUD specifically on the endothelial cells. In the future, this can lead to the discovery of novel biomarkers for alcoholism, and finding efficient treatments to help those who suffer from AUD.

Carissa Avina-Beltran

Physics, SF State University

STARS

Mentored by Dr. Carl Melis, Center for Astrophysics and Space Sciences

Dust from a destroyed planet obscuring the Sun-like star TYC 8830 410 1

TYC 8830 410 1 is a ~600 million year old, solar-mass star surrounded by inner planetary system dust that lies along our line of sight and blocks out significant portions of the star's light. Given the older age of this system, it is unlikely that the dust is associated with planet formation processes which are completed by ~100 million years. Instead, the large amounts of dust are most likely produced by a giant impact type event between mature planets. With frequent imaging monitoring at multiple wavelengths

with the Las Cumbres Observatory Global Telescopes, we are characterizing the size and dust content of the transiting structures, which will allow us to assess their origin and evolution. This talk presents analysis of multiband monitoring obtained since October 2020.

Ashleigh Ayers

Molecular Cell Biology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Anthony O'Donoghue, Enzymology

Cathepsin G and Its Role in Cistic Fibrosis and Chronic Pulmonary Obstructive Disease

Cystic Fibrosis (CF) and Chronic Pulmonary Obstructive Disease (COPD) are debilitating lung diseases that affect millions of Americans. In CF and COPD patients, exacerbations, which are acute episodes of decreasing respiratory and lung function, are triggered by an infection. As a response of the immune system, neutrophils release proteolytic enzymes that serve many functions, including killing bacteria. The neutrophil elastase enzyme has already been identified as being released to the lungs of patients with CF and COPD. However, another enzyme, cathepsin G, has also been discovered to have high activity in the lungs of patients with CF and COPD. Up-regulatory of these proteolytic enzymes causes degradation of the structural airway leading to a buildup of mucus and pathogens. By discovering inhibitors that bind to cathepsin G we can reduce protease activity and therefore maintain the structural integrity of airway. In this experiment, I will be comparing the activity of cathepsin G with the neutrophil elastase, and determining whether cathepsin G cleaves different peptides. By using substrates that have a specific wavelength of light, I will be able to characterize and differentiate the activity of cathepsin G.

Solmaz Azhdari

Political Science-International relations, UC San Diego
McNair Scholars Program
Mentored by DR. David Lake, Political Science

A Theoretical Framework to Explain Enduring Conflict in U.S.-Iran Relations After 1979

Introduction

Much ink has been shed on the enduring enmity between the U.S. and Iran. When not teetering on the edge of military confrontation, the two sides seem to have spent the past four decades pouring in grievances into a "wall of mistrust."

Iran-U.S. conflicts

1953- U.S. Orchestrated coup that made Iranians suffer an absolute monarchy under the Shah

1980-Hostage crisis

1983-U.S Marines barracks bombing. 1985-1987- Iran-Contra

1986-Tanker wars in the Persian Gulf 1988-U.S. shoots down Iranian airplane

1990- Congressional sanctions aligned with president Clinton 2002-“Axis of evil.”

2005-Khatami presidency- Iran resumed uranium enrichment.

2005-2009-Ahmadinejad's first term as president-Iran enhanced enrichment levels to 20 percent and accelerated work on advanced ballistic missiles; the

2012-Geneva round of JCPOA negotiations 2015-JCPOA

2017 – Trump extends sanctions waivers 2018-Trump withdrawal from JCPOA

2019-IRGC designated a terror group by the U.S. 2020-Assassination of General Ghasem Soleimani 2020-Iran hits U.S base in Iraq by BMs

As is clear the post-revolutionary history of U.S.-Iran relations is rife with missed opportunities, broken commitments, misperceptions of intent, and purpose of study theoretical: A framework to explain U.S. Iran relations. Practical: policymaking and effective in informing policy.

Nishant Balaji

Computer Engineering, UC San Diego

Undergraduate Research Scholarships

Mentored by Curt Schurgers, Electrical and Computer Engineering

Acoustic Species Identification

As a result of climate change there is a significant loss of biodiversity in different environments. As such, there is an increased demand for biodiversity monitoring around the world, which provides researchers with valuable insights into a region. Recently, thirty-five Audiomoths, small autonomous audio recorders, were deployed in the Madre de Dios region of the Peruvian Amazon. These Audiomoths recorded around 1500 hours of audio, making it unreasonable to manually label all the audio. In collaboration with the Population Sustainability group from the San Diego Zoo Wildlife Alliance, the Acoustic Species Identification team is working to convert the audio recordings into meaningful interpretations that identify unique species vocalizations present in the dataset using machine learning and digital signal processing techniques. A manual labeling system called Pyrenote is being developed for volunteers to manually label audio clips. This strongly labeled data, which specifically pinpoints the exact times of vocalizations in audio clips, will provide a strong basis to train the rest of the automated annotation techniques. This pipeline, being developed as a python package called PyHa, will autonomously label the locations of the audio calls in the recordings. We are currently using and developing new techniques like chunk isolation to accurately match

up the autonomously created labels with the human-made annotations. We have used power spectral density and signal to noise ratio values to help classify the audio data and identify the locations of the vocalizations within them. This can help us notice anomalies in the data like rain and trucks.

Jenna Balingit

Cellular and Molecular Biology, San Diego State University
Creating Scientists To Address Cancer Disparities Program
Mentored by Dr. Christal Sohl, Chemistry & Biochemistry

Asian Glow: Genetic Variant Aldehyde Dehydrogenase-2 Enzyme deficiency in the Asian Population and Its Link to Hepatocellular Carcinoma

Overall, the Asian population in the US has a lower risk of cancer, but higher rates of specific cancers, such as liver cancer. About 30-50% of the Asian population carry a genetic mutation where the body has a hard time properly breaking down alcohol when ingested. This genetic mutation results in decreased production of the Aldehyde Dehydrogenase-2 (ALDH2) enzyme for its role in breaking down alcohol in the liver. ALDH2 is an essential enzyme to break down ethanol when alcohol is consumed, since alcohol is considered carcinogenic to the human body. Many sociological and physiological factors have been identified on why liver cancer is prevalent in the Asian community, but the role of ALDH2 is unclear. This narrative literature review identified articles on ALDH2 using PubMed, PsycINFO, cBioPortal, and Protein Data Bank using keywords Asian, ALDH2, enzyme, liver cancer, hepatocellular carcinoma, alcohol metabolism, mortality, screening, alcohol. Reference lists of key articles were reviewed. This presentation will summarize the findings from this literature review and highlight implications. Recommendations for future research will be provided.

Hollywood Banayad

Physics, San Francisco State University
STARS
Mentored by Dr. Monica Allen, Physics

Utilizing MATLAB Interface to Communicate with Hardware(Lock-in Amplifier)

Techniques, such as microwave impedance microscopy (MIM) and lab instruments, such as lock-in amplifier (LIA), function generator, network analyzer, and isolated DC voltage, are core to our lab along with many other engineering and physics research labs. MATLAB interfacing is useful to communicate with various instruments and data acquisition, thereby data analysis as well. There are normally three main types of devices we aim to communicate within the lab: having only input, only output, and both

input & output. My goal is to build a MATLAB library with codes to communicate with LIA in terms of sending read, write, and status query commands. For example, the write command will help to adjust the output voltage of the LIA, and the query command will indicate if the output the LIA is sending to the setup is correct. While the duration of this internship would not suffice a deep dive into creating more libraries to communicate with several instruments in the lab apart from LIA, the scope of learning MATLAB interfacing technique is enormous. For example, it would be possible to achieve the communication speeds required for faster real-time experiments. The current communication speed needed to communicate with the lab instruments is of the order of hundreds of microseconds. However, faster latency (of the order of hundreds of nanoseconds) can be achieved to enhance the communication between computer and instrument to facilitate fast real-time experiments required for quantum computation.

Kassandra Barajas and Alexair Gonzalez

Psychological Science, CSU San Marcos

STARS

Mentored by Dr. Victor Ferreira, Psychology

Are mental events structured propositionally?

A proposition can be divided into two parts, the subject and the predicate (verb and object). There are two language phenomena that suggest predicate elements may form a cohesive conceptual unit, separate from the subject. First, the object seems to have a greater influence on the meaning of the verb than does the subject. For example, the meaning of the verb “pitch” changes depending on what the object is (e.g., “pitched the baseball.” vs. “pitched the idea.”), whereas the subject seems to have less of an influence (e.g., “The man pitched” vs. “The boy pitched”). Second, the majority of idioms are almost always predicates (e.g., “hit the sack”), rather than a subject and verb. In the current study, we test whether it is indeed the case that the subject and the predicate are two separate conceptual units using cued recall paradigms. Participants studied eight sentences (e.g., “Alice wrote the essay.”) in each of the three experimental blocks and were then prompted to recall the sentences in a “Who did what?” format. That is, the verb was used as a memory cue. If the hypothesis is correct, we anticipate superior memory performance for the object (because the verb and the object belong to the same conceptual unit), compared to the subject. The results will inform our understanding of the relationship between conceptual organization and language production.

Stephanie Barajas

Chemical Engineering, UC San Diego
PATHS Summer Research Program
Mentored by Dr. George Hightower, Pediatric Dermatology

Low Income Community Support with Pollution

Populations living in low income communities often struggle with the negative effects of pollution and lack the locations needed to receive proper treatment. The negative effects often cause long term defects such as upper respiratory problems and higher risk of cancerous diseases. As researchers, we propose the further investigation of the low income communities located in the San Diego area by analyzing the environment to determine the amount of pollution. The amount of pollution in an individual community can be determined through the means of using information on government websites and testing the air with a thermometer known as the Air Quality Index. After determining the amount of pollution, we research a close estimate on the population number in the community and the amount of healthcare services available nearby. A close estimate of the population is determined with household surveys sent out to the residents of the community and also from the help of government approved websites with estimates of population amount. The amount of healthcare services located nearby the community can be individually determined through website research as well as personal visits. The data analysis and results stemming from the three factors combined helps determine the amount of healthcare services needed to provide more support and list of possibilities to various ideas to lower the contamination caused by the pollution in the area. A similar approach can be later applied with focusing on groups of communities at once rather than just one individual community at a time.

Sadie Barbee

Biology, UC Riverside
Walker Lab, Department of Biomedical Sciences
Mentored by Dr. Ameae Walker, Biomedical Sciences

Prolactin upregulates SF3 Prolactin Receptor Expression in the Mouse Liver

Liver function is highly sexually dimorphic, with females metabolizing drugs differently from males, and females more resistant to hepatocellular carcinoma. The literature attributes this dimorphism to sex steroids and differences in growth hormone release. We hypothesize that dimorphism may also be related to the hormone, prolactin (PRL). There are multiple functional isoforms of the transmembrane PRL receptor (PRLR), produced by alternative pre-mRNA splicing. In mice, there is a long form (LF) and three short form (SF) receptors, with SF3 being the predominant isoform in the liver. When

PRL binds, LF promotes proliferation and inhibits apoptosis, and SFs1-3 generally act in an opposite fashion. Quantitative reverse transcription polymerase chain reaction analysis of Prlr isoform expression in mouse liver revealed that SF3 is expressed highest in all stages of the estrous cycle, and much higher in females. Considering our hypothesis, we asked whether elevated circulating PRL would affect Prlr expression and cell proliferation in the liver. Proestrus mice were treated for 7 days with 3 μ g/hr continuous PRL and were given EdU (5-ethynyl-2'-deoxyuridine), a thymidine analog that indicates in vivo cell proliferation, 2 hrs before tissue harvest. PRL treatment increased expression of SF3 by a 50% induction when compared to control mice. Livers have been sectioned and stained for EdU and are currently being analyzed. We hypothesize that EdU will indicate lower proliferation with PRL treatment due to SF3 predominance, an isoform understood to inhibit proliferation. This work will increase understanding of how the liver functions differently in males and females.

Sara Barcik Weissman

Biological Sciences, UC San Diego

MRSEC REU or RIMSE

Mentored by Professor Stephen Mayfield, Biological Sciences

Improving Genetic Tools for High Value Protein and Biofuel Production in Green Algae

Affordable, sustainable biofuels are desired as both a solution to global carbon emissions and a reduction of other pollutants. Green unicellular algae can be grown using non-potable water and on land not conventionally used for agriculture as a platform to produce lipids for conversion to biofuels. Currently, algae-derived biofuels are not cost-competitive compared to petroleum products.

One approach to offset the cost of manufacturing the biofuels is to co-produce high-value recombinant proteins. Here we are using Xylanase, an industrially relevant enzyme that breaks cellulose down into simple sugars, as a model high-value protein. Currently, the rate-limiting step of developing high-value co-products is isolating high-expressing strains of algae. Previously we have used gene expression vectors that transcriptionally link high-value transgene expression to fluorescent proteins to allow for high throughput selection using flow cytometry and Fluorescently Activated Cell Sorting (FACS). However, preliminary data suggest that the arrangement of the high-value protein and fluorescent protein in the expression vector as well as the way they are linked and selected for strongly influences the frequency and reliability of isolating a high-expressing strain.

Here we are testing different vector designs to find a gene arrangement that results in a strong correlation between fluorescent protein expression and protein of interest expression. We will then high throughput screen the transformants and run enzymatic assays to test for the presence and activity of secreted Xylanase.

Vanessa Barragan

Psychology, CSU Fullerton

STARS

Mentored by Dr. Lara Rangel, Cognitive Science

Oscillatory patterns in the dentate gyrus of the hippocampus during the evaluation of visual cues in a delayed-match-to-sample task

Many of our experiences can have similar combinations of people and places, rendering it a challenge to construct distinct memories for each. The ability to form distinct memories is critical if small differences between experiences can predict drastically different outcomes. The dentate gyrus of the hippocampus is hypothesized to assist with this ability by creating distinct representations of experiences among its active cells. Few studies have examined activity within the dentate gyrus during a task in which subjects must learn to encode initial experiences as distinct to guide future behavior. We obtained in vivo electrophysiological recordings of single cells and local field potentials (LFP) in the DG of rats as they performed a novel spatial delayed-match-to-sample task. In this task, rats must remember the location of a reward during a study phase in order to differentiate it from other possible rewarded locations during a subsequent test phase. Rats must then return to the previously rewarded location during the test phase in order to receive an additional reward. We identified critical behavioral epochs during the task in which rats assessed environmental cues that could guide subsequent decisions, and assessed neural activity during these intervals. Overall, this project aims to 1) relate recurrent rat behavior patterns to successful performance of our task and 2) uncover underlying neurophysiological signals in the dentate gyrus of the hippocampus that support the formation of distinct memories.

Arturo Baza and Jonathan Lane

Mechanical Engineering, UC San Diego

SDNI/MRSEC

Mentored by Dr. Michael Sailor, Chemistry & Bio-Chemistry and Yubin Huang

Optimizing the Hydrolysis of Organophosphorus Nerve Agents by Using Less Volatile Polymer Bases and Various Zirconium Cluster Loadings

Chemical warfare agents (CWAs) are extremely toxic chemical compounds that represent an extreme threat to society. These artificial toxins could be exposed if there is chemical warfare, terrorist attacks, or improper chemical storage. The symptoms after being poisoned by nerve agents usually appear within seconds, and people exposed to medium or large doses can quickly develop convulsions, paralysis, or loss of consciousness. As a consequence of this threat, there is an urgent need for the

development of more efficient materials for detection and degradation of CWAs. We aim to develop nanotechnological subsystems that can incorporate inorganic antidotes into the engineered fabric as a component of an outer garment, which will prevent CWAs coming in contact with the wearer. In this project we are going to use Zirconium based small molecule catalysts for the rapid degradation of CWAs simulant, dimethyl phosphate (DMNP). One of the challenges so far is that the degradation process needs to be performed under strong basic conditions (pH 8) for efficient breakdown of the DMNP. Our goal is to research how to perform the degradation process while using less volatile polymer bases; to substitute the volatile N-ethylmorpholine (NEM) currently being used. The second goal for this project is to load the Silica-Zr catalyst materials into the channel of the engineered fabric and to test its hydrolytic performance in breaking down DMNP.

Imani Bennett

Political Science, Spelman College

STARS

Mentored by Dr. Margaret (Molly) Roberts, Political Science

Monetization of Misinformation Websites

Misinformation has become commonplace on social media and its spread has received increasing attention in the news media. One of the primary difficulties of removing misinformation is that misinformation is profitable -- websites take advantage of users' interest in misinformation for financial gain. Users of misinformation websites are greeted by ads and donation buttons while seeking alternative perspectives. While previous research has focused on ad revenues and donations to misinformation sites, this project aims to decipher overall monetization patterns of misinformation websites by analyzing ad count, donation asks, membership access rates, and merchandise stores amidst a random sample of 150 misinformation websites. Investigating misinformation websites' monetization schemes will provide insight into the financial strategies of individuals that are sowing seeds of distrust within their own communities. By understanding the financial stakes of misinformation, this project will help shed light on what actions could be taken to stop its spread, and how the political economy of misinformation shapes the forms and content of misinformation online.

Natalia Berrios-Rivera

Mechanical Engineering, UC San Diego

McNair Scholars Program

Mentored by Dr. Jeff Gee, Scripps Institution of Oceanography

Analyzing marine magnetic anomalies at the northern East Pacific Rise using an autonomous underwater vehicle

Analyzing submarine volcanic activity at mid-ocean ridges is significant to our overall understanding of Earth and its magmatic processes. Monitoring submarine volcanic eruptions is difficult because eruptions occur on the seafloor, kilometers below the surface of the water. Our current understanding of these eruptions is largely informed by data collected from a limited amount of documented events. One of the few sites where recurring eruptions have been documented is the northern East Pacific Rise (EPR), a volcanically active fast-spreading mid-ocean ridge segment located in the eastern Pacific Ocean. Lava flows from past submarine volcanic eruptions provide insight into the temporal distribution of eruptions, as well as the spatial extent of lava flows from these eruptions. As lava flows solidify and cool on the seafloor, they become magnetized parallel to the Earth's magnetic field, preserving a permanent record of the magnetic field in the oceanic crust. Here, we present magnetic anomaly data from before and after the most recent eruption at the northern EPR, collected using underwater autonomous vehicles ABE and Sentry. Magnetic anomaly data provides a way to map the edges of lava flows, estimate lava flow thickness, and analyze changes in marine magnetic anomalies after eruptions. These seafloor magnetic anomalies should provide information on the timing and distribution of eruptions and lava flows at this fast-spreading ridge.

Veronica Berta

Oceanic and Atmospheric Sciences, UC San Diego

McNair Scholars Program

Mentored by Dr. Lynn Russell, Scripps Institution of Oceanography

Detecting Amine within Single Particle AMS Measurements

The presence of amines in aerosol particles is of concern as they can be toxic, increase particle growth rates, or serve as CCN to form cloud droplets. However, amine is difficult to measure within aerosols due to their low concentration. The ability to quantify amine by mass spectrometry is further limited to ensemble measurements by detection of known ion fragment. During the third and fourth North Atlantic Aerosols and Marine Ecosystems Study (NAAMES-3, NAAMES-4) cruises, a High-Resolution Time-of-Flight Mass Spectrometer is utilized to assess the composition of ambient aerosols. A method

to detect amine from single particle event trigger measurements is developed using the averaged fraction of the total ion signal that is attributed to ON ion fragments at each mass-to-charge ratio. The amount of amine across all particle classes resolved for both NAAMES-3 and NAAMES-4 clean marine air masses remained relatively low, averaging 1.33% & 0.95%, respectively, but was found to be greater in particle classes with a larger organic component. This method is then a reasonable approximation for amine contributions within particle classes resolved from single particle measurements.

Jada Bezue

Biochemistry, Xavier University of Louisiana
STARS
Mentored by Dr. Julian Schroeder, Biology

CO₂ Regulation of Stomatal Movement and Development

The atmospheric CO₂ concentration is rising rapidly and is currently near 417 parts per million. This value is the highest during human history and its ever present rise has not only had a direct impact on global warming, but it has also affected stomatal development and movements of plants. Pores called stomata, found on the leaf surface of vascular plants, control the gas exchange between the atmosphere and intracellular spaces of the leaves. Photosynthesis causes a reduction in CO₂ levels and in response to low CO₂ levels stomatal opening is triggered, causing an inflow of CO₂ and enhancing photosynthesis. On the other hand, CO₂ levels rise in darkness which triggers stomatal closure in plants. This balances CO₂ uptake and regulates water loss of the plant via transpiration from leaves. This project's main goal is to better understand the CO₂ signaling pathway and to find new pathways and genes that function during CO₂ signaling. The model organism is *Arabidopsis Thaliana*, a weed that is ideal for studying new genes and the mechanisms of guard cells that reduce water loss during drought. This project has the long-term prospect of developing new approaches for water retention of plants to keep crops resilient to climate change-induced stresses. It is hoped that this can lead to new crops that may adapt to climate change.

Alexander Boakye, Freddy Garcia, and Danielsen Moreno

Chemical Engineering / Mechanical Engineering Technologies, Howard University / Farmingdale State College / New Mexico Institute of Mining and Technology

San Diego Nanotechnology Infrastructure (SDNI)
Mentored by Oscar Vazquez-Mena, NanoEngineering

Handling the thinnest material: How to transfer graphene from a Cu foil to a Silicon chip

One of the main challenges to incorporate graphene for consumer technologies is the handling of graphene. At one-atom thickness, graphene presents unprecedented challenges for manufacturing. Herein, we describe how graphene grown by chemical vapor deposition is transferred from the copper substrate on which graphene is grown to a target substrate such as a silicon chip. Chemical vapor deposition offers the best compromise between electronic properties and size. We describe the etching of the copper by sodium persulfate and the graphene "fishing" which remains the bottle neck for larger scale production of graphene based devices. We also propose alternative solutions that can overcome current challenges.

Maya Bocanegra

Applied Mathematics, CSU Northridge
STARS
Mentored by Dr. Shaochen Chen, Nano Engineering

Mathematical analysis of coral algae photosynthesis efficiency under varying architecture and optical properties

Coral reefs are a required element of our ecosystem necessary to sustain thousands of lives. As a result of this, information about the characteristics and environments in which they photosynthesize is monumental. A variety of coral architectures and optical properties exist that affect photosynthetic performance under different light environments including shallow and mesophotic. Through the use of the Monte Carlo simulation a measure of the efficiency of coral algae photosynthesis was effectively produced. We examined the representation of the simulation output light fluence rate and photosynthetic rate. The combination of the simulation results and mathematical tools we used yielded estimates of the photosynthetic performance with arbitrary morphologies and optical properties. This is a significant development because corals are very good at utilizing solar light which gives us a great opportunity to learn from nature. Understanding this is incredibly important for determining the kind of impact environmental shifts can have on coral algae photosynthesis.

Celine Bojo

Human Biology, UC San Diego

Undergraduate Research Scholarships

Mentored by Dr. Pamela Mellon, Department of Obstetrics, Gynecology, and Reproductive Sciences

Effects of SOX2 Mutations on Kisspeptin Expression

Isolated Gonadotropin-Releasing Hormone Deficiency (IGD) is described as a genetic disorder characterized by reduced levels of Gonadotropin-Releasing Hormone (GnRH) secretion by GnRH neurons within the hypothalamic-pituitary-gonadal axis. GnRH secretion is critical for the initiation of sexual maturation and is regulated by the release of kisspeptin from kisspeptin neurons in the hypothalamus. The gene SOX2 has been identified as one of the putative causative genes involved in IGD and will be the primary focus of this research project to compare the effects of both the wild-type and mutated genes in the HPG axis to determine whether there is evidence that SOX2 is causative of IGD. The protein SOX2 functions as a transcription factor that serves an important role in development. From previous experiments, it has been observed that SOX2 represses kisspeptin luciferase in luciferase assays. The SOX2 patient mutations R43L, H101D, D123VfsX31, and Y200X have been found to reverse the phenotype of repressed kisspeptin luciferase.

Via luciferase assays, we have found that the mutations D123VfsX31 and Y200X are characterized as dominant negative mutations that interfere with the functionality of wild-type proteins. Since luciferase assays have suggested that kisspeptin is suppressed by SOX2, shRNA studies will be conducted to observe the impacts of SOX2 repression on kisspeptin expression. In-vitro models will be utilized to measure the activity of kisspeptin neurons with both the wild-type and mutated plasmids of SOX2 through qPCR analysis by transfection of the cell lines KTaR and KTaV that serve as kisspeptin models.

Rosalba Bonilla

Psychology and Sociology, University of San Diego

McNair Scholars Program

Mentored by Dr. Kristen McCabe, Psychological Sciences

The relation of parenting style to treatment rationale preference in Behavioral Parent Training interventions

Previous research demonstrates that behavioral parent training programs (BPT) are effective in treating young children with disruptive behavior disorders, but many families, particularly ethnic minority families, do not fully benefit from these programs

for reasons such as parents not enrolling, engaging, or completing the programs. One of the reasons why ethnic minority families may benefit less is because they may have parenting styles that are not compatible with the skills taught in the programs. Because there are such a wide variety of backgrounds for families using BPTs, one cannot assume that the standard presentation of therapy programs will be engaging for all parents. For example, permissive parents that are characterized by their strong parental warmth but are lower in limit setting may differ in terms of treatment rationales that are more appealing from authoritarian parents that are lower in warmth and higher on limit setting. Identifying treatment rationales that appeal differentially to parents who are either authoritarian or permissive could help clinicians and therapists to better support their clients' to potentially improve engagement in their respective programs, especially when considering families of culturally diverse backgrounds. The aim of this paper is to evaluate existing literature to determine what is known about the effectiveness of tailoring treatment rationales for authoritarian and permissive parents to increase parental engagement in BPTs, in preparation for an empirical study that will examine whether tailoring BPT treatment rationales to specific parenting styles (i.e. authoritarian and permissive) makes BPT concepts more appealing to parents.

Eric Boone

Bioinformatics, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Heidi Cook-Andersen, Biology Department

Regulation of mRNA in Early Embryo

The use of mRNA vaccines in the last year marks the first time that mRNA treatments have reached the public conscious at large. Their widespread use of the mRNA vaccines will likely usher in many other treatments in the near future. As such, understanding the way that mRNA's are regulated inside the cell will be crucial in improving the efficacy of our mRNA treatments.

To that end there are few circumstances that are better for studying mRNA regulation than the early stages of embryo development. The dynamic transition from oocyte-to-embryo takes place in the absence of new transcription. All changes undergone by the cell in this period are conducted through post-transcriptional regulation of maternal mRNA accumulated during oocyte development.

The goal of this research project is to shed light on the mechanisms responsible for regulating the oocyte-to-embryo transition. Given the importance of mRNA degradation, I will focus on finding stage specific patterns in regulation of mRNA through changes in stability. First, I will quantify alternative 3'-UTRs for each gene, then calculate a weighted average of tail lengths. Second, I will use a technique known as exon-intron split analysis to calculate stability of mRNAs on a gene level. Finally, I will analyze transcript isoforms for motifs that complement regulatory miRNA and RNA

binding proteins. Together, these analyses will shed light on stage specific patterns in mRNA stability, as well as suggest potential mechanistic pathways for mRNA regulation.

Brandon Bourassa

Oceanic and Atmospheric Science, UC San Diego

Undergraduate Research Scholarships

Mentored by Jennifer Haase, Institute of Geophysics and Planetary Physics

Airborne radio occultation instrument requirements for real-time forecasting of atmospheric rivers

Atmospheric rivers are the most impactful rainfall events in California, providing the seasonal snowpack for water resources, but also carrying the potential for extended duration rainfall and flooding. The Center for Western Weather and Water Extremes in collaboration with the Air Force and NOAA send aircraft into the events over the Pacific to improve forecasting. A key process that introduces uncertainty into the forecast is heat released during precipitation when moisture converges ahead of the cold front and is uplifted.

GPS data collected from the aircraft for remote sensing of the atmospheric moisture in the frontal zone and low-level jet it can provide unique observations to improve forecasts. These observations are derived from travel time delays measured in the GPS signal propagation to the aircraft receiver from a rising or setting GPS satellite.

Currently, the data are post-processed for retrospective studies of potential forecast improvement.

This project evaluates different approaches for deriving the GPS observations more rapidly, and the resulting impact on the accuracy. If the accuracy is sufficient, this will allow a real-time system to be used in place of a post-processed system. It will improve existing strategies for improving precipitation forecasts through enhanced use of aircraft data collected each winter season in the AR Recon program.

Stuart Boynton

Computer Engineering, UC San Diego

Electrical and Computer Engineering SRIP

Mentored by Dr Yang Zheng, ECE

Advanced Control and Optimization for Autonomous Vehicles in Mixed Traffic Systems

Traffic congestion is a worldwide issue and the possibility of reducing it has many benefits. Previous simulations and experiments have shown that autonomous vehicles (AV's) can be used to smooth perturbations in traffic flow and decrease energy consumption of all vehicles. In this project, we adopt an optimal control strategy

established in a previous work, and we investigate how changing certain control parameters affects the overall performance of the traffic system. We further compare this modified optimal control strategy with a few other existing empirical strategies in smoothing traffic flow. We finally investigate the penetration rate of AVs on the traffic performance in large and small simulations. These numerical investments will help further understand an optimal strategy to reduce traffic congestion in a system of predominantly human driven vehicles.

Nathan Bradshaw

NanoEngineering, UC San Diego
McNair Scholars Program
Mentored by Dr. Andrea Tao, NanoEngineering

Clinic-Friendly Sensor: Proof-of-concept for SARS-CoV-2 Antibodies

A clinic-friendly sensor that can rapidly detect low-level concentrations of molecular analytes is highly desirable, especially for the detection of antibodies against SARS-CoV-2 or for the detection of SARS-CoV-2 RNA without the need for additional amplification steps. Here, I will discuss my research on combining the common lateral flow sandwich immunoassay with Surface Enhanced Raman Spectroscopy (SERS), an optical technique that is capable of chemical-sensitive detection down to the single-molecule limit. This technique is accomplished by using silver nanocubes that exhibit localized surface plasmon resonances and facilitate SERS detection. I developed a proof-of-concept assay to measure streptavidin-biotin binding. The analyte (streptavidin) is sandwiched between a gold substrate and a silver nanocube in a nanosized gap. This nanogap allows us to obtain a SERS signal with an intensity that is orders of magnitude greater than a typical Raman signal. Based on the results of this work, this sensor design has the potential to be applied toward the detection of SARS-CoV-2 antibodies and coat proteins, producing a powerful biosensor that would help detect even trace viral responses within patients.

Kaimana Bright

Cellular, Molecular, and Developmental Biology, UC Santa Cruz
Undergraduate Research Scholarships
Mentored by Professor Amit Majithia, School of Medicine, Dept. of Medicine and Pediatrics

Effects of Hormone Replacement Therapy on Adipocytes

Healthcare for transgender people is an emerging discipline in the medical field. Despite rising numbers of trans patients seeking out medical treatment, relatively little is known

about the long term effects of hormone replacement therapy (HRT) on the body. While changes in body fat composition during the process of transition are well documented, evidence for changes in risk factors for diabetes remains inconclusive. This study aims to document HRT related changes in SGBS adipocytes with XY chromosomes, specifically measuring changes in cell size, proliferation, and lipid accumulation. Varying concentrations and exposure length of 17β -estradiol (E2) were tested. Similar testosterone (T) treatments were performed to simulate hormone levels normally experienced by XY cells for comparison to the E2 treated cells. This research could create avenues for further study, such as measuring other variables and the effects of treating cells with both E2 and T to simulate various stages of HRT.

Tajairi Brown-Neuson

Literature/Writing, UC San Diego
McNair Scholars Program
Mentored by Dr. Adam Aron, Psychology

The UC System Tackling the Climate Crisis: How are we doing?

While the UC System has made significant contributions to the field of climate change, its actions to reduce campus greenhouse gas emissions have been much less trailblazing. To better understand why the UC hasn't done more to tackle the climate crisis, I conducted a series of semi-structured interviews with administrators. I specifically asked them for their thoughts on climate change and their opinions on UC climate policies. Beyond the UC, this research has broader relevance for understanding why other liberal institutions across the nation have not significantly reduced their greenhouse gas emissions.

Olivia Bryan

Economics & Political Science: International Relations, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Simeon Nichter, Political Science

Divergence in Postcolonial Development Outcomes: A Historical Examination

How do critical junctures in history explain differences in development outcomes within a country? Pervasive Spanish colonialism is negatively associated with postcolonial economic development, whereas British colonialism is positively associated with postcolonial development trajectories (Lange et al. 2006, Mahoney 2010). A seminal work by Feyrer and Sacerdote (2009) substantiates a positive relationship between a country's time under colonial rule and their GDP per capita today. However, this relationship fails to account for in-country inequality, masking an income distribution

where the top share of earners enjoy economic success while the bottom suffer. Tremendous domestic inequality exists in former colonial states, a consequence of the limited access to opportunities and resource depravity subjected on natives by their colonial administrators (Engerman and Sokoloff 2006, Mizuno and Okazawa 2009). To test the hypothesis that length of colonialism produced adverse effects on economic development for citizens in the bottom quintile of the income distribution, I adapt Feyrer and Sacerdote's (2009) regression analysis by disaggregating GDP into the upper and lower quintile of the income distribution for previously colonized countries, expanding their original sample of island countries to a global sample. I expect to observe a positive relationship between years of colonial conquest and GDP for the upper class, and negative relationship between years of colonial conquest and GDP for the lower class. This study hopes to contribute to existing literature on colonialism and inequality by illustrating how disparate economic development outcomes within countries are often unaccounted for in development studies.

Justin Burzachiello

Physics, UC Riverside
STARS

Mentored by Professor Boris Kramer, Department of Mechanical and Aerospace Engineering

Model Order Reduction for Lagrangian Mechanical Systems

Engineering, scientific, and medical computational models can take tens of thousands of CPU hours to simulate, but model order reduction (MOR) can be used to reduce such a simulation's runtime and memory storage by approximating a high-dimensional system with a low-dimensional surrogate. These dynamical systems often have mathematical and mechanical structure that should be retained in model reduction for adequate interpretability, stability, and long-term accuracy. Our project compares data-driven methods for MOR of large-scale dynamical systems with the goal of preserving Lagrangian structure. We are motivated by, and will initially follow, the work of [Carlberg et al., SISC, 37(2), B153-B184, 2015], which provided a method that preserves a system's Lagrangian structure, and therefore its conservation laws and symplectic time evolution. This method formulates Lagrangian equations before reducing each component via Galerkin projection onto a proper orthogonal decomposition (POD) subspace. This subspace contains optimal energy and variation in a given dataset of solutions. Reducible components may include the system's mass matrix, external forcing function, potential energy gradient, and Rayleigh dissipation function. Our innovation will be to employ symbolic regression to learn the reduced-order Lagrangian of a system from data. We then derive the respective equations of motion. We demonstrate our work on Lagrangian systems, such as the mass-spring-damper harmonic oscillator. Programming is mainly done with MATLAB. A long-term goal is to employ this methodology in soft robotics applications. These outcomes enable engineers, scientists,

and medical professionals to simulate systems efficiently for analysis, design, and uncertainty quantification.

Thandiwe Bush

Biology, Xavier University of Louisiana

STARS

Mentored by Dr. Chengbiao Wu, Neurosciences, School of Medicine

RIN3 and Alzheimer's Disease

Alzheimer's Disease is a neurodegenerative disease that attacks brain cells resulting in memory loss and impaired cognitive ability. Research into the mechanism(s) of Alzheimer's Disease (AD) has identified the RIN3 gene to be highly expressed in patients with Alzheimer's. This finding suggests a strong association between RIN3 expression and Alzheimer's Disease. To establish RIN3 as a causal factor, we seek to closely examine the relationship between RIN3 expression and Alzheimer's Disease; we will introduce a AD variant (W63C) in the RIN3 gene into healthy mice to investigate the effects of that mutation and if it leads to Alzheimer's Disease in those mice. We will also selectively inhibit RIN3 expression in established mouse models of AD to define if the measure will prevent/slow down AD pathology and behavioral deficits in these mice. Together, our study will establish if RIN3 will be a potential target for developing effective therapies for Alzheimer's disease.

Melissa Cabrera

Sociology, Communication Studies, University of San Diego

McNair Scholars Program

Mentored by Dr. Jennifer Nations, Sociology

Student's Experiences with their University's Diversity Initiatives

Recently, diversity has become a significant part of a student's experience in higher education. Studies have found that undergraduate students that hold marginalized identities experience diversity differently than majority students at most universities. Many universities are aiming to increase diversity by implementing initiatives, such as events and policies, that promote the value of diversity. All universities approach diversity initiatives differently, therefore this research will look at one university as a case study for the impact of diversity initiatives on a college campus. The current project focuses on a mid-size, private, Catholic, liberal arts college in Southern California that is historically a predominantly white institution. To collect data for this research, private interviews were conducted with undergraduate students from the university. Students from a range of marginalized identities were interviewed to reflect the different

statuses that are considered in conversations about diversity. In the individual interviews, participants were asked to respond to diversity statements given by the university. They were also asked to reflect on their experience as a student to determine if they believe the diversity policies were sufficient and helpful to underrepresented students. The goal of this study is to use student's reflections and experiences to better understand how diversity is valued on campus and potentially identify initiatives that would improve diversity on campus.

Diana Calderon

Global Health/Ethnic Studies, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Jose Fuste, Ethnic Studies

Sexual Discourses Embodied through Latinx Lived Experiences

Sexual discourses, which include topics like virginity, sexual relations and menstruation, are often important to the sexual awareness of adolescents and young adults. However, Latinx communities are known to stigmatize and disempower women from claiming their sexual awareness during these ages that are critical to their growth. This pre-existing notion of how Latinx communities engage with sexual discourses can be misconstrued by not being based on lived experiences and instead on cultural beliefs. For this reason, this research will not assume these pre-existing stigmas and instead focus on the lived experiences highlighted through a series of focus-group discussions that in this study will be referred to as charlas. Through these conversations, I will be able to collect data on how mother-daughter relationships in Latinx communities inform daughter's awareness of their sexual awareness. Focusing on how interpersonal relationships in communities of color affect individuals lives is important in understanding what and if any issues need to be addressed.

Caitlyn Callaway

Human biology, UC San Diego
McNair Scholars Program
Mentored by Dr. Kuo-Fen Lee, Division of Biological Sciences

Pathological Mechanism of Resting Tremor in Cdk5 Parkinson's Disease Mouse Model

Parkinson's disease is a neurodegenerative disease marked by motor symptoms such as resting tremor, slow movement, and poor posture control. Deregulation of cyclin-dependent kinase 5 (Cdk5), a gene that negatively regulates dopamine neurotransmission, is implicated in the disease. In our experiment, mice with Cdk5 conditional knockout Myf-Cre neurons exhibit the resting tremor symptom. However,

the neural mechanism that drives the resting tremor remains to be seen. In order to investigate this mechanism, the study will compare the tremor phenotype of the Myf5-Cre Cdk5 cKO model to the control without Cre expression. Quantitative measurements of ambulatory, stereotypic, and freezing activity will be used in this comparison. Measurements will include average velocity, episodes, distance, time, and counts to establish a tremor phenotype in the experimental model. From this conditional knockout model, further experimentation in optogenetics and tremor analysis can be employed to uncover the neural mechanism of the resting tremor.

Dylan Calvao

Marine Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Melissa Carter, Scripps Institution of Oceanography

Biofouling Reduction System for Moored Ocean Sensors

An Arduino based microcontroller was developed to reduce biofouling on moored ocean sensors that are part of the SCCOOS Automated Shore Stations (SASS). Sediment and organic biofouling occur in sensors and instruments deployed in coastal environments, which impedes the quality of measurements. The details of the automated cleaning system including design specifications, prototypes, and testing will be shared in this presentation. A user manual was written that discusses code and hardware troubleshooting methods to help users at other locations across Southern California. A statistical analysis was conducted comparing the accuracy of the SASS measurements against the manually done tests before and after implementation of the system.

Oscar Calzada

Biochemistry, UC San Diego
MRSEC REU or RIMSE
Mentored by Dr. Michael J. Sailor, Department of Chemistry & Biochemistry

Approach to augment surgical repair of the anterior cruciate ligament using hybrid polymer mesoporous silicon nanoparticle scaffolds delivering a vascular growth factor.

The ACL (anterior cruciate ligament) is one of two cruciate ligaments and one of the four main ligaments found in the knee connecting the femur and the tibia. Its role is to control excessive motion in the knee by limiting the mobility of the joint and to provide rotational stability. Therefore, the ACL is an important component of the knee's stability and function. This project aims to improve the outcome of surgical repair of ACL injuries by enhancing revascularization of the damaged ligament. The work is divided into three components: the drug VEGF (vascular endothelial growth factor), mesoporous Si

nanoparticles, and a “patch” of the polymer PCL (polycaprolactone). VEGF is loaded into the mesoporous Si nanoparticles which are then incorporated into PCL to form the patch. This patch is intended to be surgically placed in the knee where we hypothesize that slow release of the drug in the ACL region will enhance healing. The Si nanoparticles act as the drug delivery system while the VEGF prompts revascularization of the area surrounding the ACL. This project will focus on measuring and controlling the drug release rate from the Si nanoparticles, since a slow (2-week) VEGF release rate is thought to be important in obtaining optimal recovery conditions. Additionally, work will focus on optimizing the interaction of PCL with the Si nanoparticles.

Eberardo Camorlinga-Ruiz

Materials Science and Engineering, University of California, Merced

UC LEADS

Mentored by Jinhye Bae, Department of NanoEngineering

Study Stimuli-responsive hydrogel materials to understand how to program their shape transformations.

The poly(N-isopropylacrylamide)(PNIPAM)- based smart hydrogels is one of many attempts to develop responsive photonic crystals including PNIPAM-based colloidal crystals. The enhancement of light-trapping photon management constructed by photonic crystals can successfully improve the efficiency and cost reduction of solar cells. These materials are highly investigated due to their altering unique physical and chemical properties when exposed to external stimuli. A well known material for the development of photonic crystals is PNIPAM since they are able to exhibit distinct thermo-responsive properties near a lower critical solution temperature (LCST). However, the ordered structures of microgel colloidal crystals are relatively fragile. Which results in an insufficient interaction of strong bindings between the colloidal particles. In order to successfully fabricate a PNIPAM-based colloidal crystal and prevent a collapsing crystalline structure upon the temperature change, PNIPAM-based hydrogel colloidal crystals can be embedded in a hydrogel matrix by mixing crystalline colloidal array based on PNIPAM with PAAm Pregel solution. The photopolymerization process takes place after, resulting in an enhanced stable colloidal crystal structure.

Juancarlos Cancilla

General Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Pam Taub, Cardiology

The Effects of Time Restricted Eating on Patients with Metabolic Syndrome

Metabolic syndrome (MetS) is characterized by having multiple related risk factors for type 2 diabetes (T2D) and cardiovascular disease (CVD). In industrial societies like the U.S. a combination of unhealthy eating choices and chronic circadian rhythm (CR) disruption have led to about 30 percent of the adult population to have MetS. Current lifestyle and nutrition counseling is ineffective leaving many to allow their MetS to progress. The TIMET study has proposed a Time Restricted Eating (TRE) intervention in which participants adhere to a 10 hour eating window and are counseled to take up the Mediterranean diet in order to evaluate whether participants who implement TRE will experience any changes in glucose homeostasis, metabolic biomarkers, or body composition compared to participants who do not implement TRE. A preliminary analysis has demonstrated that those who implemented TRE saw improvement in certain aspects of cardiometabolic health. Additionally, certain mitochondrial functions improved in male TRE participants. This preliminary analysis suggests that TRE can be used as a counseling method in order to help reverse MetS.

Paola Cancino

Psychology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities Program
Mentored by Dr. Georgia R. Sadler, Surgery

Psycho-oncology care for breast and cervical cancer patients in Mexico

Breast and cervical cancer incidence and prevalence rates are the highest among all cancers for women in Mexico. A breast and cervical cancer diagnosis can contribute to high psychological distress and a need for more social support. Psycho-oncology, which refers to psychological, behavioral, and emotional care, has been utilized in developed countries to help address these issues among cancer patients. Although universal healthcare is a federal mandate in Mexico, this literature review explores the availability of psycho-oncology care in Mexico for women with breast and cervical cancer. In this literature review, key articles in English or Spanish were identified by using Google Scholar, PubMed, and SciELO databases, as well as the reference lists of key articles. The keywords used included Latin*, Latin-America, Mexico, psycho-oncology care, health-anxiety, mental health, breast, and cervical cancer. This presentation will focus on the

major findings and emphasize areas of importance. Further research recommendations will also be provided.

Ricardo Cardoza Bejarano

Business Administration & Marketing, University of San Diego
McNair Scholars Program
Mentored by Dr. Eileen Daspro, School of Business

Global E-Commerce Readiness of U.S. SMEs towards the Mexican Market – Are American Small Business Prepared for Digital Commerce to Mexico?

The introduction of the United States-Mexico-Canada Trade Agreement ushered in a new era of regional trade for the region. The modernized agreement's inclusion of a chapter specifically focused on digital trade reflected a business phenomenon that had expanded markedly over the last ten years: cross-border e-commerce within the former NAFTA region. This article examines key themes in the literature needed to assess the readiness of U.S. small and medium-sized businesses (SME's) to sell to the Mexican market online based on the degree of localization of their firm's websites towards the Mexican market. First, a comprehensive review of export readiness highlighting the critical role of market readiness in the internationalization process of SMEs. Next, a detailed overview of key findings in the international marketing literature on the advantages and disadvantages of standardization-localization in international firm expansion and the critical role that localization plays in determining the international success of an SME. Subsequently, the evolution of cross-border e-commerce trade will be set forth, to provide critical evidence of the importance of these new ways of doing business in the region. Finally, the role of website localization as an integral aspect for adaptation to foreign markets, including assessment frameworks, identification of its role in export marketing success, and critical components of localization. Future research includes an assessment of the global e-commerce readiness of U.S. firms in Mexico by using established frameworks to evaluate their website's degree of localization for the local Mexican context.

Jonathan Carreon

Mathematics- Applied Science, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Qiang Zhu, Structural Engineering

Achieving Sustainability in the Aviation Industry

Over the past century, carbon emissions have continuously spiked to new levels every year. Subsequently the need for renewable and sustainable energy to be implemented

into various industries has never been more necessary. The aviation sector is no exception; it remains one of the most popular forms of travel thus it is crucial to take into account its part in both carbon and overall emissions on a global scale. This is a report contributing to scientific literature by means of comparative assessment for the benefits and flaws that come with aviation along with the advancement for achieving sustainability. Additionally, it will follow the patterns air travel emissions undergo with respect to global emissions. It will also be considering different forms of primary energy such as biofuels, electricity, and electrofuels ultimately analyzing the benefits of utilizing them. Efficiency will play a major role in discussion as methods of combustion, aerodynamics, design, and overall performance determine what may be most efficient for the future of air travel. Dialogue with a number of companies and their experience with sustainable energy implementations through means of biofuels such as United Airlines will also assist in showcasing how these fuels work in practice. In essence, an analysis of different fuel sources will pave way for a realistic projection of what there is to expect as the aviation industry strives to achieve climate change objectives.

Anastacia Carrick-Gonzales

Biochemistry, UC San Diego

McNair Scholars Program

Mentored by Dr. Amina T. Schartup, SIO: Geosciences Research Division

Influence of Trace Metal Concentrations on Phytoplankton Community Dynamics in La Jolla Coastal Waters

The uptake of trace metals with no known biological function by phytoplankton is of great interest because of the existential threat of trophic level transfer of these toxins. Our reliance on Fossil Fuels causes environmental change; not only does their use lead to the release of GHGs, but also trace metals to our atmosphere. Some of the trace metals introduced function in metalloenzymes, others are known to be toxic to organisms or have no known metabolic function. These trace metals eventually settle on the surface ocean, and we are effectively introducing micronutrients to the marine system typically present in low concentration, limiting the growth and size distribution of phytoplankton, the primary producers of the ocean. This research focuses on identifying how the phytoplankton community structure is influenced in the presence of certain trace metals around Scripps Pier, and is important to understanding how the biogeochemistry of the ocean is changing with anthropogenic perturbation. By conducting a metal analysis on phytoplankton specifically, we can examine how the organism at the base of the marine food web and most biogeochemical processes is influenced by the trace metals present. Though there have been previous studies characterizing the phytoplankton community structure for these waters during the upwelling season, there has not been a study evaluating how certain types of trace metals influence or dictate this community structure.

Ana Raquel Carvalho Bertao

Biochemistry, University of Minho

MRSEC REU or RIMSE

Mentored by Dr. Michael J. Sailor, Chemistry and Biochemistry

Approach for cancer therapy based on mesoporous silicon nanoparticles delivering a combination of chemotherapeutic and antibiotic agents

Cancer is one of the leading causes of morbidity and death worldwide, with growing numbers of cases and deaths every year. Despite substantial advances in cancer treatment, response to therapy remains a foremost challenge. Recent evidence suggests that malignant tumors have characteristic associated bacteria profiles and that those bacteria can compromise the efficacy of cancer chemotherapies. The results from the literature underscore the importance and potential of a co-treatment with antibiotics in the cancer treatment approach. Thus, this project aims to develop dual-loaded Drug Delivery Systems (DDS) of pharmacologically active species, comprising an antibacterial drug and a conventional anti-cancer drug, using mesoporous silicon nanoparticles as carriers for drug delivery. The goal of this project is to synthesize the host nanostructures, load both drugs into the nanocarriers at therapeutically effective levels, and characterize the resulting DDS. Aiming for the delivery of the pharmacologically active species to both bacteria and to cancer cells, the evaluation of toxicity of the final nanoformulation is also an objective of this project.

Martin Casas Maya

General Biology, UC San Diego

Genentech Scholars Program

Mentored by DR. Robin Knight, Pediatrics

Long-read Nanopore sequencing of diverse environmental samples from the Earth Microbiome Project

The technological advances of third-generation DNA sequencing have improved our ability to accurately resolve taxonomy and function in metagenomic samples. These advances have allowed researchers to obtain long-read sequence data from samples that have never been analyzed in this way before. By using these novel methods, we will perform shotgun metagenomic sequencing of environmental samples from the Earth Microbiome Project in order to build upon the existing 16S rRNA gene and short-read shotgun metagenomic data that have already been generated from these samples. We will be using Oxford Nanopore Technology's platform, the Nanopore sequencer, which has greatly increased read length and data output produced when sequencing samples. This is important since it has been established that long-read sequencing analyses have

certain advantages over 16S and short-read methods, such as resolving homopolymer regions and a better ability to resolve taxonomic assignments. Together, these analyses would help highlight the importance of long-read sequencing across diverse environmental samples and allow researchers to learn more about the diversity and importance of particular environments included in the Earth Microbiome Project, as well as patterns across them.

Grant Castaneda

Math-Computer Science, UC San Diego
Undergraduate Research Scholarships
Mentored by Sarah Gille, Scripps Institute of Oceanography

Impacts of topographic flows on surface ocean ecosystem dynamics

Climate is sensitive to the exchange of heat and carbon between the surface and the deep ocean. This vertical exchange is strongly mediated by small scale oceanic processes: fronts, which downwell and upwell water, and breaking internal waves or tidal flows over steep topography, which produce turbulent mixing. These small-scale processes are not resolved in global climate models and so must be parameterized, which requires different strategies for fronts than for internal waves. In situ observations are essential for the development and testing of such parameterizations. This project will use in situ oceanographic data to explore the connection of these small-scale processes with the exchange of heat, salt, nutrients and biology between the surface and the interior of the ocean. The main aspect is to examine the relationship between rates-of-exchange (fluxes) and the environmental and flow conditions that were sampled by the cruises. This project will analyze physical and biogeochemical data from a cruise that sampled the breaking internal tidal flow over the Kaena ridge near Oahu, Hawaii. Establishing a link between the observable physical phenomena and the fluxes of heat, nutrients and carbon is an important first step toward better parameterizations of unresolved processes and comparing the results from the cruises with prevailing theories can aid in prioritizing research efforts. While the focus is on the analysis of in situ data, the project may also involve comparisons to numerical model output or satellite observations.

Jasmine Castellanos

Biology, CSU Fullerton

STARS

Mentored by Dr. Graham McVicker, Biological Studies

Machine learning model predicts the level of open chromatin from genetic variants

Regulatory sequences in the genome are typically marked by open chromatin, and genetic variants that affect open chromatin are more likely to impact gene regulation and human traits. Currently, it is very difficult to predict which genetic variants will affect open chromatin. This project ventures to predict whether a genetic difference in a sequence will generate a different level of open chromatin. Open chromatin regions in specific cell types within the rat amygdala were first obtained using data from a single-cell ATAC-seq (Assay for Transposase-Accessible Chromatin and sequencing) experiment. At heterozygous sites that overlap open chromatin, allele-specific open chromatin (ASoC) was estimated by comparing the number of ATAC-seq reads matching the reference and alternate alleles. The ASoC estimates will be compared to predictions from a Chromatin Accessibility Prediction (CAP) machine learning model based on a convolutional neural network. The inputs to the CAP model are reference and alternate sequences based on the heterozygous sites, and the outputs are numeric predictions for the levels of open chromatin. By predicting the level of open chromatin for two alleles, the predictions for the CAP model can be compared to experimental observations of allele-specific open chromatin. The results serve as an independent test for the developing machine learning model. It is expected that the level of open chromatin predicted by the CAP model will be correlated with the ASoC estimates.

Erick Cervantes

Biochemistry/Chemistry, UC San Diego

McNair Scholars Program

Mentored by Dr. Dionicio Siegel, Skaggs School of Pharmacy and Pharmaceutical Sciences

Synthesis of Anti-Cancer Chemical Groups

Cancer drugs that covalently modify targeted biological macromolecules have a long history in drug development. Starting with the accidental discovery in World War I that the chemical warfare agent mustard gas reduced the measurements of bone marrow and lymph nodes new drugs were developed based on chemicals that had been initially designed to kill cells. With over 40 FDA approved drugs that function through covalent chemical reactivity this strategy is a validated yet underutilized approach. With a number of recent successfully developed covalent kinase inhibitors the applications to

cancer therapeutic development is apparent and appreciation for this strategy is growing. However, there remains reluctance to develop covalent drugs due to the potential of reactions with untargeted proteins leading to unwanted side effects and/or immunogenic responses. This lack of specificity can be improved by changes to the K_i of binding and the k_{inact} for the covalent reactions. As a result the development of a panel of covalent reactive groups that can be used against specific protein-based nucleophiles is needed to develop the next generation of covalent drugs with selective anti-cancer activity with maximal efficacy and minimal toxicity. Through this project we will advance new biologically-reactive chemical group that will add to the covalent warheads that can be used in cancer drug development and apply this to the creation of inhibitors for currently undruggable targets.

Priscila Chagolla

Public Health, San Diego State University
Multidisciplinary Educational Approach to Reducing Cancer Disparities Program
Mentored by Dr. Malcarne, Psychology

Disparities in fertility preservation discussions with cancer patients prior to treatment

Cancer patients who have undergone certain cancer treatments have been identified as being at risk for infertility, raising a concern, especially for young adults. Research suggests that very few patients are provided with information about the impact of cancer treatment on fertility and information about fertility preservation. Existing barriers to fertility preservation include lack of educational resources, low physician referral, and financial costs. Highlighting the barriers to fertility preservation discussions is important for increasing awareness on this topic. A literature review will be conducted using the following databases: CINAHL, Pub-Med, and PsycINFO. Keywords include fertility, reproductive, fertility preservation, cancer treatments, and young adults. This presentation will identify the findings from the literature review and will make recommendations for future research regarding fertility preservation barriers among minority groups.

Maya Changaran Kumarath

Cognitive Science, UC Merced

SOAR

Mentored by Dr. Tyler Marghetis, Cognitive and Information Sciences

Are religious conversions like scientific insights? Similarities and differences in critical transitions across domains of human belief

Why do people change their minds, lose their faith, leave their relationships, or transform their moral stances? These are all examples of critical transitions, or ‘ruptures,’ in personal belief or identity. This study investigates the causes, contexts, and effects of these sudden, transformative ruptures. Past work has studied critical transitions in single domains (e.g., religious conversion, scientific insight). However, little is known about domain-general mechanisms that underlie these ruptures, how a rupture in one domain may affect another, and whether there are individual differences in how people experience these ruptures.

In a within-subjects survey design, we are collecting data from US adults about ruptures they have experienced in a variety of domains (e.g., morality, social identity, politics, scientific beliefs, aesthetics, etc.). The survey uses a funnel design, beginning with open-ended free-response questions and gradually narrowing down to targeted, theory-informed, forced-choice questions.

Data collection is ongoing. Responses will be analyzed using multilevel generalized linear models. Free-response data will be analyzed using iterative interpretative coding (i.e., Grounded Theory). We predict that personal ‘ruptures’ will be predicted (and perhaps caused) by changes in seemingly unrelated aspects of people’s lives, including social network, physical location, and cultural practices. We also predict individual differences, with some people experiencing many sudden ruptures across domains, others undergoing gradual changes, and others experiencing repeated ruptures in only certain domains. Ultimately, this study will contribute to the development of a domain-general account of when and why we experience critical transitions or ‘ruptures’ in our lives.

Angela Chapman

Psychology - Cognitive and Behavioral Neuroscience, UC San Diego

McNair Scholars Program

Mentored by Dr. Savita Bhakta, Psychiatry

Event-Related Potential Measures in Schizophrenia Patients: A Systematic Review

Schizophrenia (SZ) is a complex neuropsychiatric disorder, characterized by cognitive impairment across various domains including, attention, executive functioning, and verbal memory which could act as significant predictors of socio-occupational disability.

Substantial research has been conducted to develop cognitive-enhancing treatments, however, there is a variable response to these pro-cognitive therapies in SZ patients. In recent years, biomarkers are being identified that would predict procognitive treatment sensitive subgroups of SZ patients. We focused on neurophysiological measures including mismatch negativity (MMN), P300, P50, P100, N100, and N400, and their role as potential biomarkers in predicting sensitivity to procognitive treatment as well as indicating psychosocial/functional outcomes in SZ patients. To do this, systematic keyword searches on the PubMed database were conducted. The outcome for neurophysiological measures, excluding MMN, involved 8 articles being selected for analysis while searches focused on MMN resulted in 11 selected articles. We found that neurophysiological measures P50 and P300 predicted psychosocial/functional outcomes ($p < 0.05$) while N100 predicted therapeutic outcomes ($p = 0.003$). However, MMN was found to be a sensitive measure for all three outcomes in SZ patients with a particular emphasis on psychosocial functioning ($p < 0.003$) and treatment response ($p < 0.05$). Given the biomarker potential of MMN, future studies would focus on improving the predictive sensitivity of MMN measures to cognitive remediation therapies in SZ patients by using a combined virtual reality (VR)-electroencephalogram (EEG) naturalistic oddball paradigm.

Alexandria Chargois

Psychology, Spelman College
STARS

Mentored by Dr. Gail Heyman, Psychology

Children's structural reasoning about social group differences

When children explain the causes of social group inequalities, prior studies find that intrinsic qualities such as ability and interest are more commonly referenced than the structural constraints faced by social groups (e.g., lack of educational opportunities). It is important for children to understand how structural factors impact inequality in order to reduce their assumption that some groups are inherently different or deficient. Recent studies find that structural thinking can emerge in childhood, yet this work has mostly focused on novel groups, and thus there is a gap in knowledge about encouraging children's structural understanding of real-world inequalities. This is a unique challenge, given that children may have already developed intrinsic explanations. The current study examines whether certain types of evidence increase children's structural understanding about a real-world group difference (i.e., girls playing with dolls more than boys). Children (5 to 12 years of age) will be randomly assigned to one of two conditions that each present evidence for structural causes: (1) within-group change evidence (i.e., demonstrating that, once structural barriers are removed, girls play with more varied types of toys), and (2) between-group comparison evidence (i.e., demonstrating that boys, who have fewer structural barriers, play with more varied types of toys as compared to girls facing structural barriers). It is

hypothesized that the within-group change condition will be more powerful in increasing structural thinking because it directly refutes the idea that the initial inequality was due to inherent preferences. Preliminary study findings will be discussed.

Besma Chaudry

General Biology, UC San Diego

Ahmadian Fellowship

Mentored by Professor Olivia Osborn, UCSD School of Medicine: Division of Endocrinology and Metabolism

Efficacy of Kv1.3 Antibody in Pancreatic Cancer-Induced Cachexia

Cachexia is a life-threatening condition associated with cancer that is characterized by significant loss of muscle mass and anorexia. These symptoms, combined with tumor burden, are associated with a poor prognosis. This distinct change in metabolism occurs in response to increased malignant proliferation and severe tissue wasting, which ultimately causes involuntary weight loss and fatigue. Previous studies unveiled a novel therapeutic target within malignant cells, the voltage-gated potassium channel Kv1.3, which plays a pro-inflammatory role in T lymphocytes and microglia and possibly promotes cachexia. Previous studies have shown that blockade of Kv1.3 channel blocker with a neutralizing antibody induces significant weight gain in wildtype female mice. In these studies, we will investigate whether Kv1.3 channel inhibition may also induce food intake in a mouse model of pancreatic cachexia. We hypothesize that treatment with Kv1.3 neutralizing antibodies will increase food consumption and decrease weight loss compared to control treated mice. Additional controls without cancer (antibody-only and wildtype controls) will be studied to further evaluate the phenotypic differences between the groups. Hypothalamic gene expression neuropeptides that regulate appetite will be compared across groups. In summary, these studies will investigate the therapeutic potential of Kv.13 inhibition for the treatment of cachexia.

Vicky Chen

Biochemistry, UC San Diego

Triton Research & Experiential Learning Scholars (TRELS)

Mentored by Brian Zid, Department of Chemistry and Biochemistry

Translation elongation and its effect on the localization of nuclear-encoded mitochondrial mRNAs

Mitochondria play a significant role in energy production for the cell with their functions supported by proteins constructed from translated mRNA. Our lab has previously found that translation elongation can be important for localization to the mitochondria for a

few select genes. The goal of this study is to expand on whether or not the effect of translation elongation on mitochondrial mRNA localization is a general characteristic. Using bioinformatics, our lab has seen that mRNAs constitutively localized to the mitochondria elongate slowly while conditionally localized mRNAs elongate quickly, yet this has not been experimentally verified. To test this I will examine ten different nuclear-encoded mitochondrial mRNAs, categorized to be either conditionally or constitutively localized to the mitochondria, and quantify their elongation rates with an in-vivo elongation reporter. I will use PCR to amplify the open reading frames (ORF)s of the genes of interest and clone them downstream of a tetracycline inducible promoter and upstream of nanoluciferase. These reporter constructs will then be transformed into yeast. Using a luciferase plate reader, I can then track the dynamics of induction and infer the translation elongation rate along the mRNAs of interest, comparing them with the bioinformatically calculated translation elongation rates. This research is important as mitochondria are not only essential for energy generation, but are also linked to processes such as cancer and metabolic disorders.

Derek Chen, Daniel George, and Xiaoye Zuo

Electrical engineering / Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Michael C.Yip, Electrical and Computer Engineering

Breathing Lung Phantom for CT-guided Needle Biopsy

Phantoms that mimic actual patients have been widely employed for treatment evaluation in the medical imaging and radiation therapy fields. Specifically for the lung, several phantoms have been developed to simulate respiratory motions and validate dose delivery systems. Although current lung phantoms can produce realistic motions, image effectively in CT scans, or be biopsied, none are a viable stand-in for in-vivo biopsies and ablations. In our project, we aim to build a lung phantom that simulates human breathing patterns, produces practical poking effects, and shows realistic Hounsfield units in CT scans. We also included markers to align the point sets of our phantom with that of a needle injection robot so that we can track the tumor location remotely in real-time. We simulated the breathing motion by controlling the inner pressure of the lung with a blower and evaluated the motion using an RGBD camera. For realistic poking and scanning results, we experimented with different materials and ended up using silicon rubber for skin, fat, and tissue modeling. Our first CT scan shows accurate Hounsfield unit values for the lungs, but the bone of our phantom is brighter than most human bones. The materials that we chose should have accurate mechanical properties based on existing literature but we have yet to test that. The development of a realistic phantom is crucial to validate CT-guided robot procedures.

Wei Ji Chen

Bioengineering: Biotechnology, UC San Diego
Undergraduate Research Scholarships
Mentored by Stephanie Fraley, Bioengineering

Assessing the Effects of Collagen Mutations on Cancer Cell Migration

Cancer is the second leading cause of death worldwide, with nearly two million new cases and 600,00 deaths in 2020 alone. It encompasses a variety of diseases disrupting, hijacking, and evolving cellular reactions and molecular mechanisms, making it difficult to diagnose and treat. Among the many factors that promote cancer progression, the extracellular matrix (ECM) plays a significant role in remodeling the tumor microenvironment (TME) to favor invasion and metastasis. As the most abundant constituent of the ECM, collagen acts as the scaffold of TME and regulates ECM remodeling through biochemical and biophysical signaling that effects a variety of cell biological properties associated with increased malignancy.

Emerging research provides strong evidence of the functional role collagen mutations have in inducing the key cancer hallmarks. Current literature reveals collagen mutation effects in the TME and metastasis remains poorly characterize. The goal of the project is to characterize the biophysical and biochemical differences in collagen mutations, leading to greater clarity on the mechanisms elicit by collagen mutations effecting cell-cell and cell-ECM interactions, and therefore the role it has in regulating proliferation, differentiation, survival, and invasion.

Kit Fong Cheung

Microbiology, CSU Northridge
STARS
Mentored by Manon Morin / Dr. Rachel Dutton, Biological Sciences

Using cheese rind microbiome as a model to study microbial interactions in different community compositions

Microbial communities are crucial irreplaceable ecosystems to sustain life on Earth. Microbial communities are extremely complex ecosystems as microorganisms interact with one another through diverse mechanisms. It is essential to understand the interactions in microbial communities to be able to replicate favorable microbial communities or manipulate these communities to benefit the society. However, the many interactions of microorganisms in these communities, and how they specifically change along with increasing complexity are still yet to be fully understood. In order to understand these complex communities better, cheese rind models that replicate

microbial communities in the environment and genome-based approaches using high throughput sequencing technologies are implemented to identify and understand interactions. In this project, our model community has been designed from the Brie cheese model consisting of *Hafnia alvei*, *Geotrichum candidum*, *Penicillium camemberti*, and *Escherichia coli*. This project aims to characterize *H. alvei* interactions in 7 different conditions of different composition complexity (in terms of number and type of interacting species). From there, we plan to identify interactions conserved or replaced in comparison to *E. coli*'s interactions, in similar conditions. Also, we propose to identify and compare patterns at different levels of complexity that arise due to changes in the type and number of interacting species in the cheese model. Understanding the interactions *H. alvei* has with other microorganisms in the cheese community will allow better understanding of complex microbial communities allowing manipulation and control of microbial communities.

Allen Cheung

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Nuno Vasconcelos, Electrical and Computer Engineering

3D Object-induced Action Decision for Autonomous Vehicles

In the domain of autonomous vehicles (AVs), action decisions and explanations are paramount in establishing safety and a sense of trust among passengers. While the use of 2D camera images has been the standard for AV perception, LiDAR technology has proven to be an advantageous supplement in self-driving tasks due to its greater invariance, precision, and robustness in more challenging driving scenarios. Though the size of RGB images remains largely static during driving, point cloud density can vary greatly across different scenes and timesteps. Therefore, processing 3D point clouds efficiently becomes incredibly important given the limited computing resources onboard AVs. By only paying attention to the points that pertain to the final action decision, memory consumption and processing time can be reduced. In this work, we explore the point cloud modality and how we can incorporate 3D data into the action-induced pipeline for AVs. An extension of the Waymo Open Dataset with annotations for driver action decisions and explanations is proposed for our tasks. Point cloud sampling methods that consider the downstream task are used to select salient points that are critical to the action decision. To allow for multimodal action predictions, we leverage 2D-3D fusion mechanisms alongside an action-induced object selection module. Our work aims to improve autonomous vehicles in terms of action interpretability and computational demand through the selection of critical points in 3D driving data.

Shiantel Chiang

Neurobiology, UC San Diego
Ahmadian Fellowship
Mentored by Dr. Amir Zarrinpar, Gastroenterology

The Role of Gut Microbial Bile Acid Deconjugation on PCOS

Despite being the most common cause of anovulatory infertility, affecting up to 18% of women in the US, polycystic ovary syndrome (PCOS) is poorly understood and often ineffectively treated. PCOS is characterized by hyperandrogenism, anovulation, and polycystic ovaries. Recent studies in murine models demonstrate that composition and function of the gut microbiome, and corresponding changes in bacterially-modified bile acids (BAs), may contribute to PCOS pathophysiology. Based on our preliminary results, the serum BA pool, which is modulated by the gut microbiome, affects reproductive health, likely by acting directly on the gonads and altering BA receptor signaling pathways. This project aims to determine whether PCOS disease phenotype can be ameliorated through modulation of microflora. The Zarrinpar lab developed a novel technique to knock-in functions into the gut microbiome using engineered native bacteria (ENB) that colonizes the gut for perpetuity with a single intervention. This ENB expresses bile salt hydrolase (BSH), which modifies host BA pool composition through deconjugation of BAs. We have shown that increased luminal BA deconjugation by BSH decreases serum androgens and improves insulin sensitivity in male mice. We will investigate whether our ENB intervention improves metabolic and reproductive dysfunction in a letrozole-induced PCOS mouse model, including insulin sensitivity and ovulatory cyclicity. We will assess this using a 2x2 experimental setup: placebo or letrozole-treated mouse model, colonized with BSH-expressing or non BSH-expressing ENB. This study lays a foundation for exploring the gut microbiome as a therapeutic target for women with PCOS.

Emerson Chin

Nanoengineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Samuel Edmunds, Nanoengineering

Metallic Nanoisland Sensor Arrays for the Measurement of Cardiomyocyte Contractility

Cardiomyopathies are a class of diseases that interfere with the mechanical properties of the heart. This interference prevents the cells from accomplishing their primary purpose: coupling the periodic electrical excitations of the heart into contractions of the ventricles. We monitor the contractions of cardiomyocytes to draw conclusions concerning cell health. The process of developing a sensor platform requires creating

and characterizing microscale strain sensors. To take these measurements, we develop a system utilizing high-sensitivity graphene-metal composite strain gauges with the ability to perform contractility measurements in parallel. Having a sensor array that measures in parallel and is highly-scalable greatly increases measurement efficiency over conventional methods.

Roshni Choksi

Psychology, CSU Long Beach

STARS

Mentored by Dr. Timothy Brady, Department of Psychology

Visual Long term Memory can replace Active Maintenance in Visual Working Memory

Long-term memory refers to the storage of information over an extended period of time. If you can remember something that happened more than just a few moments ago, whether it occurred just hours ago or decades earlier you're using long term memory. In contrast, visual working memory is a cognitive system that maintains a limited amount of visual information that can be quickly accessed to serve a specific purpose. The extent to which long-term memory is utilized during the active maintenance of information in working memory is currently unclear. Here, we investigate how the presence of a previously encoded item influences subsequent working memory storage. We test this by first presenting participants with a series of real world objects to encode into long term memory. Next, participants complete a working memory task where they encode 3 items sequentially, prior to being tested on their memory with a two-alternative forced choice task. Critically, the order of the items encoded in the working memory sequence is manipulated such that previously encoded items can be presented first or last. We find that performance on novel items is improved when they follow, but not precede previously encoded items. Specifically, performance on the secondary item in a working memory sequence is superior when it is preceded by a previously seen item compared to a novel item. These results demonstrate that working memory and long term memory interact differently under certain circumstances and suggest that people may require fewer working memory resources for previously seen objects.

Anthony Cirilo

Public Health (conc. Epidemiology), UC San Diego
Creating Scientists to Address Cancer Disparities Program
Mentored by Dr. Georgia Sadler, Moores Cancer Center

Allostatic Load in Pediatric Cancer Survivors: Predicting Future Adverse Health Outcomes

Allostatic load is defined as the “wear and tear” of the body’s systems, or physiological dysregulation, as a result of chronic exposure to psychosocial stressors or possible traumatic events. The dysregulation of the multi-systems such as cardiovascular, immunological, and metabolic, can lead to adverse mental and physical health outcomes, including adverse aging-related outcomes. The literature has outlined that pediatric cancer patients, which range from ages 0 to 14 years, undergo two forms of major chronic stress: physical stress from diagnostic and medical procedures related to cancer, as well as the psychological stress of living as a cancer patient. Both types of stressors are likely to induce dysregulation of systems and increase the likelihood of future adverse health outcomes. This review will present the findings of allostatic load as a key predictor of adverse health outcomes in survivors of childhood cancer. This review of the literature utilized the key databases of PubMed/Medline, PsycINFO, CINAHL, and Embase to acquire peer-reviewed original articles published between 2012 and 2021. Articles that concerned pediatric or childhood cancer survivors, chronic stress, and health outcomes were reviewed. Keywords used include: allostatic load, chronic stress, cancer survivor, pediatric cancer survivor, and health outcomes. Future intervention studies to reduce allostatic load composite scores to improve the long-term health outcomes of cancer survivors, as well as utilizing allostatic load to predict health outcomes for pediatric patients of other diseases, are warranted.

Kaylauni Cisneros

Human Biology, UC San Diego
McNair Scholars Program
Mentored by Christina Sigurdson, UCSD Health, Department of Pathology

Manipulating Prion Protein (PrP) Amino Terminal Residues to Understand PrP-Mediated Neuronal Toxicity

Prions cause fatal and transmissible neurodegenerative diseases in humans and animals. Prion diseases are also called transmissible spongiform encephalopathies (TSEs), due to the small vacuoles that form in diseased brain tissue, creating a “sponge-like” appearance (Aguzzi, 2009). One fundamental characteristic of prion diseases is the aggregation of misfolded prion protein into amyloid plaques. This occurs when cellular prion protein (PrPC), which is encoded by the gene Prnp, is conformationally converted

into the aggregated form, PrP^{Sc}. To better understand the physiological function of PrP^C and how it may be linked to prion-induced neurotoxicity, a knockin mice model known as “PrP-93N” was developed that expresses the Prnp gene with an additional glycan on the N-terminus. PrP-93N mice and prion infected mice share similarities such as spontaneous neurodegeneration, astrogliosis in the hippocampus, and spongiform encephalopathy. Despite these similarities, 93N mice have an absence of PrP aggregates, suggesting that PrP^C may play a neurotoxic role even when uncoupled from its aggregation. Primary neurons isolated from PrP-93N mice display signs of excitotoxicity, including necrotic neuronal death, evident from electron microscopy observations of the hippocampus. In our research, we cultured primary neurons from Prnp knockout mice and transfected them using plasmids with mutations in the amino terminus of Prnp. We then stained the neurons using the Map2 antibody to assess dendritic beading as an indicator of excitotoxicity. Finally, to better understand structure-function relationships, we test how different amino acid charged residues on the prion protein amino terminus may play a role in triggering neurotoxicity.

Evan Clark

Molecular and Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Galia Debelouchina, Chemistry and Biochemistry

Insight into the Effect of Heterochromatin Protein 1 on Chromatin Remodelers in Mononucleosome and Multi Nucleosome Environments

Cells have a daunting task when faced with over 6 feet of DNA that must be compacted into the tiny nucleus of the cell. One way that cells accomplish this task is by organizing their DNA into chromatin. This structurally dynamic compaction of DNA has two main regions, heterochromatin and euchromatin. Cells condense DNA very tightly into regions of heterochromatin in order to inactivate the genes contained in the DNA. Regions of euchromatin however, are packed much less tightly and contain active genes. The regulation and creation of these chromatin environments are in part achieved by chromatin remodelers, a class of proteins that serve to rearrange the nucleosomes that make up chromatin. Another big player is a protein called heterochromatin protein 1 alpha (HP1 α). Recent literature has suggested that HP1 α interacts with chromatin and remodelers to repress the activity of chromatin remodelers. Here, I have developed a remodeling assay that has allowed me to test this hypothesis in the context of one and many nucleosomes. I then tested the effect of HP1 α on the remodeling activity of the remodelers CHD1, ACF and Brg1. These experiments give insight into how important nuclear proteins work together or against each other to silence genes in the cell.

Andrea Contreras

Human Developmental Sciences, UC San Diego
Creating Scientists to Address Cancer Disparities Program
Mentored by Dr. Georgia Sadler, Surgery

Survival Rate Disparities between Osteosarcoma and Ewing's Sarcoma in Pediatric Patients

Osteosarcoma and Ewing's Sarcoma are both malignant bone tumors that mostly affect pediatric patients. Despite their similarities, which will be discussed in the presentation, the five year survival rates for osteosarcoma and Ewing's sarcoma are very different. We hypothesize that certain factors such as age, gender, race, ethnicity, genetics, and research funding contribute to the disparities found between osteosarcoma and Ewing's sarcoma. A literature review was conducted of articles found in PubMed, CINAHL, and EBSCO databases using the following keywords: osteosarcoma, Ewing's sarcoma, pediatrics, survival rate, Hispanic Americans and genetics/genetic testing. Other reputable sources, such as the American Cancer Society, were also searched for relevant information. Additional articles were obtained by reviewing reference lists of key articles. This presentation will discuss findings and implications for future research. Between the years 2010 and 2016, the five-year survival rate of childhood osteosarcoma (ages 0-14) and adolescent osteosarcoma (ages 15-19) were 68% and 67%, respectively. The five-year survival rate for childhood Ewing's sarcoma and adolescent Ewing's sarcoma were 75% and 58%, respectively. Notably, the National Pediatric Cancer Foundation reports that only 4% of government funding on cancer research is distributed towards pediatric cancers. Out of this 4%, little funding is geared towards sarcomas. Despite the fact that sarcomas are rare compared to other pediatric cancers, such as leukemia, further research and funding are necessary in order to improve the survival rates of osteosarcoma and Ewing's sarcoma to match the high survival rates of those that are more common.

Miles Corley

Microbiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Matthew Daugherty, Biological Sciences

Characterizing a new host-virus arms race between Interferon Stimulated Genes and viral proteases

Cell intrinsic immunity rapidly responds to viral infection through recognition of pathogenic molecular patterns. The immediate response of this intrinsic system is subject to immense evolutionary pressure as it must adapt to subdue the viral presence

but also evade viral antagonism of host factors. One subset of this intrinsic systems is the interferon stimulated genes (ISGs); this group includes proteins such as MxA, OAS1, TRIM5, TRIM34, and many others. We have recently discovered that proteases from viral families including Picornaviridae and Coronaviridae can cleave human. These data suggest that these viruses are subject to MxA's antiviral properties and that MxA is rapidly evolving to escape viral protease-specific degradation. My project will identify MxA's effectiveness against picorna- and coronaviruses and determine how viral inhibitory strategies hamper MxA's antiviral properties as well as identify other ISGs in similar host-pathogen conflicts.

Victor Cortez

Chemical Engineering, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Michael Sailor, Chemistry & Biochemistry

Preparation and Stabilization of Silicon Quantum Dots and Integration into a New Identification System

The preparation of quantum-confined silicon from mesoporous silicon derived from electrochemical etching of p-type silicon wafers is studied. Quantum confinement arises from nanometer-scale features embedded in the mesoporous silicon framework, and a notable consequence of this phenomenon is visible photoluminescence (PL). Electrochemical etching of p-type silicon results in silicon features that are >10nm large, which are too large to generate quantum confinement. The feature size can be reduced to <5nm by subsequent dissolution or by thermal oxidation, here we explore the techniques of preparing silicon nanostructures in a more rapid, one-pot synthesis. The steady-state and time-resolved PL response of the silicon nanostructures, containing native oxide or other coatings is explored.

In conjunction with Dr. Michael Sailor's research group, a new type of lock will be created that incorporates silicon Quantum Dots to allow a new type of identification that cannot be replicated. The Quantum Dot will have a specific wavelength associated with an individual and the lock only allowing the specific wavelengths to enter. The Quantum Dots cannot be replicated as oxidation within the Quantum Dot occurs due to exposure to air and can be monitored via FTIR spectroscopy. A proof of concept will include a mechanism to mimic recognition of specific wavelengths and allow for proper reading of the silicon Quantum Dot. This new lock will eliminate most problems of modern means of access, such as RFID, NFC and Mag Strips.

Christopher Creighton

Psychology, California State University, Fullerton

STARS

Mentored by Dr. Lara Rangel, Cognitive Science

Assessing the Function of the Dentate Gyrus Using a Spatial Associative Learning Task

The formation of distinct memories from similar experiences critically depends on the creation of distinct neural codes in the brain that account for subtle differences. The manifestation of such distinct codes is termed pattern separation. This code can be leveraged to associate subtle differences between experience with different outcomes. It is theorized that the dentate gyrus, a sub region within the hippocampus, plays a crucial role in this process by creating a distinct, distributed neural code across its vast cell population for different experiences. Our current project seeks to experimentally assess when and how the dentate gyrus supports the formation of distinct memories. To do this, rats were trained to perform an associative learning task in which they needed to return to a previously rewarded arm of a maze by correctly differentiating it from other arms of a maze. We quantified behaviors that were executed during the task and examined neural activity during these behaviors, such as local field potential (LFP) activity. Specifically, we looked at behaviors such as visual scans of the environment at the beginning and middle of trials, when rats investigated aspects of their environment that could be used for subsequent decisions. Using this task, we hope to better understand both the behaviors and neuronal activity correlated with the formation of distinct spatial memories.

Christian Cruz

Biochemistry, California State University Northridge

STARS

Mentored by Dr. Thomas Bussey, Chemistry and Biochemistry

Augmented Reality as a Visual Learning Tool in Biochemistry

Learning biochemistry requires understanding interactions of microscopic and complex structures in an organism. Due to the small scale of biochemical processes, student understanding of related concepts could be improved by helpful external representations. Since the usage of augmented reality (AR) becomes more prevalent as a new tool to create external representations, researchers have been interested in understanding its impact on student learning. As different forms of external representation are often used together during instruction, understanding how instructors utilized the range of available external representations is important for studying the impact of new forms of external representation. In this study, I will present

a qualitative analysis of an instructor's lectures on the sodium-potassium channel with a focus on how different external representations are utilized during instruction. Using grounded theory methodology, I aim to illustrate the content material presented in instruction and identify the instructor's emergent ways of using external representations.

Nikhil Dange

Electrical Engineering, UC San Diego

Electrical and Computer Engineering SRIP

Mentored by Professor Karcher Morris, Electrical & Computer Engineering

Improving CircuitPython Development Environments

Authors: Nikhil Dange, Laura Vlahakis, Katie Hsieh, Farnia Nafarifard, Karcher Morris

The primary goal of this educational research project is to develop curriculum that enables students with skills in Python and circuits. Modules have been developed over the last year that use CircuitPython, a Python-variant language that can be used for programming microcontrollers. These modules focus on both circuit building and programming concepts as students are motivated to work through pre-made mini-projects.

Several modules focusing on the programming aspects of this project were recently added. Specifically, various compatible integrated development environments (IDEs) were introduced and compared. The Mu editor, an environment preferred by the CircuitPython community and used initially in our educational modules, has many limitations. Visual Studio Code and Sublime Text are both presented as viable alternatives, along with documentation and setup instructions. The new environments enable working on CircuitPython modules and future more complex projects. With the use of various extensions, VS Code has the potential to become an important tool, past the scope of CircuitPython.

These modules will be used in the upcoming ECE Summer Internship Prep Program. Students will work through the modules to gain an understanding of CircuitPython, build circuits and improve their programming skills. We will assess the students' ability to transition to the new programming environments through a series of surveys. Additionally, we will investigate how students interact with Visual Studio Code through mathematics and machine learning modules.

Zachary Daniel

Marine Biology, UC San Diego

Undergraduate Research Scholarships

Mentored by Jack Gilbert, Scripps Institute of Oceanography/ Department of Pediatrics

Oyster and Abalone Microbiomes and the Effects of Associated Diseases

The purpose of this project is to explore the many methods used to investigate the microbiome and associated diseases of oysters and abalone. Methods include learning how to sample host organisms, extract DNA and RNA, and use various bioinformatic programs to investigate both the oyster and abalone microbiome. These analytic techniques will be applied to diseases like ostreid Herpesvirus-1 (OsHV-1) in the Pacific Oyster (*Crassostrea Gigas*) and Withering Syndrome in White Abalone (*Haliotis sorenseni*) to better understand the role of the microbiome in disease. Both of these diseases have caused mass mortalities of the mentioned species affecting both the environment and aquaculture. Mass mortality in oysters, an essential species for ocean and pollution filtration, causes a degradation of water quality. Abalone, which are already endangered, is an essential species that grazes on algae to create habitat for other organisms. Mass mortalities of these species also affect commercial fisheries, severely impacting the economy. Comparing the microbial alpha and beta diversity of diseased and healthy samples will allow for further research into what allows these diseases to spread, what mechanisms they use, and how to treat them in the future.

Simon Danitz

Physics w/ specialization in Materials Physics, UC San Diego

Triton Research & Experiential Learning Scholars (TRELS)

Mentored by Dr. Zheng Chen, Nanoengineering

Characterization of Stretchable Hydrogel Electrolytes for Zinc-Air Batteries

Zinc-air batteries (ZABs) with hydrogel electrolytes show significant promise for highly stretchable energy storage. Through polymers which provide structure, such as crosslinking or micelle packing, hydrogels can contain pockets of aqueous solution that act similar to liquid electrolytes, while sustaining a well defined and stretchable gel structure. However, phenomena such as water retention, reduced interfacial contact over time, and other deterioration by environmental factors pose a challenge to the practical usage of ZABs. We focused on characterizing a non-ionic hydrogel which can restore these interfacial contacts by reverse thermogelation with added hydroxide-containing salts. In order to optimize ionic conductivity, operating temperature, and synthesis procedure, the concentrations of three different alkaline solutions and the polymer will be optimized together. We will then compare the effect of the salts in the

electrolyte to understand their effect on water retention, sol-gel transition temperature and concentration, and ionic conductivity. We expect to prepare a hydrogel electrolyte which allows for higher concentrations of lithium salt and polymer binder in solution, improving both ionic conductivity and water retention due to increased hydratable ions and hydrogen bonding sites.

Alejandro Dauguet

Neurobiology/Linguistics, UC San Diego
UC Scholars
Mentored by Dr. Jose Luis Burgos, Global Health

Piloting a Stress-Reducing Mindfulness Intervention Among Migrants Seen at a Student-Run Free Clinic on the Mexico-U.S. Border

The metropolis of Tijuana, Mexico serves as one of the most popular migration avenues on the US-Mexico border, harboring immigrants, asylum seekers and other individuals seeking safety and/or economic opportunities. This status has also contributed to great strife among Tijuana's growing population, with homelessness, drug abuse and crime perpetuating amongst the disadvantaged. Many migrants and homeless individuals suffer from mental health issues, especially depression and anxiety, and yet the availability of outlets for exploring one's mental state is scarce and poorly understood. As a nonprofit student-run free clinic, the Health Frontiers in Tijuana (HFIT) Clinic serves as a sanctuary for these individuals, providing medical care and support through community resources. HFIT has sponsored previous initiatives that employed meditation and mindfulness towards addressing the mental health issues of its clients. The goal of this project is to pilot a mindfulness intervention in a free clinic in Tijuana, Mexico (i.e. HFIT Clinic). The second goal of this project is to assess the feasibility, acceptability and satisfaction with the mindfulness intervention among patients seeking care at the HFIT Clinic. Results will shed light on strategies to integrate mindfulness intervention in the clinic procedures.

Aakash Davasam

Biochemistry, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Rommie Amaro & Dr. Vicki Grassian, Department of Chemistry and Biochemistry

Surface Activity of Amino Acids in Sea Spray Aerosols

Greenhouse gases disrupt the Earth's energy equilibrium by trapping and scattering solar radiation. While many factors drive the planet's warming, it is believed that

atmospheric aerosols, on average, can help offset this disrupted equilibrium through cloud formation. Clouds change the surface albedo of the planet, increasing the solar radiation reflected back into space. Sea spray aerosols, in particular, are ubiquitous particles in our atmosphere that become suspended in the air when ocean waves break. These aerosols contain a plethora of organic and inorganic compounds, including but not limited to free amino acids, combined amino acids, and salt ions. It has been observed that salt concentrations and pH levels affect the surface activity of biological molecules in sea spray. To better understand how salts are responsible for stabilizing organics at the interface, we used leucine, a surface active amino acid known to be prevalent in sea spray. Steered all-atom molecular dynamics (MD) simulations were combined with umbrella sampling to construct potential of mean force (PMF) plots, enabling us to investigate the surface propensity of leucine at different protonation states and salt concentrations. To complement this experimentally, Brewster-Angle microscopy and infrared reflection absorption spectroscopy (IRRAS) techniques were used in conjunction with a surface tensiometer and Langmuir trough to gain insight into the surface pressure and morphology of leucine containing monolayers at the air-water interface. This work can ultimately be extended to incorporate more complicated biomolecules, such as whole peptides and proteins.

Allison Delehoy

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

The Role of Non-coding RNAs in Psoriasis

Psoriasis is a skin condition that occurs due to the over-replication of keratinocytes. It is characterized by raised irregularly-shaped red patches on the skin, mostly found on extremities. Patients diagnosed with psoriasis are known to be more susceptible to other conditions such as obesity, diabetes, heart failure, and hypertension, so understanding the molecular causes of psoriasis would be helpful for the development of therapeutics for the disease in the future. Non-coding RNAs (ncRNAs) are RNA sequences that do not encode a protein, but they are known to have a role in gene expression. The purpose of this study is to understand the role of non-coding RNAs in psoriasis. By using short hairpin RNAs (shRNAs) to knockdown the target ncRNA of this project, we will see the effect that ncRNA expression has on keratinocyte replication in psoriasis. Through preliminary studies, we identified an ncRNA that is linked to psoriasis, which we named PSAR. I hypothesize that PSAR is a positive regulator of cell replication, so the knockdown is expected to impede the keratinocyte replication process. To test this hypothesis, I will generate short hairpin RNAs to knock down PSAR expression. Then, I will test whether knockdown of PSAR ncRNA affects the rate of keratinocyte replication. The results will test if PSAR ncRNA may be involved in psoriasis.

Elisa DePhillippis

Nursing, San Diego State University
Creating Scientists To Address Cancer Disparities Program
Mentored by Vanessa Malcarne, Psychology

The intersection of breast cancer and cardiovascular disease in African American women

African American women have the highest mortality rates of breast cancer and the lowest survivorship rates of breast cancer compared to all other racial/ethnic groups. Research has suggested an intersectional relationship exists between breast cancer treatments and increased cardiovascular disease risk. Cardiotoxicity from breast cancer treatments increases the risk of cardiovascular disease. Cardiovascular disease is the leading cause of death within the African American community. This literature review will discuss the disparities faced by African American breast cancer survivors in the context of cardiovascular sequelae and challenges in receiving proper survivorship care plans and post-treatment education. This literature review identified articles since 2016 via PubMed, CINAHL, and PsycINFO. Keywords included African American, Black, women, breast cancer, survivorship, care plan, cardiovascular, risk, and cardio-oncology. Article references were used to find additional key articles. Studies from the American Cancer Society, National Cancer Institute, and Centers for Disease Control and Prevention were accessed to gather statistics on breast cancer and cardiovascular disease. This literature review will evaluate the association between breast cancer treatments and cardiovascular complications in African American women. This research presentation will summarize the findings of this literature review and include a call to action for future research in survivorship education.

Harjot Dhaliwal

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Stanley Lo, Cell and Development Biology

First Generation Student vs Traditional Students

Over the past years, the population of first generation students continues to grow and expand in college campuses. However, this raises more concern to the low graduation rates and grade point averages exhibited by many first generation students. Although there have been countless studies that draw more awareness to these low academic statistics displayed by first generation students, there has been a lack of projects addressing the exact issues that cause the low retention rate. More specifically, there is a gap of knowledge in addressing these issues from a perspective of community

cultural wealth, and science capital and identity. This paper provides a unique perspective by analyzing and breaking down first generation students in comparison to traditional students from a lens that measures a student's community cultural wealth, science aspiration and identity. To clarify, community cultural wealth is defined as a set of skills and knowledge used by students of color in an academic environment. Science capital utilizes social and cultural capital that connects with science in order to measure a student's engagement and aspiration in the field of science. Science identity involves experiences that help students classify themselves as a science person. We implemented all three frameworks in survey questions that were carefully constructed from previous studies. Although the main goal of the survey is to address differences between first generation students and traditional students, we will also analyze the data on intersections of race and gender and final course grades.

Angelica Dimas

Marine Biology, UC San Diego

McNair Scholars Program

Mentored by Dr. Jennifer Smith, Scripps Institution of Oceanography

Do competitive interactions predict demographic outcomes for common corals on Rarotonga?

Coral reefs are constantly being threatened by both natural and anthropogenic stressors. These stressors have led to coral mortality and ultimately algal increases. Whether corals can thrive and outcompete algae is important to understand when considering if coral communities can maintain resiliency as these disturbances become more frequent. Competition among members of the benthic community revolves around space and light (Benayahu et al, 1981) which primarily involves corals and algae. To better understand if corals are capable of outcompeting different algal taxa, I will observe the relationship between four genera of coral and their direct competitors. Specifically exploring how the proportion of direct contact with crustose coralline algae (CCA), turf algae, and Lobophora relate to changes in coral colony size over time. To conduct this study, I will use photo quadrants and a large-area imagery (100m²) of reefs to determine change in benthic community composition, and competitive outcomes over the course of a year. Preliminary findings demonstrated a significant negative correlation ($p < 0.05$), between Leptoria and turf algae, and a significant positive correlation between Leptoria and Lobophora at an island level, but no significant correlations were observed at the site level.

Brian Dinh

Molecular & Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Calvin Yeang, Cardiology

Defining the Inflammatory Monocyte and Cytokine Changes Associated with Lipoprotein Apheresis in Patients with Elevated Lipoprotein(a)

Lipoprotein(a) [Lp(a)] is a major risk factor for cardiovascular disease (CVD) and is present in 20% of the population. As Lp(a) is the major carrier of pro-inflammatory oxidized phospholipids, vascular inflammation has been postulated as the predominant mechanism by which Lp(a) mediates CVD risk. We hypothesize that potent Lp(a) lowering by lipoprotein apheresis will result in a reduction in monocyte inflammation as characterized by flow cytometry and transcriptomic analyses. The results of this project will enhance our understanding of Lp(a)-mediated inflammation relevant to CVD risk as well as evaluate whether lipoprotein apheresis may be an effective treatment for attenuating Lp(a)-mediated inflammation.

Kirk Richard Dolar

Biology: Ecology and Evolution, CSU Northridge
STARS
Mentored by Dr. James Nieh, Biology

Analysis of hygienic behavior and toleration of Varroa destructor in feral and managed honey bees Apis mellifera.

Varroa destructor is an ectoparasite of western honey bees (*Apis mellifera*), causing declines in populations worldwide. One natural defense is social immunity in which the honey bee colony mitigates pathogens and pests by removing infested developing broods. Several focused studies have shown that Africanized honey bees have higher hygienic behavior than their European and Carnolian counterparts by responding quicker and more intensely to remove Varroa mites as well as removing more infested broods. This project aims to better understand whether feral and managed honey bees' hygienic behavior differs by analyzing the data collected through pin-kill assay and colony size survey. These analyses will determine the efficacy of different honey bee population's ability to tolerate Varroa destructor and provide insight to the pathogen dynamics between feral and managed *A. mellifera*

Ashton Domi

Oceanic and Atmospheric Science, UC San Diego
Undergraduate Research Scholarships
Mentored by Amato Evan, SIO CASPO

Climate Modeling and Dust Storm Prediction

Climate change is actively affecting weather and the environment around the world, including Southern California where warming temperatures are speeding up the drying up of the Salton Sea. As the banks of the Salton Sea recede, dust storms may become more frequent with strong wind events and larger quantities of loose, dry sediment on the lakebed. This project will look to determine if small-scale weather simulations developed using the Weather Research and Forecasting Model, WRF-chem, can accurately portray a dust storm of equivalent size and intensity to the information retrieved by our instruments. WRF will be used in this project to conduct idealized simulations on dust storms that have varying parameters and initial conditions, such as wind speed, potential temperature, and pressure. Starting out with large-scale weather patterns, the model first needs to be able to track a low-pressure system traveling over southern California, which is characteristic of winter storms that correlate to dust-aerosol events. The model will output simulations based on weather parameters from a dust event that occurred on February 22, 2020. If WRF can accurately simulate this dust storm, the cause and mechanisms of this type of event e.g. the role of, lee waves off of Laguna Mountain, and gravity-induced cold-air pools from rain showers, can be determined.

Dallas Dominguez

Electrical Engineering, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Saharnaz Baghdadchi, Electrical and Computer Engineering (ECE)

UCSD evGrandPrix Autonomous Racing Vehicle Project

The rapidly growing field of autonomous vehicles naturally proposes global concerns for passenger safety, system reliability, and affordability. The purpose of this project was to combine cutting edge technology from the fields of actuation, sensing, and control to construct an autonomous racing vehicle under \$30K USD that would address those three concerns. Working on a 6-month project timeline (Feb 2021 - Sep 2021), both industry engineers and students in the fields of Mechanical Engineering, Electrical Engineering, Computer Science, and Data Science were brought together to develop separate "bolt-on" modular autonomous subsystems for an electric go-kart. The team was able to successfully build the electric vehicle and attend the September 2021 race

at the Purdue University evGrandPrix event in Indianapolis. Many of the technologies used for this build are still very expensive (LIDAR, GNSS, Software Access), but this project clearly shows we are at a point in history where students and hobbyists finally have access to resources previously held only by government agencies or corporations with vast assets. This project serves as a foundation for future autonomous vehicle projects at UCSD as the cost of these technologies continues to fall over the coming years.

Nia Dumas

Political Science, Spelman College

STARS

Mentored by Dr. LaGina Gause, Political Science

How has racial segregation influenced voter suppression in Georgia?

Racial housing segregation disproportionately affects the black community by denying access to education, fresh groceries, and voting information. This study examines the impact of housing segregation on voting rights and mobilization efforts in the black community. Scholars say the black community is typically mobilized by Black women, but rarely discuss the influence of housing segregation on these efforts. Housing segregation has negatively impacted the black community by closing them off to certain opportunities and categorizing their communities as hazardous, which has led to lower voter engagement, lower political reach lower and lower faith in government thus impacting their involvement in politics.

Sylas Eckhart

Biological Anthropology, UC San Diego

STARS

Mentored by Tatum Simonson, UCSD school of medicine

Epigenetic Adaptations to High Altitude in Andean Populations

The high-altitude environment places unique stresses on the body due to decreased oxygen availability. Chronic exposure to low oxygen conditions can result in the development of Chronic Mountain Sickness (CMS), which is characterized by higher hemoglobin concentration and may be associated with negative health outcomes such as high-altitude pulmonary hypertension and further exacerbated by hypoxemia due to sleep-disordered breathing at altitude. During a five-year period, we collected data from 194 Andeans with and without CMS in Cerro de Pasco (CdP), Peru (~4350 m). We aim to determine 1) if genetic/epigenetic profiles are associated with key phenotypes, and 2) whether epigenetic profiles changed over time and whether these changes are related

to disease progression in a subset of individuals ($n = 13$) examined at multiple time points. First, we will examine whole-genome sequence and genotype data to determine whether genetic factors alone predict phenotypes in a multivariate time-series model. Second, we will examine epigenetic profiles in individuals using the Illumina Methylation EPIC kit and Bioinformatics tools and packages including Gene Ontology, Genomic Regions Enrichment of Annotations Tool, and methyl Kit and quantify relationships between epigenetic profiles and phenotypes. Third, we will quantify the amount of change in DNA methylation in 13 participants studied more than once and determine if any epigenetic profile changes are associated with changes in phenotype. The results of this study will be the first to merge genomics, epigenomics, and phenotype data and quantify changes in epigenetic profiles that may be relevant to the progression of high-altitude diseases.

Aiyana Edwards

POLITICAL SCIENCE, SPELMAN COLLEGE

STARS

Mentored by DR. PAMELA BAN, POLITICAL SCIENCE

DESCRIPTIVE REPRESENTATION AND THE LEGISLATIVE AGENDA IN TEXAS

What is the effect of having a minority legislator on the topics of bills introduced from that district? This topic has not been thoroughly researched as of yet; however, it is necessary to understand the implications of diversity in the legislature. We argue that descriptive representation does indeed affect bill and agenda proposals in the Texas House legislature. To examine how race and ethnicity affect the subject, topic, or content of bills introduced in the Texas House of Representatives, we collect demographic data for representatives from each district across the 84th, 85th, 86th, and 87th Texas House of Representative sessions. We expect to find key differences between the minority (Black, Asian, and Hispanic / LatinX) and non-minority (White) legislators and the subject matters of proposed bills. We use cross-sectional comparison and within-district comparison models to analyze our data.

Danielle Etiel

Biochemistry, University of San Diego

McNair Scholars Program

Mentored by Jessica Bell, Biochemistry

Structural consequences of SIKE phosphorylation

Protein-Protein interactions (PPIs) are contacts between proteins that are a crucial part of intracellular communication and function. Suppressor of IKKepsilon (SIKE), is

associated with multiple, distinct PPIs including TANK-binding kinase 1 (TBK1), STRIPAK (striatin-interacting phosphatase and kinase) and cytoskeletal proteins, tubulin and actinin. Although SIKE's function is not fully defined in these complexes, SIKE is phosphorylated by TBK1 at up to six SIKE serine residues, S133, S185, S187, S188, S190, and S198. Phosphorylation can limit or define PPIs. Using a SIKE phosphomimetic-mutant (S133/185/187/188/190/198E), size exclusion chromatography and chemical crosslinking studies showed a monomeric species, whereas native SIKE separated as a dimer. Co-immunoprecipitation revealed that the tubulin interaction was enhanced with the phosphomimetic SIKE. These studies suggested that SIKE could undergo a phosphorylation-induced structural change that affected SIKE interactions. To examine individual phosphorylation sites on SIKE structure, phosphomimetic-mutants at each phosphorylation site were computationally created, and the interface stability of each model for each mutant assessed on a per residue basis (HawkDock-MM/GBSA). S187E, S190E, and S198E showed significant stability differences from native SIKE when assessed on a per residue basis. Site-directed mutants for these sites were created and sequence confirmed. The short-term goals of this project are to characterize mutants by SEC/crosslinking to determine oligomer state and tryptophan fluorescence to examine local environment changes at the dimer interface. Long-term goals are to measure the effect of phosphorylation on protein interactions between wild type and phosphomimetic-mutant SIKE variants using a BODIPY-labeled SIKE and fluorescence anisotropy.

Marissa Evans

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Sreekanth Chalasani, Neuroscience

Investigating the specificity of predator induced food avoidance in C. elegans

It has been shown that many different species are capable of conditioned fear responses, but it hasn't been shown yet that *C. elegans* are capable of them. To investigate this, we used a known predator of *C. elegans*, *Pristionchus pacificus*, which is found in similar environments and is capable of biting and killing *C. elegans*. We designed an assay that tested the specificity of predator occupied food avoidance to see if *C. elegans* is able to identify bacteria previously associated with predators. We first tested multiple wild isolate bacteria with distinct odor profiles to find a pair of bacteria that *C. elegans* was able to distinguish. Of the 3 bacteria, we found that JUB12 and JUB38 were similarly attractive to *C. elegans*. We then tested that the presence of predators still results in *C. elegans* leaving to lay their eggs off the lawn. Finally with this knowledge we were able to create an assay that has a distinct training and testing phase. The training phase occurs when *C. elegans* is placed on a predator-occupied lawn and given enough time to experience bites. During the testing phase, the

C. elegans are given a choice between the bacteria they experienced during the training period or a different bacteria.

I expect that the results of this research will show that C. elegans is capable of associating specific cues with predators, so we can use C. elegans to investigate genetics and neural circuits of aversive conditioning in an ethologically relevant context in the future.

Eden Evans

Visual Arts - Media; ICAM - Music, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Professor Amy Alexander, Visual Arts

Stories in Motion: Exploring the Intersections of Movement, Narrative, and Computer Vision

Looking at how movement and the language of the body act as storytelling devices, this video artwork will use computer vision techniques to identify and categorize motion, form, structure, and gesture among other elements of dance in terms of their narrative components and properties. My analysis employs computer vision techniques in order to gather quantitative pose estimation and motion analysis data of recorded video, from which I am creating a digital media piece which works to translate the stylistic and storytelling sensibilities of modern dance into a procedurally-generated visual narrative. Additionally, I will be looking exclusively at the work and practice of Martha Graham, who is renowned for her radicalization of modern dance during the mid-20th century, and who developed her own distinct movement vocabulary—known as the Graham Technique—as a method of exploring the bodily expression of human emotion and behavior. Her works and choreographic motifs are recognized by their dramatic intensity and use of oppositions, focalized by concepts of contraction and release, which act as powerful and intuitive storytelling devices. In tandem with a review of literature surrounding the conceptual and technical ideas of Graham, my piece aims to determine and digitally interpret the choreographic elements of Graham’s philosophy of movement, as well as how they emblemize human emotion and communicate narratives.

Jehan Ezzulddin

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Sandra Daley, Pediatrics

Social Determinants of Health and Allostatic Load

This research assessed how social determinants of health impact levels of allostatic overload among women, and how excessive levels of chronic stress cause biological embedding and alterations in the DNA.

Information for this research was obtained from documentaries, lectures, Tedtalks, webinars, literature review, and longitudinal data from a variety of studies which tested how disparities have affected populations at risk. A combination of laboratory results testing lipid panel [e.g., HDL, LDL, cholesterol, and triglycerides], and anthropometric measurements were reviewed to compare levels of allostatic load and its contribution to biological embedding.

Data presented suggest that elevated levels of allostatic load increase mortality rates among adults regardless of their race or ethnicity; however, AL is considered a cumulative phenomenon, influenced by many social determinants such as race, socioeconomic status, and psychosocial factors. Exposure to this form of chronic stress alters the brain's development, causing biological embedding, and may be a contributor to premature death in the U.S.

Adrianna Ferguson

Political Science, Spelman College
STARS
Mentored by Professor Thad Kousser, Political Science

GENDER VALIDATION AND POLITICS

Do women in politics need validation from men to be elected? United States Politics and Policy Center argue that women in politics need validation to establish credibility in the eyes of voters. By validation, I mean endorsements in order to be considered a credible candidate. We plan to test this theory by evaluating the success of women candidates with and without endorsements from men. In this research, we expect that it proves women candidates does not need the endorsements from men in order to be elected.

Jose Figueroa Jr

Physics, St. Mary's University
MRSEC REU or RIMSE
Mentored by Dr. Shirley Meng, NanoEngineering

Fluorinated Graphite as High Energy Density Cathode for Primary Lithium Battery

Lithium fluorinated graphite (Li-CFx) batteries are a class of primary batteries that were first commercialized in 1970s. Due to their light weight, high theoretical capacity, high energy density, and high reliability, they have been extensively utilized in implantable medical devices, military, and aerospace applications. Despite all the advantages listed, a limiting factor of Li-CFx batteries is their poor rate capability. It has been shown that this is mainly associated with sluggish ionic and electron diffusion in CFx cathode structure. Liquid exfoliation is a technique mainly used in synthesis of nanosheets from layered nanomaterials. This project will examine the role of liquid exfoliation on the electronic and ionic conductivity of liquid exfoliated CFx cathode using experimental and computational methods. In the experimental part of this study, electrochemical performance of Li-CFx cells will be investigated for pristine and modified CFx cathode structure followed by material characterization using scanning electron microscopy (SEM), Raman spectroscopy, and x-ray diffraction (XRD). Computationally, first principle calculations will be performed using the Quantum Espresso (QE) package to investigate the electronic properties as well as ionic diffusion barriers in the Li-CFx system.

Samantha Flores

Biological Anthropology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Amy Non, Anthropology

Determining the clinical impact of race adjustment on pulmonary function tests

SARS-CoV-2 (COVID-19) swept the world as it went from a health emergency to a global pandemic in a matter of months. After almost a year, we continue to see hundreds of thousands of new cases daily worldwide. Recovery from the virus is not uncommon; in fact, a majority of people who contract the virus recover. The treatment plan following the COVID-19 infection is then determined by a series of lung function tests and, in some cases, CT scans. A spirometer is a device used in the testing of lung function and sometimes, as a therapy itself. Lung function measurements are then used to determine diagnoses, severity of lung damage, treatment plans, and healthcare benefits. However, when using a spirometer to measure the lung capacity of a Black patient, a built-in “race correction” is used that reduces a patient’s predicted values by 10-15%[1]. Smaller adjustments for Asian and Hispanic patients are also used. The built-in race corrections

may cause underdiagnoses of some pulmonary conditions because lower lung function is considered “normal” in non-white patients. Using electronic medical records from 300 non-white UCSD patients, this study aims to recalculate pulmonary function in recovered COVID-19 patients without race-based corrections in order to analyze how unadjusted values may change diagnosis and treatment plans. By recalculating predicted values of lung function among non-white patients, we will evaluate the clinical relevance of race corrections in the pulmonary function values.

Juliana Foley

Chemical Engineering, UC San Diego
McNair Scholars Program
Mentored by Darren Lipomi, Nano and Chemical Engineering

Degradation Rate of Perovskite Solar Cells with Multi-Layer Graphene Barriers

In recent works, there have been signs of graphene being used as a potential barrier in the process of protecting perovskite solar cells. In this paper, the degradation of perovskite films in air is being tested through CVD-grown graphene barrier films coated with single- and multi-layers. The defects present in CVD-grown graphene can likely be reduced by building up multiple layers on top of one another. These barrier films are composed of parylene, a semi-permeable material, along with up to three graphene monolayers. The films are tested by using a UV heat lamp and a source meter to measure the conductivity. Being that parylene with no layers of graphene is the standard degradation rate, it was determined that one layer of graphene reduces the degradation of the films by a significant amount. Additionally, two- and three-layer graphene further reduces the degradation rate. These results promote future applications with graphene barriers through perovskite film encapsulation, potentially increasing the stability of perovskite solar cells.

Kaelyn Ford

Human Biology, UC San Diego
Genentech Scholars Program
Mentored by Dr. Varykina Thackray, Ob/GYN and reproductive medicine

Role of hyperandrogenism in the auto-regulation of androgen receptor expression

Polycystic ovary syndrome (PCOS) affects ~10% of women of reproductive age and is characterized by endocrine, reproductive, and metabolic dysregulation. Androgens are male-dominant steroid hormones that are increased in females with PCOS (hyperandrogenism). Studies showed that castrated male rats had increased levels of androgen receptor (AR) mRNA in the prostate and seminal vesicles, suggesting a

negative feedback mechanism of AR mRNA expression via androgen signaling. This negative feedback could help us understand changes in AR mRNA expression in PCOS. We hypothesize that AR mRNA expression will be downregulated in reproductive and metabolic tissues of a PCOS mouse model compared to placebo mice. We used a letrozole-induced PCOS mouse model that captures the hallmarks of PCOS in women such as hyperandrogenism, irregular cycles, and polycystic ovaries as well as weight gain, insulin resistance, hyperinsulinemia, dysglycemia, and dyslipidemia. Letrozole is a non-steroidal inhibitor of aromatase, which is the enzyme that converts testosterone to estradiol, and increases testosterone levels in the body. In this experiment, to assess expression of AR mRNA as representative reproductive and metabolic tissues, we used quantitative polymerase chain reaction (qPCR) to quantify the number of copies of mRNA transcribed from the AR gene. In the liver, AR mRNA was lower in the PCOS model compared to placebo — while AR mRNA in skeletal muscle was the same between the groups. Additional experiments will be performed to measure AR mRNA levels in other metabolic and reproductive tissues to determine if there is tissue-specificity in the auto-regulation of AR in the PCOS model.

Chiara Frank and Dana Steinberg, and Yuntae Lee

Neuroscience, UC Los Angeles

UC Scholars

Mentored by Mateusz Gola, Institute for Neural Computation

VREEG - VR and EEG Environment for Rapid Assessment of Neural Biomarkers of Addiction and Eating Disorders

Substance (e.g. alcohol) and behavioral (e.g. gaming) addictions and other impulse control behaviors (e.g. binge eating) are highly prevalent. As chronic and relapsing disorders, they pose a detrimental challenge for affected individuals and their social environment. Such behaviors have shared characteristics that correspond to alterations of dopaminergic neurons signaling higher reward expectancy and reward prediction error, which can be measured with the fMRI and EEG (e.g. with feedback relative negativity evoked potentials). Unfortunately, classic methods to assess these biomarkers are costly, time-consuming, and currently present no clinical usability. Therefore, our study attempts to develop a VR environment which would allow for controlled exposure of incentive cues (evoking reward expectancy) and various types of rewards (e.g. food, illicit substances) in highly engaging conditions. Combined with EEG and advanced signal processing methods, this environment could allow for shorter and clinically usable assessments of reward expectancy and prediction error. Its effectiveness will be tested in eating disorders and addiction.

Cristian Fuentes Hernandez

Political Science, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Luis Alvarez, History

San Ysidro as a Case Study for Cultural Resistance against the Border

Surrounding the U.S-Mexico border, communities are affected every day by the wall. From waiting hours to cross the border to families being separated due to immigration status, for these communities, living by the Border is a part of their culture. In this article, Cristian Fuentes Hernandez uses the border community of San Ysidro as a case study to highlight Chicanxs and Latinxs cultural resistance to the border. This study builds on existing literature about the collective political resistance against the US-Mexico wall and the organization of ethnic groups in San Diego. In this article, we will talk about how San Ysidro detaches from the greater San Diego region due to its proximity to the border with Mexico and develops its own cultural identity. By conducting oral interviews with San Ysidro community members from San Ysidro High staff/students, a school miles away from the border, this study hopes to capture the ways in which Chicanx/Latinx people today culturally resist the geopolitical divisions of the border and contribute to the effort of rewriting American history with a more inclusive approach that represents those groups that were ignored by the American mainstream and raise awareness of the tangible consequences that immigration debates are having on communities.

Alexander Fuqua

Nanoengineering, UC San Diego
MRSEC REU or RIMSE
Mentored by Dr. Andrea Tao, Nanoengineering

Simulating the Optical Properties of Ag Nanocubes Assembled in a Checkerboard Pattern

Self assembly techniques can provide scalable methods of integrating novel properties of nanomaterials into modern devices. Both in situ experimental techniques and simulations that are able to give insight into assembly mechanisms are important for furthering these methods. For example, self-assembled silver nanocrystals (such as nanocubes) have potential application in techniques such as surface-enhanced Raman spectroscopy and as optical metamaterials. One assembly structure of interest is a periodic array of nanocubes that maximizes the edge-to-edge nanocube connections to generate many optical hotspots. The resulting structure resembles a classic checkerboard pattern and has yet to be achieved experimentally. As a result, the optical properties of this complex assembled structure are not well characterized. I will

simulate the optical properties of individual silver nanocubes, nanocubes arranged in this checkerboard pattern, and potential intermediates to the final checkerboard assembly. I will use the Finite Difference Time Domain (FDTD) solver in Lumerical to simulate the scattering, absorption, and near-field of these various structures. These results have the potential to be compared against experimental spectroscopic data and assembly rates to provide insight into self-assembly mechanisms.

Xiomara Gaeta Agreda

General Biology, UC San Diego
Creating Scientists to Address Cancer Disparities Program
Mentored by Dr. Sadler, Surgery

Factors contributing to poor cervical cancer outcomes in Hispanic/Latina women

Hispanic/Latina women have the highest incidence rate of cervical cancer out of any racial/ethnic group in the United States. Human Papillomavirus (HPV) infection has been identified as a leading cause of cervical cancer, despite the many available preventative measures such as HPV vaccine, HPV testing, and Papanicolaou smear/test. All of these have successfully lowered cervical cancer incidence rates among other ethnic groups, but Hispanic/Latina women continue to have the highest mortality rate due to late cancer diagnosis. Multiple factors may have contributed to this disparity such as cultural beliefs (i.e., religion, machismo, fatalism), and socioeconomic status. This narrative literature review collected articles using PubMed, Google Scholar, ProQuest, and CINAHL databases using keywords Hispanic/Latino women, cervical cancer, cancer screening, HPV vaccine, HPV vaccine attitudes, HPV testing, machismo, religion, spirituality, and fatalism. The information gathered will be summarized and essential risk factors will be highlighted. Lastly, recommendations will be given for future research on the topic.

Noah Gaitan

General Biology, UC San Diego
STARS
Mentored by Dr. Antoine Chaillon, Medicine

Investigating prominent death biomarkers and effects of the dying process on HIV reservoirs in Last Gift participants via rapid autopsy

Antiretroviral therapy (ART) improves the quality of life for persons with HIV (PWH) by suppressing HIV replication but does not eliminate HIV reservoirs. As a result, HIV persists throughout the body into deep tissue reservoirs, and despite ART regimens, it can lead to several comorbidities, including cardiovascular, respiratory, and hepatic

diseases. To better understand where HIV hides within the body, we developed the unique 'Last Gift' cohort. In this cohort, we enroll altruistic individuals who graciously donate their bodies to research after death, allowing further investigation of HIV reservoirs and the potential impact of the dying process (i.e., organ dysfunction) on reservoir characteristics. We will collect clinical data and pre and post-mortem (via rapid autopsy) specimens from each participant throughout the study. Using these samples, we will characterize the HIV reservoirs throughout the body and determine a composite 'death process index score' for each participant based on electrolytes, inflammatory markers, and markers of organ dysfunction by comparing these values to normal ranges. Next, we will evaluate how the dying process can affect HIV reservoir characteristics (e.g., size, activity). Upon completing this study, we will obtain valuable information for future HIV end of life research by documenting the consequences of the 'dying process' on the HIV reservoirs residing in deep tissues. Our inquiries will be impactful in discerning whether certain death markers and subsequent reservoirs apply to all PWH and thus provide a robust framework that focuses on how to significantly reduce these reservoirs amidst identifying a cure.

Yidi Gao

Aerospace Engineering, UC San Diego
UC Scholars
Mentored by Dr. Carlos Coimbra, MAE Dept.

Thermal Switch Design for Lunar/Martian Rovers

This project, sponsored by Professor Carlos F. M. Coimbra at the Jacobs Schools of Engineering at UC San Diego, aims to design, model and test a device that acts as a thermal switch. Thermal switches are engineering devices that allow for discontinuous conductance at different temperatures, thus keeping electrical components within operating conditions that prevent equipment failure. This particular thermal switch is being designed for extreme environments in terms of pressure and heat flow, such as those found on Mars or on the Moon. The goal of the project is to design the thermal switch for operation under strict temperature ranges, so as to protect the electronics for extended lifetimes. The thermal switch is thus designed to optimize different components of space probes by keeping the electrical components within tightly-controlled temperature limits (e.g., zero to forty celsius) while the surroundings are exposed to variations from -150 to 120 celsius. To reduce mass for aerospace applications, the expandable thermal switch operates with nitrogen filled nickel bellows that are commercially available but need to be properly sealed. The final thermal switch operation will be tested under nitrogen cooling and high infrared fluxes, which simulate the extreme conditions found in space exploration environments.

Scott Garcia

Bioengineer, UC Merced
Louis Stokes California Alliance for Minority Participation (CAMP)
Mentored by Dr. Wei-Chun Chin, Department of Bioengineering

Effects of Electronic Cigarettes Liquid Components on Airway Mucus Swelling Kinetics

Scott E. Garcia, Carlos Vasquez, Wei-Chun Chin, PhD; School of Engineering, University of California, Merced

Electronic cigarettes or e-cigarettes have gained major traction in several domestic markets across the globe within recent years, with a significant increase in use among underage individuals. E-cigarettes have been repeatedly marketed as a safer alternative in comparison to tobacco products, with lures such as flavored e-cigarettes becoming incredibly successful in targeting younger audiences. With the emergence of these new electronic cigarettes current research has focused on the direct toxicity of these devices, however, our study focuses on addressing the gap regarding the rheological effects on airway mucin secretion associated with e-cigarette use. Furthermore, our study investigates the health impacts correlated to these devices, specifically common lung diseases, such as chronic obstructive pulmonary disease and asthma. We utilized A549 human epithelial carcinoma cell lines alongside video microscopy to monitor the swelling kinetics of mucus when exposed to liquid e-cigarette components at varying nicotine concentrations. Our results indicated that e-cigarettes with nicotine at varying concentrations, and whether composed of propylene glycol (PG) or vegetable glycerin (VG), lead to abnormally viscous mucus placing an individual at a higher risk for developing respiratory diseases. More importantly, these results may be used to refine or improve protocols involved in electronic cigarette production and more so the regulation of e-cigarettes

Bethelihem Gebremeske

Public health, UC San Diego
McNair Scholars Program
Mentored by DR. Dennis Trinidad, Family medicine and public health

Child Marriage in Ethiopia: Too young for Marriage

Ethiopia is home for more than 100million people. In Ethiopian society, there are very rigid gender roles that men and women are expected to abide by. Personal and individual choices regarding adhering to such roles are generally limited because of very strong cultural expectations. Women and men in this society fall into the conventions already developed for them without rebellion. Early marriage is one of the very harmful

traditions practiced in Ethiopian culture. This includes the marriage of young girls who have not fully matured biologically and mentally. These practices come from cultural traditions that are very harmful to the Ethiopian society. The tradition pushes young girls to get married at a very young age instead of getting their education, which increases the chances of being in poverty. One of the very strong cultural expectations is for young married girls is to bear children within the first few years of marriage. Giving birth at a young age increases the risk of obstetric fistula. An obstetric Fistula is a childbirth injury mostly caused by unrelieved, prolonged obstructed labor. USAID and Ethiopia fistula foundation found that about 36,000 to 39,000 young women live with obstetric Fistula and 3000 new cases occur every year.

Maxime Ghesquiere

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Mark Ettenhofer, Psychiatry

Eye tracking in VR for diagnosis of neurological conditions

Diagnosis of neurological conditions is typically performed by in-person tests involving tracking subjects' response to visual and mental stimuli. This project aims to develop a task using Virtual Reality and eye tracking technology to streamline and facilitate the diagnosis process. To this effect, a 3D, game-like, virtual reality task is developed to collect eye-gaze data corresponding to a search task. The task involves finding certain target objects within a virtual scene. Once the eye-gaze data is collected and processed, pattern recognition software will be used to extract meaningful indicators of neurological conditions. The goal is to determine if such a VR based system can be used effectively to diagnose neurological conditions.

Aditi Gnanasekar

Bioengineering: Biotechnology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Weg Ongkeko, Surgery

Integrating clinical, genomic, and transcriptomic data to determine the influence of transfer RNA expression on head and neck cancer progression

There is mounting evidence that shows that the dysregulation of transfer RNAs (tRNAs) and their derivatives are involved in the proliferation and invasiveness of cancer, although little is known about the mechanisms by which dysregulated tRNAs drive pathogenesis. The integration of tRNA read counts with clinical data and gene expression data may provide important insight on how tRNA dysregulation can influence

cancer progression and prognosis, which drastically varies even between patients with the same cancer. In particular, head and neck squamous cell carcinoma (HNSCC) of varied etiologies, including human papillomavirus-related (HPV) cancer and smoking-caused cancer, manifests itself very differently in patients. The cause for why HPV(+) cancer patients exhibit more positive response to treatment and significantly higher survival rates compared to HPV(-) cancer patients is still yet to be elucidated. Consequently, even advanced treatments for HNSCC, including immune checkpoint blockade and antigen-specific immunotherapy, have low response rates. If tRNAs play an important role in determining differences in the immune landscape between HPV+ versus smoking-related cancer, specialized therapies that target tRNA transcription and expression may be more effective in treating etiology-based subsets of HNSCC. In this project, tRNA expression, gene expression, clinical variables (including overall survival and tumor stage), and cancer pathway data for head and neck squamous cell carcinoma were integrated, in order to determine how tRNA dysregulation can alter gene expression, induce methylation at tumor suppressor and cell cycle-related genes, and determine differences in head and neck cancer patients' response to treatment and overall clinical outcome.

Zainab Goawala

biochemistry, University of San Diego

McNair Scholars Program

Mentored by Dr. Lauren Benz, Chemistry and Biochemistry

Defect Engineering of MOFs to Enhance Molecular Adsorption

Metal Organic Frameworks (MOFs) are a unique class of materials composed of metal clusters linked with organic ligands to give porous nanoparticles. MOFs are of interest due to their unique structure which gives rise to high porosity leading to large surface area for gas storage, and the ability to alter pore size. Other applications include separations, catalysis, sensors, and drug delivery.

The main goal of this research is to develop a course-based undergraduate research experience (CURE) for a general chemistry lab at the University of San Diego which explores the use of MOFs as sorbent material. Since the CURE will require students to study MOF adsorption by selecting a molecule of interest, we are currently utilizing UV/Vis spectroscopy to detect and quantify the adsorption of representative compounds such as methyl blue and red dye-40. In addition, we are adapting the synthesis of a particular MOF, MIL-88, to the general chemistry lab in order to incorporate experience with MOF synthesis. The motivation for this research stems from the need to introduce students to complex, open-ended modern problems early on.

Preliminary results have shown that ZIF-8 readily adsorbs both dyes, with differing adsorption amounts at equilibrium, likely due to differences in molecular charge and/or size. Methyl blue being larger (799.80 g/mol) and negative and red dye 40 (496.42

g/mol) being positive. Second order kinetics were identified in both cases. Students, through this research, will link the real-world adsorptive properties of MOFs to molecular properties.

Jay Golden

Bioengineering: Bioinformatics, UC San Diego

Undergraduate Research Scholarships

Mentored by Dr. Melissa Gymrek, Genetics/Computer Science Engineering

Exploring the Structure of Transmembrane Protein Helical Bundles using Computational and Laboratory Methods

Transmembrane protein structures are stable in the greasy environment of lipid bilayers, which creates additional constraints on what methods and processes can be used to determine their structure. Even the best machine learning and physics-based methods fail to predict transmembrane domain structures of proteins at consistent and usable accuracy. We investigated the 3D structure of the transmembrane domain for the YME1 protein, which is known to have a hexameric helical bundle in the transmembrane domain, and generalized the approach for other transmembrane domains from linear sequence. We first collected and filtered a set of homologous protein sequences which were analyzed to select covarying positions which indicated spatial interactions and helical faces with low sequence conservation which indicated a lipid facing surface. We then sampled a large set of generated structures with variations in interactions between helix angles and distances, restricted by physical properties, and selected for structures with high correlation to our position constraints that were informed by evolutionary data to select higher likelihood structures. Selected models are further examined using cutting edge computational molecular modeling methods including Rosetta's Monte Carlo implicit membrane model and GROMAC's all-atom dynamics simulations. I am also using biophysical methods to experimentally characterize synthetically designed membrane proteins which form analogous TM bundles within lipid through cloning, expressing, and preparing the designed membrane protein samples for X-ray crystallography. My research focuses on unifying many data-driven approaches with the chemical rules for how protein segments fold and assemble into stable structures in lipid environments.

Gabrielle Gomez

Behavioral Neuroscience, University of San Diego
McNair Scholars Program
Mentored by Michael Eptein, Copley Library

Cognitive and Neurophysiological Impacts of Autoimmune Diseases of the Thyroid

This review looks at studies conducted in the past two decades focusing on treatment, cognitive symptomatology, and neurophysiology in patients with autoimmune diseases of the thyroid gland independent of thyroid hormone dysfunction. Autoimmune diseases of the thyroid, including Hashimoto's Thyroiditis (HT) and Graves' Disease (GD), are established as the leading causes of thyroid hormone dysfunction. Treatment of these diseases typically commences when patients reach hypothyroid or hyperthyroid hormone levels. Many patients, however, still exhibit cognitive symptoms such as inattention and memory loss despite euthyroid hormone levels. These cases are more difficult to treat due to poor understanding of pathology and diagnostic criteria, and are often misdiagnosed due to similar symptom profiles with psychological disorders. Cases of encephalopathy in patients with elevated titres of anti-thyroperoxidase antibodies in their cerebrospinal fluid, first noted in the literature as Hashimoto's Encephalopathy (HE), later renamed Steroid Responsive Encephalopathy associated with Autoimmune thyroiditis (SREAT), have gained attention in the literature in the past decade as more studies investigate the pathology of these cases. Thyroid autoantibodies are at the forefront of this research, speculated as a source of pathology in SREAT or a potential marker of another autoimmune disease altogether. Thyroid antibodies are also implicated in research on cognitive impairment without subsequent encephalopathy. More research is needed for a better understanding of autoimmune mechanisms in thyroid autoimmune disease and how they impact the brain in euthyroid patients in order to better diagnose and treat these individuals.

Daisy Gomez-Fuentes

Sociology, San Diego State University
STARS
Mentored by Dr. Frances Contreras, Education

The Longitudinal Impact of PUENTE on Students

For more than 30 years, the PUENTE Project has improved the transfer and retention rates of tens of thousands of underrepresented students in California. PUENTE's mission is to increase the number of disadvantaged students who earn a college degree and return to their communities to serve as mentors and leaders for future generations. PUENTE interdisciplinary approach is through writing, counseling, and mentoring. The

program continues to expand in California; now, there are four middle schools, 38 high schools, and 65 community colleges. The purpose of this study is to investigate the longitudinal impact of PUENTE on college students who were a part of the program during middle school. Through surveys, interviews, platicas, and secondary data, we intend to gain a holistic understanding of the college decision process. The future results of this study will provide essential implications in understanding the impact of PUENTE It is vital to understand the longitudinal impact of PUENTE as it is an opportunity for educational success for underrepresented students in California.

Jordan Gomezpadilla

Cognitive and Behavioral Neuroscience, UC San Diego
Creating Scientists To Address Cancer Disparities Program
Mentored by Dr. Georgia Sadler, Surgery

Factors Associated With The Higher Incidence Rate And Lower Survival Rate Of Non-hispanic White Males Diagnosed With Glioblastomas

Non-hispanic white males have the highest incidence rate and the lowest survival rate when diagnosed with glioblastomas. Although this population tends to have better and easier access to medical care, their survival rate is the lowest compared to other ethnic groups. A literature review was conducted using PubMed, Academic Research Complete, CINAHL, ERIC, and Google Scholar to find articles with keywords such as white/male, genetic variations, brain tumor survival, disparities/brain cancer, and ethnic/cultural survival rates. The results will summarize the findings and report the most significant factors that contribute to this disparity. Possible future research that will be discussed is the individualization of treatment to patients and further research on the genetic variations of long-term glioblastoma survivors in order to improve prevention and treatment outcomes.

Geenee Gonzales

Kinesiology, San Diego State University
Creating Scientists To Address Cancer Disparities Program
Mentored by Dr. Vanessa Malcarne, Psychology

The Impact of Obesity on Breast Cancer Risk and Survival Among Asian American Women

Most research examining the effects of obesity on breast cancer has been focused on non-Hispanic white women in the United States and Europe. However, links between obesity and breast cancer may vary across racial and ethnic groups. Some evidence suggests that obesity among women of Asian descent in the United States may be more

strongly associated with increased breast cancer risk and lower survival rates than in other groups. However, the literature is mixed. A narrative literature review was conducted to investigate this disparity. Research articles were identified using databases including PubMed, CINAHL, and Google Scholar, and keywords breast cancer, obesity, Asian American, race/ethnicity, cancer risk, and cancer survival. The existing literature addressing this topic will be summarized along with suggestions for future research.

Eduardo Gonzalez

Public Health, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities Program
Mentored by Dr. Georgia Robins Sadler, Surgery

Geographical provinces and cancer mortality in Ecuador

Although gastric cancer has decreased globally, it is the leading cause of death in Ecuador. In addition, lymphatic-hematopoietic tissue cancers were among the top 15 causes of death in 2019 in Ecuador. Age, gender, and geospatial patterns of provinces may play a role in cancer mortality among Ecuadorians. The statistical registry of general deaths by the National Institute of Statistics and Censuses (INEC) is an open-access database for Ecuador, written in Spanish. Using the INEC database, death rates and demographic data of gastric and lymphatic-hematopoietic tissue cancers were collected. The data were manually extracted and organized by provinces, age, time, and gender in Excel. The mortality rates were standardized by 100,000. In 2019, deaths of gastric cancer were 2.3% (n=1705) and lymphatic-hematopoietic tissue cancers were 2.0% (n=1446). In 2018, deaths of gastric cancer were 2.4% (n=1704) and lymphatic-hematopoietic tissue cancers were 1.9% (n=1339). In 2018, males (≥ 75 years of age) had the highest cancer deaths of gastric (n=395) and lymphatic-hematopoietic related tissues (n=177) combined. Provinces with the highest mortality rates from gastric cancer in 2019 were Azuay (15.22), Loja (14.14), Carchi (14.01), and Cotopaxi (13.88). Provinces with the highest mortality from lymphatic-hematopoietic tissue cancers in 2019 were Imbabura (12.76), Bolívar (11.04), Pichincha (10.88), and Loja (10.85). Further research in Ecuador is needed to identify the cause of geospatial patterns associated with specific cancers. Socio-economic conditions and access to medical care may play a role in cancer mortality based on provinces.

Irene Gonzalez

Critical Race and Ethnic Studies, UC Merced

UROC-H

Mentored by Professor Robin DeLugan, Anthropology and Heritage Studies

Re-designing Cultural Institutions through Indigenous Voices

A research study that examines the representation of local California Yokuts tribes in Merced County museums/ history centers and UC Merced library. The Yokuts are the original native peoples of the Central Valley composed of different tribes, and where UC Merced resides. This study is designed to analyze public museums/history centers in Merced County arguing that incorporating indigenous voices and perspectives will result in more accurate and culturally relevant depictions about California tribes. Combining site visits with interviews of key personnel such as directors, and interviewing individuals that identify as members of the Yokuts, the study explores how we are learning about our local California tribes, specifically in what ways are they being represented visually, materially, and in written language. Specific recommendations will be offered to re-design or enhance the way information is presented by including indigenous perspectives. By extension, the recommendations will be applicable to other public institutions for improving the future representation of California Indians.

Ximena Gonzalez

General Biology, UC San Diego

Triton Research & Experiential Learning Scholars (TRELS)

Mentored by Dr. Trey Ideker, Departments of Medicine, Bioengineering, and Computer Science

Role of CDK1 gene in cancer progression

One in two people will develop cancer in their lifetime. Current treatments for malignant cancer are limited and often induce severe side effects. Developing novel treatments requires us to better understand the mechanisms behind uncontrolled proliferation of malignant cancer cells. Cyclin-dependent kinases (CDKs), including CDK1, are proteins that control cell proliferation by regulating cell cycle progression. To understand the role of CDK proteins, researchers “knockout,” or delete, genes encoding CDKs and observe the phenotypes caused by the loss of that gene. These experiments suggest that CDK1 serves important roles in cell division, cell cycle regulation, suppression of DNA re-replication, and regulation of other CDKs. However, it remains unclear how CDK1 regulates cell cycle progression and programmed cell death (apoptosis). To further understand the role of CDK1, I will knock-out the gene using CRISPR-Cas9, a genome editing system that can target specific locations in the DNA, and

introduce a loss-of-function mutation in breast cancer cell lines. Using fluorescent reporters (i.e. FUCCI and Hoechst) that can indicate the cell cycle stage of cells, I will assess the difference in cell cycle progression between wildtype and CDK1 knockout cells. Finally, I will determine whether CDK1 knockout leads to apoptosis by using annexin V staining, a method to detect apoptotic cells. The project aims to find differences between the cells with and without CDK1 to better understand the role of CDK1 in cancer progression.

Ashley Gonzalez

Environmental Studies, University of San Diego
McNair Scholars Program
Mentored by Dr. Alberto Pulido, Department of Ethnic Studies

Community Resilience Yes, Junkyard No!

Analytical studies on environmental racism have focused on the interconnections between policymakers and environmental hazards in low-income communities to determine the degree of racial inequality. Yet, the majority of these studies ignore the arrival and permanence of toxic spaces such as junkyards and polluting industries impacting poor bayfront neighborhoods such as Logan Heights. We purport to examine this topic on two fronts

First, I plan to investigate the historical connection between the battle over greenspace between the Chicano Park takeover and the junkyard. Junkyards in Barrio Logan play a crucial role in how environmental racism came to be in this community. My second goal is to demonstrate how the resilience and need of a community through political mobilization will result in re-building the neighborhoods that were destroyed and disregarded by policymakers. We will adopt a Participatory Action Research approach (PAR), in order to discover how and why issues of environmental justice have been at the center of community mobilization in Logan Heights for over 50 years.

Hanna Gootin

Human Biology, UC San Diego
UC Scholars
Mentored by Amir Zarrinpar, Gastroenterology

The Role of Microbial Bile Acid Biotransformations in Obstructive Sleep Apnea-Associated Atherosclerosis

Obstructive sleep apnea (OSA) is a sleeping disorder characterized by the repeated cessation of breath, causing intermittent hypoxia and hypercapnia (IHC). Patients with

OSA have a high risk for cardiovascular diseases (CVD). However, the underlying mechanisms for this increased risk are largely unknown. The gut microbiome is associated with major risk factors for CVD such as insulin resistance, dyslipidemia and atherosclerosis. The gut microbiome plays an important role in lipid metabolism through bile acid (BA) signaling. It produces bile salt hydrolase (BSH), which deconjugates liver-produced primary BAs, thereby allowing the formation of secondary BAs by the gut microbiota. Mammals cannot deconjugate primary BA and rely on microbial BSH in the gut lumen. Whether increased BSH activity affects dyslipidemia, as observed in atherosclerosis with OSA, is still unknown. The objective of this study is to assess whether altering gut microbiome function, (e.g. BSH), could impact atherosclerosis under OSA conditions. We hypothesize that OSA results in altered gut microbiome dynamics and BA signaling which affects host atherosclerosis. To test this hypothesis, we will use host native bacteria, engineered to express BSH, to manipulate the gut microbiome and assess whether increased BA deconjugation can affect atherosclerosis in a mouse model of OSA. Using a targeted metabolomics approach, we will assess the levels of fecal BA to determine how OSA may affect BA metabolism and whether BSH overexpression can alter OSA-associated changes to fecal BA.

Melissa Guereca

Biology with a Specialization in Bioinformatics, UC San Diego

STARS

Mentored by Dr. Katherine Petrie, Biological Sciences

Evolutionary Pathways of Biofilm Populations

Pseudomonas fluorescens SBW25 is a bacteria that proliferates on plants and is known to evolve new phenotypes rapidly. This bacteria has been established as a model of biofilm evolution, offering critical information to understand the development of pathogenic bacteria. With this, our study aims to determine if any novel mutations contribute to biofilm evolution aside from those previously recorded (Koza, 2017). In this study, we will analyze hundreds of SBW25 samples grown by students in the UCSD Microbiology Lab course. These samples grew in microcosms under optimal conditions to form biofilms. Our newly developed bioinformatics analysis pipeline involves the use of fastqc, fastx_toolkit, breseq, and additional software tools to further optimize the analysis that will compare derived data with its ancestral genome. This analysis will serve to uncover possibly unidentified mutations. Since students have manipulated the environment to challenge *Pseudomonas fluorescens* SBW25 to grow biofilms in distinct ways, we hypothesize that new mutational pathways will be observed. The results of this study will impact future research carried out in the UCSD Microbiology Lab course, providing students an advanced bioinformatics pipeline to use in their studies. The results will also give insight into the evolutionary mechanisms of biofilms, which will advance our knowledge surrounding the progression of bacterial infections and

diseases. Ultimately, our findings will be important for efforts intended to create improved treatments for bacterial illnesses.

David Guirgus

Psychology, CSULB

STARS

Mentored by Dr. Judith Fan, Cognitive Science

How does exposure to computer science before college increase motivation to pursue a further study in computer science and related fields?

Past research has shown that access to opportunities to learn about computer science (CS) before college is a strong predictor of participation in CS during college and in STEM related fields. Access to such opportunities is scarce, which may lead many students without access to such opportunities to be less inclined to pursue further education in Science, Technology, Engineering, and/or Math (STEM) fields. The current study aims to assess the impact of participation in a summer artificial intelligence (AI) camp for San Diego-area high school students on these students' attitudes, motivations, and sense of belonging as a scientist. Participants will complete a pre and post survey designed to measure the following constructs: attitudes toward STEM education among family members and peers, motivation to pursue further study in science, beliefs about one's own aptitude for science, beliefs about the degree to which intellectual ability is fixed or malleable, and beliefs about the factors predicting success in science. We will evaluate the degree to which participation in the camp affects participants' motivation, attitude, and sense of belonging in pursuing STEM in college and as a career. Future studies will examine the long-term impact of such interventions 1-3 years following the conclusion of the camp, as well as other factors such as culture, socioeconomic status, and environment.

Varvara Gulina

Psychology, California State University Fullerton

STARS

Mentored by Dr. Lianne Urada, Social Work

Abuse and sexual exploitation of Russia's unrecognized victims: Analysis of women's appraisal of victimization using frameworks of cognitive dissonance and Sexual Scripts.

Globally, over a third of women have experienced either physical or sexual violence in their lifetime. Additionally, up to a third of all adolescent girls report their sexual experiences as being forced (CDC 2020). In Russia, the numbers of female human trafficking, sexual victimization and physical abuse is one of the world's highest (USDS,

2019). The attitudes towards force and physical abuse in general is more lenient in Russia and the discourse surrounding the urgency surrounding victim rights garners little attention in the U.S. Applying Cognitive Dissonance theory (Festinger, 1957) and Cultural Sex Script Theory (Gagnon, Simon, 1973), this study explores whether more females trading sex in Saint Petersburg and Orenburg, Russia, appraise their experiences of entering the sex trade as voluntary. Bivariate analysis and multiple logistic regression assessed whether women who reported voluntarily entering into the sex trade were more likely to experience abuse as children; were more likely to perceive men using them as decent/caring (AOR= 2.54); and were less likely to consider leaving the profession. Client specific factors that contribute to this construal were also analyzed, including subjection to beatings (66%), rape (66%), and humiliation (86%). Implications of this study reveal the importance of intervention strategies that account for a woman's unawareness of her own victimization and the subconscious psychological barriers that prevent her from seeking help. Necessity of recognition of Russian sex workers as victims of abuse, exploitation, and force is also emphasized.

Zijia Guo

EE and Applied Math, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by PROFESSOR Sujit Dey, ECE

Deep Learning Enabled Millimeter Wave Beam Management for Outdoor Networks

Driven by new applications such as edge-rendered AR/VR, Autonomous Driving, and the growth of Machine-to-Machine communications, the required capabilities of wireless communication have grown exponentially. Millimeter Wave (mmWave) communications is a promising solution for this problem due to its large bandwidth enabling high throughput. When implementing mmWave networks, one of the biggest challenges is beam management because the high frequency incurs higher path loss and vulnerability to blockages that must be mitigated with careful beam management. Learning solutions have been shown to account for site specific geometry in order to create zero overhead beam management policies -- the key focus of this project is evaluating how generalizable these learning approaches are. The majority of learning solutions can only be evaluated in restricted scenarios. However, this isn't indicative of the wide range of heterogeneity seen by cellular networks today. This project extended the prior simulation studies by adding additional radio configurations, such as mobile handsets, enabling the evaluation of learning approaches in rich (and more realistic) environments. In order to undertake a larger scale simulation study, it was necessary to improve simulation speed and therefore an approach was created that simplifies the world model by as much as 94% without impacting the fidelity of the simulated environment.

Ulises Gutierrez Nunez and Shatchel Jetly

Nanoengineering, Instituto Tecnológico y de Estudios Superiores de Occidente
MRSEC REU or RIMSE

Mentored by Distinguished Professor Michael J. Sailor, Department of Chemistry &
Biochemistry

Study of Silicon:Calcium Fluoride core:shell Nanoparticles as a Potential Imaging Agent for Positron Emission Tomography

Porous silicon nanoparticles are of interest as medical imaging agents due to their biocompatibility and low toxicity. This work aims to develop a class of imaging agents for Positron Emission Tomography (PET). One of the more common radioisotopes used in PET imaging is fluorine-18. The isotope is typically administered via the radiopharmaceutical fludeoxyglucose F18 (FDG). The body treats the FDG molecule similar to glucose, and so the radiopharmaceutical highlights regions of the body where abnormal glucose metabolism occurs. The aim of this work is to provide a fluorine-18 vehicle that can target and image other types of diseased tissues specifically, gastrointestinal stromal tumors (GIST). While FDG-PET has been used to image and stage GIST in patients, the low levels of penetration of FDG in GIST limits its application.

The approach takes advantage of the low solubility of calcium fluoride, and involves preparation of nanoparticles consisting of a mesoporous silicon or silica core and a calcium fluoride shell. The objective of the project is to develop and characterize the aqueous chemistry of calcium, silicon, and fluoride to generate nanoparticles in a rapid and simple process that maximizes the loading of fluorine-18. Chemical reactions of calcium silicate, silicon, silica, and fluoride will be performed on a porous silicon wafer model system using optical reflectance and Raman spectroscopy. Amount of dissolved sample, porosity, and structural stability of the products will be characterized. These measurements will provide information to guide development of porous silicon nanoparticles as optimal PET imaging agents for gastrointestinal stromal tumors.

Fartoon Hagi-Mohamed

Literature/Writing, UC San Diego

McNair Scholars Program

Mentored by Dr. Stephanie Jed, Literature

Memoir Writing and Intergenerational Trauma: the Reparative Power of the Personal Narrative

My research examines the creative memoir as a form of expressive writing which can be used to alleviate the effects of intergenerational trauma, namely sociocultural

dislocation and experiences of a lack of agency. There is a well-documented body of research which speaks to the therapeutic benefits of expressive writing, including boosting one's psychological wellbeing and improving aspects of social relationships. However, quantitative research is unable to show how the practice of expressive writing works, in particular cases, to alleviate trauma. To provide a possible answer to this question from a humanistic perspective, I conduct a qualitative reading of six memoirs with particular attention to usage of the concrete strategies of conveyance, distribution, and reconstruction within and their potential to help memoirists' to clarify and potentially overcome the effects of intergenerational trauma. I analyze the ways in which these memoir writers use the medium to connect to their unique narratives and cultural histories and to foster a community centered around healing and repair. I identify passages that show memoir writers deliberately moving from attention to their life stories to the reconstruction of important memories, a need to share their stories in community, a sense of sociocultural location, a restored sense of agency, and a feeling of coherence in their narratives.

Ryan Hajj

Cognitive Behavioral Neuroscience, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by DR. Robert Rissman, Neuroscience

COVID-19 Survivors and Long Term Cognitive Issues

In recent months, a global re-emergence of Severe Acute Respiratory Syndrome Coronavirus 2, SARS-CoV-2, and its new highly infectious variants are being observed in countries abroad. This variant could make its way back into the U.S. and pose a health risk to all, especially for those who are not vaccinated. Even asymptomatic COVID-19 patients are experiencing various cognitive issues at an alarming rate. Some common long term cognitive symptoms include brain fog, dizziness, loss of smell and taste, and memory loss. The combination of high transmissibility of the alpha variant of SARS-COV-2 virus and the uncertainty of long term cognitive symptoms of COVID-19 could result in a major public health crisis in near future. An analysis of community acquired respiratory viruses, such as MERS and SARS is done to determine the cognitive effects on patients with past outbreaks, allowing for a better understanding of cognitive symptoms of current SARS-COV-2. In addition, close examination of the CNS involvement with cognitive symptoms is conducted to understand how and why the virus affects a portion of the brain. This gives an advantage in allowing an early detection of patients symptoms and early treatment options to speed the cognitive recovery process.

Anna Hakimi

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

Effect of Running-induced Neurotransmitter Switching in Adult Mouse Hilus on Episodic Memory

Synaptic plasticity in the brain modulates cognitive function and animal behavior. Neurotransmitter switching, a novel form of synaptic plasticity, has been of particular interest as it permits a change in the sign of the synapse, from excitatory to inhibitory or vice versa. Following sustained exposure to a stimulus, neurons in the brain can switch the neurotransmitter they express, inducing behavioral changes in the animal. Exposure of mice to running for one week induces a decrease in the number of neuropeptide Y (NPY)-expressing neurons and corresponding increase in the number of neurons expressing vesicular glutamate transporter 1 (VGLUT1, a marker of glutamatergic neurons) in the hilar region of the hippocampal dentate gyrus. However, the behavioral changes associated with the NPY-to-glutamate switch remain unclear. The objective of this project is to investigate the correlation between the running-induced transmitter switch in the hilus and performance in behavioral tasks involving episodic memory in mice. Following one week of running, episodic memory performance was evaluated with the Novel Object Recognition (NORT) and Contextual Fear Conditioning (CFC) behavioral tests. To determine whether the NPY-to-glutamate transmitter switch occurs within a single neuron, NPY hilar neurons were labeled with a GFP virus prior to exposing the mouse to running, and the number of NPY hilar cells expressing NPY or VGLUT1 was quantified via histochemistry and confocal microscopy. Preliminary results suggest that switching occurs in single neurons and that the switch is correlated with enhanced cognitive performance.

Samantha Hanauer

Marine Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Bradley S. Moore, Scripps Institute of Oceanography

The Marine Sponge Microbiome

The marine environments surrounding San Diego are habitats for a diverse range of marine sponges. These marine sponges are structurally unique and are interesting sources of biologically active natural products. These natural products are of particular interest; they present clinically-significant antibacterial properties, including activity against the often antibiotic-resistant bacteria *Staphylococcus aureus*, a common cause

of hospital infections. This research will mainly focus on *Cliona celata* or the boring sponge, named after its unique predation of boring holes into mollusk shells. Using samples of *C. celata*, this project will seek to purify and further understand the currently unknown halogenated metabolites and their antibacterial properties. This will also include the use of human pathogenic bacteria from laboratory models in search for the target that these metabolites have been selected for. While chemical analysis and understanding of the natural products from *C. celata* are important, it is equally as essential to understand how these compounds affect the wider environment they are in. This process includes studying the correlation between bacterial diversity in *C. celata* and the presence and prevalence of the aforementioned compounds; to do this, 16S sequencing will be used across multiple samples. Overall, this research will investigate the natural products/metabolites associated with *C. celata* and its bacteria, and the ultimate role that they partake in the natural marine environment.

Matyas Hanna

Microbiology, San Diego State University
UCSD-SDSU Partnership Scholars Program
Mentored by Dr. Alfredo Molinolo, Biorepository(3rd floor), Moores Cancer Center

*Patient participation in a research study at UC San Diego, Moores Cancer Center
Biorepository after Covid-19 vaccination*

UC San Diego Moores Cancer Center Biorepository (BR) is a College of American Pathologists (CAP)-Accredited core that consents patients for tissue collection, storage, and distribution. In 2018 the BR launched the Minority Outreach Repository Effort (MORE) to increase minority participation, and to evaluate disease distribution and minority perception of research. Anjakos et. al, 2021 analyzed the impact of Covid-19 pandemic in patient consent and found a decrease in participation. Upon return to normal patient visitation and full BR staff coverage due to availability of the Covid-19 vaccination, we hypothesize that minority participation will also return to normal. We will analyze the minority enrollment in relation to vaccination and visitation compared with non-minority populations.

The BR identifies and pre-screens (HIPAA waiver) potential patients from oncology clinics with the help of treatment teams. Eligible patients are interviewed by coordinators to obtain Informed Consent (IC) using an IRB-approved protocol. Patient race, ethnicity, and vaccination status were obtained from the UCSD Epic electronic medical record and appointments data from the Cancer Registry Data.

MORE increased minority participation for “all sampled races by 20 to 30%” from July 2019 to March 2020, before the Covid-19 pandemic began. The effect of Covid (March to December 2020) decreased participation by 30%, averaging 31 patients per month rather than about 107 per month (Anjakos et. al, 2021). The rate of participation by race

stayed consistent pre and during Covid-19. Since December 2020, more than 400 consents have been obtained under the MORE program.

Bailly Happi

Chemical Engineering, UC San Diego

MRSEC REU or RIMSE

Mentored by Dr. Michael Sailor, Department of Nanoengineering

Porphyrin-based porous Si nanoparticles for photocatalytic detoxification of nerve agents.

Authors: Dr. Michael Sailor, Reagan Beers, Bailly Happi

Porphyrin-based molecules are among the most studied photocatalysts/photosensitizers as Reactive Oxygen Species (ROS) generators for degradation of chemical and biological CB agents. Our research laboratory has previously demonstrated that the photo-response of photosensitizers can be greatly enhanced by encapsulating the photosensitizer within a rigid porous host. This current study aims to extend this approach to porphyrin molecules, using porous Si particles as our starting material and quantifying ROS generation. Of interest in this study is singlet oxygen, one of the most reactive ROS. Singlet oxygen is an electronically excited state of molecular oxygen. Quantification of singlet oxygen will be achieved through UV visible light spectroscopy measurement. The approach used to load the candidate porphyrins into the Si nanoparticles will first be evaluated using, indocyanine green (ICG) as a test molecule. Once the loading strategy has been established, the process will be repeated with porphyrin. Loading of the molecules into the porous Si hosts will be monitored via Fourier-transform infrared (FTIR) spectroscopy, which identifies functional groups. The size and surface charge of the nanoparticles will be characterized using dynamic light scattering (DLS) experiments. Ultimately, our goal is to develop a system with a potential application in detoxification of toxic environmental chemicals.

Jillian Harris

Biology, Xavier University of Louisiana

STARS

Mentored by Dr. Claire Meaders, Biological Sciences

"What do scientists look like?" The impacts of a STEM intervention on student perceptions of scientists

It has been observed that girls in middle school begin to lose interest in STEM (NCES, 2006) and that middle school students have little knowledge about the vast range of STEM careers (Blotnick et al., 2018). The In their eyes team developed a comic-based

lesson plan in spring of 2021 with the goals of increasing student knowledge and attitudes towards environmental conservation as well as their science identity. Local sites were used for science learning that introduced students, through trading cards, to diverse role models to show students the various STEM career paths available to them. To evaluate potential changes, before and after the lesson plans, they asked students to draw a scientist working and many follow up questions to help students analyze their drawings. This summer, the Meaders research lab analyzed the student drawings as well as pre- and post- student surveys. We analyzed surveys from approximately 30 students that included a mix of quantitative and qualitative questions. Additionally, we looked at whether the implementation of various scientific role models affected student's perceptions of who scientists are. Three researchers used inductive coding to develop a codebook that was used to study various aspects of student drawings of scientists. In our poster, we will present preliminary results of the survey and drawing analyses.

Joshua Hartman

Human Biology, UC San Diego
Creating Scientists to Address Cancer Disparities Program
Mentored by Dr. Leslie Crews, Medicine

Factors associated with an increased risk of multiple myeloma in the African American community

Multiple myeloma is the second most common lymphohematopoietic cancer in the US; however, it is the most prevalent cancer of this kind in the African American community. The multiple myeloma incidence and mortality rates for African Americans are more than double those of any other ethnic group. This disparity has remained constant, even with the development of novel and improved treatments and therapies. Although some factors which explain this disparity have been identified, no exact causes have been proven to fully account for it. A narrative literature review was conducted using articles identified via PubMed, Google Scholar, Embase, and Web-of-Science databases. The articles were organized into categories (Obesity, Immunological Challenges, Family History, Genetic Variations, Access to Healthcare, Disparities in Treatment, and Socioeconomic Status) based on their focuses and then summarized and integrated. The presentation will describe how each of these factors plays a role in the increased risk of multiple myeloma in African Americans and will highlight future directions for research and community education.

Desiree Harvell

Applied Physics, Cal State University San Bernardino
STARS
Mentored by Saavidra Perera, Astronomy

An Analysis on the Efficiency of a Shack Hartmann Wave Front Sensor

The Gemini Planet Imager (GPI) is a complex instrument with the purpose of directly imaging and surveying exoplanets from the ground. Until recently GPI was mounted on the Gemini South Telescope in Chile, and is currently under the process of being relocated to the Gemini North Telescope located in Hawaii. Along with a change of location, the instrument will undergo a number of upgrades, including the integration of a newly built pyramid wave front sensor (PWFS) for the adaptive optics system. The Earth's atmosphere is a limiting factor for large ground based optical and infrared telescopes. The atmospheric turbulence results in blurred and speckled scientific images. The importance of the PWFS is to measure the atmospheric turbulence, while the adaptive optics system corrects these influences on the images. The PWFS is being built and tested at the University of California San Diego. Precision of its alignment is vital, and one way to help facilitate and test the alignment is to use a Shack-Hartmann wave front sensor (SHWFS). The SHWFS is essentially a CCD with a lenslet array that will be able to identify and measure optical aberrations in the PWFS, so that they can be corrected. Our goal is to build and test the efficiency of the SHWFS, in which entails characterizing the CCD, aligning an optical system and ensuring aberrations are at a minimum, and developing scripts to verify performance.

Michelle He

Molecular and Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Pamela Mellon, Obstetrics, Gynecology, and Reproductive Science

Regulation of female fertility by neuromedin-S neurons of the suprachiasmatic nucleus

The suprachiasmatic nucleus (SCN) within the hypothalamus is responsible for generating bodily timekeeping mechanisms and contains neuronal subpopulations that orchestrate and biochemically synchronize many physiological functions to circadian rhythms. Specifically, AVP and VIP neurons within the SCN are known to project onto the reproductive axis in two discrete locations: kisspeptin neurons and gonadotropin-releasing hormone (GnRH) neurons, respectively. Studies have shown that both these projections are necessary in the accurate timing of ovulation. However, their downstream effects on fertility have never been studied in vivo. Most AVP and VIP neurons also express neuromedin-S (NMS), a neuropeptide restrictively produced in the

SCN that plays an essential role in generating daily behavioral rhythms. Previous studies show that of mice lacking functional NMS neurons exhibit incoherent daily molecular oscillations and disrupted SCN timing mechanisms.

This project will investigate the regulatory effects of NMS-expressing AVP and VIP neurons on the timing of the luteinizing hormone (LH) surge and subsequent fertility. Female NMS-Cre mice will be stereotaxically injected in the SCN with a Cre-dependent virus expressing TeTx, the light chain of the tetanus toxin, that specifically targets NMS neurons. NMS neurons that take up TeTx will be silenced and unable to project to the reproductive axis. Mice will be measured for fertility and circadian rhythms before and after injection via vaginal cytology and intraperitoneally-implanted telemeters, respectively, to determine the effect of NMS neuronal silencing on reproductive capacity. This project will help further our knowledge of the neuroendocrine basis of ovulation and circadian rhythm-associated infertility.

Sydney Hemenway

Materials Science & Engineering, University of California, Berkeley
Power Optimization of Electrothermal Systems (POETS) REU
Mentored by Professor Paul Braun, Materials Science & Engineering

Characterization of Coated and Textured LiCoO₂ Cathodes under Extreme Conditions

Interfaces underpin our quest to expand the amount of energy stored in lithium ion batteries (LIBs) because surface chemistry has profound effects on the electrochemical performance of cathode materials. Under extreme cycling conditions, lithium cobalt oxide (LiCoO₂, LCO) cathodes lose stability due to surface changes: spinel formation and cobalt dissolution. We seek to understand if a physical barrier between the cathode and electrolyte is the main requirement for stable cycling at high temperature and high voltage. We analyze alumina (Al₂O₃) coated and crystallographically oriented LCO under extreme conditions (60°C, 4.5V) to demonstrate the effectiveness of electrolyte-facing oxygen groups in stabilizing the cathode electrolyte interface. We also relay the relative performance of (003)- and (110)-oriented thin film LCO in order to isolate the effects of bulk anisotropy. We provide more awareness into optimal component fabrication and future studies directed at surface modification and bulk-textured cathodes.

Malia Henry

International Studies - Economics, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. K. Wayne Yang, Ethnic Studies

Promoting Cultural Awareness on Campus

The primary goal of this research project is to analyze potential solutions to promote diversity on campus. To test the hypothesis that reallocation of student fees promotes diversity if directed to culturally competent, university-sanctioned programs, I compared diversity initiatives across universities. Studies have proven that the primary agent for promoting equity in higher education is structural change. By infusing diversity into the curriculum, diversity initiatives decrease minority alienation, promote student involvement and minority enrollment.

I propose implementation of a virtual orientation of minority alum. This structural adjustment acts as a feasible means to increase cultural consciousness by highlighting minority achievements. Currently, there are no school-wide virtual orientations that spotlight diverse communities on campus. As a result, many students and faculty are unaware of the history of UCSD's minority population, or the various identities and backgrounds their counterparts hold.

Taking place during fall quarter, newly enrolled undergraduates, transfer, and graduate students, along with staff, faculty and administration, would be asked to complete a structured program of introduction to the history of UC-San Diego's minority alumni. 3 alumni, would be featured, including a short bio, campus accomplishments, student/community advocacy projects, and supporting campus resources.

Helen Hernandez

Biochemistry, UC San Diego
Creating Scientists To Address Cancer Disparities Program
Mentored by Dr. Sadler, Surgery

Identifying the protective factors for pediatric brain cancer within minority versus white non-Hispanic infants and children.

White children are diagnosed with malignant brain tumors at a higher rate compared to other ethnic/racial groups. Various studies have demonstrated that these rates are associated with children's birth weight and dietary intake. These studies utilized odds ratios, which suggested increased risks of malignant brain tumors for infants below and above-average birth weight, and infants with weak immune systems. This study

explored the potential protective factors against malignant brain tumor susceptibility in both minority and white non-Hispanic infants and children. This narrative literature review identified articles using: PubMed, NCBI, CINAHL, and Google Scholar databases. Among the keywords used in this literature were: Epidemiology, Infant, Neoplasm, Prognosis, Risk Factors, and Diagnostic Imaging. The search includes subjects between the ages of zero to four. All findings from the literature review and key results will be analyzed and presented with recommendations for future research and proposed solutions.

Yazmin Hernandez, Lauren Waggoner, and Jason Wu

Bioengineering / Nanoengineering, UC San Diego
MRSEC REU or RIMSE
Mentored by Dr. Michael Sailor, Nanoengineering

Synergistic effects of antibiotic payloads co-loaded in porous silicon nanoparticles against Pseudomonas aeruginosa

Overuse of antibiotics and *Pseudomonas aeruginosa*'s (*P. aeruginosa*) environmental adaptability have developed bacteria strains that are resistant to most available antibiotic treatments. Although new antibiotics have been developed to combat *P. aeruginosa* infection, antibiotic development is challenging and time consuming, and these antibiotics are often seen as “drugs of last resort” that are only used in extreme infectious cases. Therefore, there is an urgent need for novel therapeutic strategies that can increase the efficacy of currently available antibiotics against *P. aeruginosa* infections and lower the frequency of resistance development. In the presented work, we explore the efficacy of nanoparticle mediated multidrug therapy against *P. aeruginosa* by co-loading antibiotic payloads in porous silicon nanoparticle (pSiNP) therapeutic delivery platforms. Surface modification of pSiNPs with polyethylene glycol and *P. aeruginosa* targeting peptides have the potential to improve systemic delivery of therapeutics to sites of infection. We will thus compare the loading efficacy, pSiNP degradation profiles, and the drug activity upon release from co-loaded pSiNPs compared to single antibiotic loaded pSiNPs. We hypothesize that co-loading colistin and antibiotics from the family of fluoroquinolones into pSiNPs will provide a synergistic effect in antibiotic effects against *P. aeruginosa* in vitro compared to pSiNPs loaded with only one antibiotic, reducing the minimum inhibitory concentration of the antibiotics. The conclusion of this work will lead us to further explore the synergistic effects of co-loaded antibiotics in pSiNPs towards the targeted treatment of *P. aeruginosa* lung infection in vivo.

Victoria Herrera

Human Biology, UC San Diego
Creating Scientists Program
Mentored by Dr. Georgia Sadler, Surgery

How issues in dermatology education and literature may cause disparities in skin cancer patients of Hispanic and African American descent.

The incidence of malignant melanoma in Hispanic and African American communities is low, but these communities are often diagnosed at a later stage, have lower survival rates, and experience longer wait times to receive care than Caucasians. Skin cancer is commonly overlooked and underdiagnosed in darker-skinned individuals, which often leads to more advanced diseases and worse prognoses. Diagnosis of skin conditions is primarily based on images, but the medical literature is heavily skewed towards fair-skinned images. The lack of diversity of skin tone among the images used to teach about skin cancer impedes the accurate diagnosis of melanomas for patients with darker skin tones. There is strong evidence for the shortcomings in the dermatological education of medical students, primary care doctors, and dermatologists, yet little has been done to address the problem. This has negatively impacted Hispanic and African American communities. Issues with dermatological education include medical school curriculum in the U.S. and the underrepresentation of people with darker skin in dermatological research. A narrative literature review was conducted with PubMed and MedlinePlus databases using the keywords Hispanic, African American/Black, skin cancer disparities, skin cancer, and melanoma disparities. This presentation will discuss the results of this literature review and provide recommendations for viable solutions and future research.

Isabel Herrera Guevara

Psychology with Specialization in Cognitive Psychology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Lindsey Powell, Psychology

Emotional evaluation of others' goals

Humans connect with each other through social interactions. Social interactions lead to social groups and a sense of belonging. Social groups are especially important as they provide physical and emotional support. Just as you expect emotional support when completing a goal, you expect others from your group to do as well. Conversely, it is unlikely to expect emotional support from members outside your group. Our study explores this nature by asking whether 10- to 11-month-old infants have expectations about how an agent should react when an affiliate agent completes a goal-directed action vs. how an agent should react when a member a non-affiliated agent completes a

goal-directed action. We hypothesize that infants will expect observers to be happy when an affiliated agent successfully completes a goal-directed action, indicated by longer looking time at the negative emotional reaction. For infants who receive the affiliated block first, we will compare infants' mean log-transformed looking times to emotion test trials using a repeated measures ANOVA with test order (positive vs. negative first) as between-participants factor. We also hypothesize that infants will not be surprised when the observer emotes a negative emotional reaction when the unaffiliated agent completes a goal-directed action. We will analyze all infants' mean log-transformed looking times in a repeated measures ANOVA with both block type (affiliated vs. non-affiliated) and test order (positive vs. negative) as between-participants factors. These findings would provide insight into how babies come to reason about responses to the goals of affiliated and non-affiliated others.

Erica Hild

Biomedical Engineering, University of Delaware

MRSEC REU or RIMSE

Mentored by Dr. Jonathan Pokorski, Department of Nanoengineering

Structural characterization of naturally derived polymeric scaffolds encapsulated with Cyanobacteria

Erica Hild [1], Debika Datta [2], Jonathan K Pokorski [2]

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Integrating living matter in polymeric materials is an emerging area in fabricating biocomposite materials. In our present study, we aim to integrate cyanobacteria in naturally derived polymers like alginate and chitosan through gel immobilization. Cyanobacteria are ideal biohybrid materials because they are photosynthetic microorganisms that require only water and carbon dioxide for survival. Moreover, they can be genetically engineered to provide useful stimuli response. The ability of the cells to respond to specific external stimuli makes them a promising candidate to gain material control when incorporated into polymeric constructs. The cyanobacteria used in this study are unicellular *Synechococcus* sp. and filamentous nitrogen fixing *Anabaena* sp.

We investigate the effect of polymer and cross linker concentration, and cell types on the structural properties of these hybrid materials. The gelation potential of alginate was tested by chemical crosslinking with calcium chloride and for the chitosan using glycerol phosphate followed by thermal cross-linking. After the optimization of the

hydrogels, they were tested for 3D printability using bioink (cells mixed with hydrogel). The 3D printed matrix was designed using CAD design software. Biohybrid materials were characterized to determine mechanical properties, morphology, and functional group concentration.

The results of these investigations will provide significant insights in control of hybrid material properties and address the fundamental challenges faced in fabrication of stimuli-responsive biosynthetic materials.

English Hills

Sociology: Pre-Law, Spelman College

STARS

Mentored by Professor: Pablo Pardo-Guerra, Sociology

Black Mental Health and Youth Criminalization in Schools.

Although growth in the U.S. prison population over the past decades have been widely discussed, few studies examine how access to mental health services are potential determinants of incarceration and connection to early mental health interventions in the school-to-prison pipeline. The U.S. has increasingly turned to incarceration as a means of social control of marginalized youth. According to recently available national data, 43,580 young people were held in either detention centers, residential treatment facilities, or other confinement settings on a typical day in 2017 (Rovner, The Sentencing Project). This number dramatically increases in adulthood. There are 3 million people in jail and prison today, far outpacing population growth and crime. Between 1980 and 2015, the number of people incarcerated increased from roughly 500,000 to 2.2. Million (NAACP: Criminal Justice Fact Sheet)

In contradiction to popular beliefs, the increase in the incarcerated population is not due to an increase in crime, but moreover as a function of social influences, specifically the criminalization of Black youth. This study examines how access to mental health resources in K-12 institutions are a determinant to marginalized youth and their early encounters with the legal system. This research samples data from two school districts in California, using a mix of qualitative and quantitative methods to highlight disparity among the different districts of different socioeconomic compositions. By design, this system treats people unfairly. It drives and reinforces racial inequity and targets black people disproportionately.

Brandon Ho

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Imanuel Lerman, ECE

A miniaturized wireless data streaming system for in-vivo vagus sentinels to detect early infection

A promising area of clinical research has been growing in wearable diagnostics that has proven to be a powerful tool in healthy physiological as well as disease diagnostics. As the field grows and develops, a number of specializations are already emerging including diagnostics focused on: cardiac dysfunction, epilepsy, and most recently infectious disease detection. Our research centers around developing a research grade wearable diagnostic system to ultimately detect and classify infection in the pre-exposed pre-symptomatic and exposed pre-symptomatic disease stages. Our device has potential to revolutionize early infection detection (up to 24 hours prior to other technologies), radically revolutionizing current healthcare practice by providing pre-sickness diagnosis thus expediting treatment and preventing pathogen spread. This work stands to be transformative for fundamental improvement in the situational awareness of immediate signs of both natural or biological warfare infection spread, enabling circumvention of surprise and improvement in national health security preparedness. This device technology and system would serve as a first line diagnostic for the at home consumer, the patient in the hospital or clinic setting and in disaster areas surveilled by our military services in the biodefense and medical countermeasure forces.

Khang Hoang

Bioengineering: Biotechnology, UC San Diego
Genentech Scholars Program
Mentored by Dr. Lingyan Shi, Bioengineering

Stimulated Raman Spectroscopy Imaging of Lipid Metabolism Alteration in Amyotrophic Lateral Sclerosis

Amyotrophic lateral sclerosis (ALS) is a type of motor neuron disease that results in paralysis and death from a progressive loss of upper and lower motor neurons. Following the prognosis of ALS, only 5-10% of cases survive for another 15-18 years. TAR DNA-binding protein 43 (TDP-43) is a critical protein that regulates DNA structure and epigenetic control. In ALS, TDP-43 becomes misfolded and truncated, which causes the mitochondria to produce excessive levels of Reactive Oxygen Species (ROS). It is believed that the accumulation of ROS in ALS can induce apoptosis by oxidizing the Iron-

Methionine 80 (Fe-Met80) bond in Cytochrome C (Cyt C) and four acyl tails of Cardiolipin (CL) on the inner mitochondrial membrane. However, this belief has not been verified by a cohesive study due to a lack of appropriate non-invasive imaging technologies with cellular resolution. In our lab, we develop and apply a new high resolution in situ optical imaging method, isotope-probed Stimulated Raman Microscopy (ip-SRS), to visualize metabolic dynamics of CL and Cyt C at a subcellular scale for a better understanding of the impact of oxidative stress on mitochondrial redox state, CL metabolism and cell viability in ALS samples. We plan to grow mutated TDP-43-induced cells in excess Deuterium-labelled Methionine culture media. Using the ip-SRS in our lab, we expect to quantitatively visualize the subcellular resolution of altered lipid metabolic activities in mutant cells and further distinguish CL's spatial heterogeneity under oxidative stress and its relationship with cell death.

James Holcomb

Molecular and Cellular biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Samara Reck-Peterson, Cellular and Molecular Medicine

Pex14 and Pex14/17's role in peroxisome localization

Cells are constantly transporting different cargos to assist in various processes. To accomplish this, motor proteins connect to these cargos, and move them up or down specialized 'roads' known as microtubules. In the filamentous fungus *Aspergillus nidulans*, peroxisomes are transported throughout the cell via a form of transport termed 'hitchhiking'. Hitchhiking is a process where peroxisomes attach themselves to motor-bound early endosomes to be transported. How this attachment is regulated and all of the proteins involved in hitchhiking are not currently known. Previous studies in mammalian cells have shown that a protein called Pex14 can bind microtubules and mediates peroxisome motility. The *Aspergillus nidulans* genome encodes both a Pex14 homolog and a Pex14/17 fusion protein which may also be involved in peroxisome transport and localization. My project will involve testing whether Pex14 or Pex14/17 are involved in peroxisome hitchhiking. To do this, I will generate *Aspergillus nidulans* strains with fluorescently labeled peroxisomes. I will then knock out Pex14, Pex14/17, and both simultaneously and determine whether the absence of these proteins result in peroxisome accumulation or peroxisomes motility defects relative to the wildtype via confocal microscopy. My project will provide insight into the regulation of peroxisome hitchhiking.

Wai Lam Hong

General Biology, UC San Diego

STARS

Mentored by Dr. Joanne Chory, J. Paola Saldierna Guzmán, Plant Biology

Identifying Mutations of PPC₃ in Arabidopsis thaliana

The world is threatened by climate change and dwindling resources. The exponential increase of the human population poses two detrimental issues to the modern world: climate change and lack of food. By providing a solution to these recurring problems, other related issues, such as melting glaciers, broken ozone layers, and starvation can be mitigated. In addition, this renders future generations of humans more viable. Carbon dioxide is a major contributor to climate change due to its heat-trapping properties. According to the NOAA, CO₂ levels increased rapidly ever since the 1900's, reaching a high of 419 ppm in May 2021. This statistic will be amplified, as the human population is predicted to reach 9.9 billion by 2050. An increasing population will also cause a shortage of food. Crop production is limited by the amount of farmland available. As a result, the preexisting problem of starvation will be exacerbated when the population reaches its carrying capacity.

Our project aims to identify root growth promoting genes to optimize carbon sequestration and crop yield. For this purpose, the modeling system for flowering plants *Arabidopsis thaliana* is being utilized to analyze gene functions. The ideal set of genes will then be transferred to crops. We hypothesize that creating larger root systems will minimize the impact of climate change by storing more CO₂ in the ground.

Ayanna Horn

Biology/Pre-Med, Xavier University of Louisiana

STARS

Mentored by Dr. Chengbiao Wu, Department of Neurosciences

RIN3 and Alzheimer's Disease

Alzheimer's Disease is a neurodegenerative disease that attacks brain cells resulting in memory loss and impaired cognitive ability. Research into the mechanism(s) of Alzheimer's Disease (AD) has identified the RIN3 gene to be highly expressed in patients with Alzheimer's. This finding suggests a strong association between RIN3 expression and Alzheimer's Disease. To establish if RIN3 as a causal factor, we seek to closely examine the relationship between RIN3 expression and Alzheimer's Disease; we will introduce a AD variant (W63C) in the RIN3 gene into healthy mice to investigate the effects of that mutation and if it leads to Alzheimer's Disease in mice. We will also

selectively inhibit RIN3 expression in established mouse models of AD to define if the measure will prevent/slow down AP pathology and behavioral deficits in these mice. Together, our study will establish if RIN3 will be a potential target for developing effective therapies for Alzheimer's disease.

Ronald Horne

Biological Science, California State University, Fullerton

STARS

Mentored by Dr. Tannishtha Reya, Pharmacology and Medicine

Determining Molecular Dependencies in Pancreatic Tumor Initiation and Regulation

Pancreatic cancer (PC) is amongst the most lethal of human malignancies and has relatively little-known treatments other than surgery. Symptoms of PC do not present themselves until advanced stages of progression. Through RNA sequencing of cancer stem cells (a highly chemo-resistant subpopulation of pancreatic cells) a number of enriched genes were identified. These highly expressed genes are hypothesized to serve a significant role in regulating tumor development. Proline Rich Acidic Protein 1 (Prap1) is among the enriched genes identified and is involved in epithelial cell regulation as well as functioning with DNA repair mechanisms. Although it was initially studied for its use in the uterine tract during pregnancy, it has been increasingly involved in carcinogenic studies. Given Prap1 is turned on during the tumorigenesis process, it is possible it could play a key role in initiation and regulation of pancreatic cancer.

Jan Hsiao

Biology: Bioinformatics, UC San Diego

Undergraduate Research Scholarships

Mentored by Dr. Sreekanth Chalasani, Neuroscience

Identification of Ultrasound-sensitive Ion Channels in Bioluminescent Dinoflagellates

Dinoflagellates are bioluminescent protists that light up in crashing waves with a soft blue glow at night. The light is a product of the luciferase-luciferin reaction occurring in scintillons (pocket structures) of the vacuole membrane. Mechanical stimulation is known to activate cellular signaling pathways that result in calcium release from intracellular stores. Calcium current then generates an action potential along the vacuole membrane. Action potential activates voltage gated proton channels in the vacuole membrane, lowering the pH in the scintillons, which is required for the pH-dependent luciferase-luciferin reaction to occur and release light. Chalasani lab recently found that ultrasound stimulation can trigger bioluminescence in dinoflagellates. Based on this, we want to identify ultrasound-sensitive ion channels responsible for activating

the cellular signaling pathway upstream of the bioluminescence response to ultrasound stimulation. Research in the lab previously identified mechanosensitive channels in humans and *C. elegans* that respond to ultrasound stimulation. Therefore, we can identify mechanosensitive channels in dinoflagellates using phylogenomics and test for a role in ultrasound response using drug assays. For each candidate channel, applying its agonist should amplify bioluminescence response to ultrasound stimulation, and conversely, applying its antagonist should quench bioluminescence response to ultrasound stimulation. To further confirm the findings from the drug assay, we are designing siRNA experiments to knock down gene expression of the potentially identified ultrasound-sensitive ion channels. If successful, channel identification and drug and/or siRNA knock downs will quench the dinoflagellate bioluminescence response to ultrasound stimulation.

Chao-Chin Hsu and Gwendalynn Stilson

Neurobiology / Human Biology, UC San Diego
volunteer research in the Corr lab
Mentored by Professor Mary Corr, Medicine

Cell specific TLR4 regulation of inflammatory arthritis

Inflammatory arthritis can be deforming and debilitating. One such disease is rheumatoid arthritis which is an autoimmune disease that is 3 fold more common in women than men. This disease is associated with autoantibodies that bind to proteins in the joint. To replicate the features of this disorder we use the K/BxN passive serum transfer model of arthritis. In this model recipient mice reliably develop an arthritis that resolves. The paw swelling is accompanied by mechanical allodynia. In male mice the mechanical hypersensitivity persists in wild type mice, but not in females and not in Toll-like receptor 4 (TLR4)^{-/-} mice. To better understand the key cell types involved we tested mice that had specific cre recombinase driven deficiencies in TLR4 using promoters for glial fibrillary acidic protein (GFAP) and lysozyme (LysM). All of the mice developed visualized paw swelling after passive serum transfer that remitted. In the Tlr4 Δ LysM mice the level of allodynia resolved in both males and females similar to the Tlr4^{-/-} mice. The Tlr4 Δ Gfap mice also demonstrated a partial recovery in both males and females albeit to a lesser extent. These studies indicate that both LysM and GFAP expressing cells contribute to the phenotype seen in the global Tlr4^{-/-} mice but neither is solely sufficient.

Kevin Hu

Mathematics-Computer Science, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. John T. Hwang, Mechanical and Aerospace Engineering

Efficient Sparse Matrix Solvers in Python for Large-scale Design Optimization

When solving large-scale design optimization problems with a significant amount of different design variables, large and sparse matrices are commonly encountered. Sparse matrices are primarily composed of zero elements along with a few nonzero elements. Therefore, it is feasible to significantly reduce the computation time and memory usage by only considering the use of nonzero elements for computations. In order to understand the methodology for solving linear systems, sparse matrices in dense format were initially used with various factorization and solution techniques such as the Cholesky factorization, LU factorization, forward substitution, and back substitution. For performance purposes, the numerical algorithms pertaining to these techniques were written as Fortran subroutines as opposed to Python functions. The Fortran subroutines were then wrapped using a Fortran to Python interface generator known as F2PY to create an importable Python package. This was done to utilize the speed of Fortran along with the useability of Python. After completing this, a similar approach will be taken in developing sparse matrix factorization algorithms along with wrapping existing open-source Fortran packages like LUSOL. If this is achieved, a major contribution will be reducing the redundancy in computation while solving for the factors of a matrix resulting from the addition or deletion of a row or column from another matrix with known factors. This will translate to higher computational speeds and efficient memory utilization. These benefits will be realized with an increased ease of use and convenience when the subroutines are wrapped for languages such as Python.

Samson Hui

Chemistry, University of San Diego
McNair Scholars Program
Mentored by David DeHaan, Chemistry and Biochemistry

What is the uptake of catechol / guaiacol into aerosol particles containing Fe and/or sulfate?

Kyle Hunady

Materials Science and Engineering, Georgia Institute of Technology

SDNI

Mentored by Ester Kwon, Bioengineering

Novel targeting and delivery of nanoparticles using in vivo click chemistry to treat traumatic brain injury

Traumatic brain injury (TBI) affects people of all ages and is a leading cause of death and disability worldwide. It is difficult to deliver therapeutics to the site of TBI because the blood-brain barrier (BBB) limits access to brain tissue. While the BBB is compromised following injury, providing a short window to deliver therapeutics, this opening is transient. This time constraint necessitates alternative approaches to deliver drugs to TBI past the 24-hour window. The clotting cascade is part of the repair process, and is activated immediately after injury. Here, we modify the clotting cascade to target therapeutic delivery through bioorthogonal copper-free click chemistry. This is accomplished by adding a dibenzocyclooctyne group (DBCO) onto the clotting protein fibrinogen, which is subsequently incorporated into the clot. Then, a therapeutic vehicle modified with an azide group can selectively bond to DBCO in the clot. We have shown previously with an in vivo mouse model that this targeting technique can deliver a model fluorescent dye to the TBI site. In this work, we characterize the kinetics and nanostructure of modified clot formation because improper clot formation can lead to accelerated fibrinolysis and thus inhibit healing of TBI. Thus, we use in vitro turbidity experiments to measure kinetics and scanning electron microscopy (SEM) to measure nanostructure of modified clots with native clots. Through this characterization, we aim to show that fibrinogen modified with DBCO will not affect the structure or kinetics of clot formation to support its application for TBI treatment.

Jaden Huynh

Psych: Cognitive and Behavioral Neuroscience, UC San Diego

Creating Scientists To Address Cancer Disparities Program

Mentored by Dr. Sadler, Surgery

Does psychiatric illness predict lower cancer survival rates?

This narrative review explored what is known about the consequences of coping with a cancer diagnosis in addition to a comorbid psychiatric illness.

This literature review used the Pubmed, ScienceDirect, and Google Scholar databases to explore this aim. Search terms included: severe psychiatric illness (SPI), social stigma,

higher fatality rates, cancer, and disparities. References cited at the end of closely allied articles were also explored in the search for other relevant articles.

This presentation will identify various factors that were associated with poor outcomes for patients who are coping with both severe psychiatric illness and cancer. Recommendations for future research will be suggested with the goal of helping to ensure optimal cancer outcomes among patients who are coping with psychiatric illness and cancer.

Zion Igwe

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Matthew Herbst, Making of the Modern World

Women in Nollywood vs Hollywood

Nollywood is one of the few industries that is rapidly growing in popularity. This film industry features numerous qualities that can attribute to its success (namely frequently changing scenery, the fact that the industry is a collection of indie films since this began from a collection of aspiring filmmakers, and more). One of the most definitive qualities of this industry is its representations of women. This film industry is one of few that drastically differ in ideals from movie to movie and the analysis of how women are represented further illustrates this complexity. Viewers and scholars alike have noticed that within drama movies (one of the most popular genres in Nollywood) women can either be the most defined and fleshed out individuals or can be further reduced to one dimensional characters in order to criticize/support cultural ideals (namely polygamy, the necessity of men, and other traditionalistic values) (Onyenankeya 73). Coupled with Nollywood's global popularity (ranking as the third most popular film industry in the globe) these movies have a large impact upon outside perspectives (whether implicit or explicit). Nollywood's representation of women can further be analyzed with the comparison of how drama movies within Hollywood and Nollywood speak out to either reject or defend the patriarchal values of a given nation. Both film industries attempt to cater to larger audiences through culture. Nollywood films are typically more critical of the Nigerian government while Hollywood films try to defend American values by critiquing the society of other nations.

Elizabeth Ingram

Literature/Writing | Health Care/Social Issues, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Leslie Carver, Psychology

Increased Use of Inclusionary Language and Coordination in Bias Reporting Mechanisms Creates Better User Experience

Creating an inclusive and equitable space for students to address and report incidents of bias in terms of language and information design strategies results in a higher reporting compliance rate and a more positive experience for the Complainant (victim) or the person reporting a bias incident. This study researches the effect of inclusive language when used in bias reporting mechanisms specifically and how it increases or decreases the reporting of these incidents. In dialog with prior work, a correlation has been found where victims are more inclined to report bias and feel more encouraged to report such incidents when inclusive language is used. Non-reporting can also be based on fear of reprisal or vaguely-worded privacy statements. Title IX regulations delineate data privacy requirements and, as such, are a valuable educational resource in best practices for data collection and dissemination. ADA Law, enacted in 1990, has roots deeply embedded in the fair housing, civil rights, and disability rights movements, which serve to ban bias, harassment, or discrimination based on race, ethnic origin, sex, or ability. Guidelines from these laws, along with a comparison to the bias reporting web pages of other universities to those of the UCSD Office of Students with Disabilities (OSD) and Office for the Prevention of Harassment and Discrimination (OPHD), are the basis of this study. Thus, inclusive language, coordination between relevant web pages, and greater transparency regarding data privacy will result in a more inclusive and positive experience for the Complainant.

Aline Irafasha

Chemistry, Wellesley College
MRSEC REU or RIMSE
Mentored by Akif Tezcan, Kenneth Han, Yui Na, Chemistry and Biochemistry

Entrapment of Macromolecular Cargo Within Polymer-Integrated Crystals (PIX)

Proteins have gained extensive attention due to their applications in therapeutics, drug synthesis, and material industries. Each protein has a particular function that is closely linked to its structure. The intricate network of intramolecular interactions holds the protein together and maintains its activity. Without their particular folding, proteins experience inhibited activity and can be rendered inactive. Furthermore, proteins are sensitive to their environment and susceptible to external stressors such as shear stress,

changes in pH, and ionic strength. Under these conditions, proteins can denature and lose their functions. To combat this limitation, researchers have protected proteins from external environments by encapsulating them in polymeric systems or crystalline frameworks. In this work, we demonstrate the use of polymer-integrated protein crystals (PIX) as a material to increase protein stability. PIX are a class of hybrid materials that seamlessly integrates hydrogel polymers with macromolecular ferritin crystals. The resulting material can isotropically and reversibly expand/contract, allowing the controlled entrapment and release of macromolecules. As a proof-of-concept, we investigate the capture/release, retention, and activity of protein cargo within PIX. We have selected green fluorescent protein, cytochrome c, lysozyme, and glucose oxidase as target proteins as they cover a range of size, charge, and activity.

Nkechinyere Iroanusi

Human Biology, UC San Diego

Triton Research & Experiential Learning Scholars (TRELS)

Mentored by Dr. Tanaka, Ethnic Studies

What Does Compassion Mean to Uninsured and Under-Resourced Communities of Color?

Due to many historical injustices, communities of color have often felt misused by medicine at large. There is a cycle of distrust and general unpleasantness with healthcare providers. Unfortunately, the injustices haven't stopped, as many people of color feel that those in the medical profession lack one of the basic qualities that are needed in healthcare: compassion. In many research studies about compassion, healthcare professionals and other experts define compassion. However, the people we should be asking are not the providers themselves, but the patients as they are the ones that will know if they receive compassionate care. Focusing research like this on communities of color, especially since there is already distrust, is important. Although research on compassion has increased, there is little data on how under-resourced, culturally, and ethnically diverse communities define compassion, which can help mitigate the health disparities plaguing these communities. This study will help delineate how compassionate the healthcare industry is, and if it is not what work can be done to make it more compassionate. A purposely made survey was created with a focus group of Black community leaders, non-profit founders, and physicians from San Diego. This survey is composed of questions that target experiences and attitudes towards physicians and healthcare providers for people from the Black community to expand on. Therefore, the Black community, across all socioeconomic groups, can be directly asked what compassion personally means to them, allowing us to finally understand 'What Does Compassion Mean to Uninsured and Under-Resourced Communities of Color?'

Akemi Ito and Michelle Zaichik

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

Using DREADDs to Examine the Role of the Hippocampus in Processing Elapsed Time

Various studies examining the temporal aspects of memory have found the hippocampus to be involved in temporal processing. Previous research from our laboratory has provided evidence for the importance of the hippocampus in discriminating the duration of elapsed time; however, these studies used permanent lesions to disrupt hippocampal function in rats. In order to leave brain tissue and connectivity intact, we are currently exploring the use of virally-delivered DREADDs as an effective, minimally invasive method to inhibit the function of the hippocampus. The DREADDs being used in our laboratory are the inhibitory hM4Di DREADDs, which bind an exogenous ligand, CNO, and inhibit the function of the targeted area — in this case, the hippocampus. The hippocampus is only inhibited within a few hours of CNO administration, and otherwise, the hippocampus functions normally. This technique would allow for within-subject analysis of the role of the hippocampus in our Time Duration Discrimination (TDD) task. We will present our behavioral TDD task and current methodology using chemogenetics to inhibit hippocampal function during time discrimination behavior.

Mianjel Jack

Neuroscience, Xavier University of Louisiana
STARS
Mentored by Dr. Lindsey Powell, Psychology

The Neural Basis of Infants' Preference for Helpers

Social preferences is highly studied in the field of psychology, more recently with infants. While infants depend on their social partners for caregiving, researchers have recently begun to investigate infants' preferences for some social partners over others. It has been observed that infants show preferences along many dimensions: people who are friendly towards them, people who speak their native language, and people who are helpful, to name just a few. However, it is not yet known if such preferences all involve a common computation of social value, or if these social evaluations are all based on distinct cognitive mechanisms. Past work shows that the left medial prefrontal cortex, or the left MPFC, predicts the social preferences in infants based on positive cues such as smiling, friendliness, and infant-directed speech. My work in the STARS program will test if this brain region also predicts infants' social preferences for helpers. To study this,

infants will be shown images of helping and hindering events while researchers collect fNIRS data. Then, a preferential looking test and a preferential reaching test will be done where the infant has to decide between the helper and hinder by looking and or reaching towards that individual. The average magnitude of the infants' left MPFC responses will be computed to see if it predicts their subsequent preferential looking or reaching to the helper vs. the hinderer. The implication of this project is to understand the neural basis of infants' earliest moral evaluation.

Kelsea Jackson

Psychology, Spelman College

STARS

Mentored by Dr. Lindsey Powell, Psychology

Infants' Understanding of Ownership Rights

An understanding of ownership requires both an understanding that objects belong to people, and that owners have rights over their property. Previous research suggests that 12-month-old infants use verbal cues like "mine" to connect a person with a specific object. However, it is unclear whether infants also attribute ownership rights to others. Addressing this gap will help resolve whether ownership understanding is innate or if it is the result of experiences through culture or bodily and personal rights. The purpose of the current study is to examine if infants between 11-13 months have a foundational sense of ownership rights. Infants will first watch a series of videos in which one actor verbalizes their ownership of a toy. In some subsequent test trials, infants will see another actor choose to play with a toy that does not belong to the first actor. In other test trials, infants will see the second actor decide to play with the toy belonging to the first actor. Infants' looking times will be recorded and examined to determine whether infants expect the second actor to play with the unowned toy or the toy belonging to the first actor. We hypothesize that infants will look longer (i.e., be surprised) when the second actor plays with the owned toy than the unowned one, indicating that they have an understanding of ownership rights. We also expect a developmental trend in which the expectation that people will respect others' ownership rights increases between 11 and 13 months of age.

Jessica Jang

Human Biology, UC San Diego

Undergraduate Research Scholarships

Mentored by Dr. Kellie Breen Church, Department of Reproductive Medicine

A new Kiss1hrGFP x Sun1GFP crossed transcriptomic mouse model to analyze arcuate Kisspeptin neurons

Estradiol, more commonly known as estrogen, is widely known to contribute to women's reproductive functions but is also important for bone, brain, and metabolic function. Due to its extensive functions throughout the body, estrogen production research is critical. Within the brain, Kisspeptin-containing neurons have recently been found to be the highest order of neurons in estrogen production, controlling the hypothalamus-pituitary-ovarian axis. The Breen Church laboratory has evidence that two populations of hypothalamic Kisspeptin neurons are inhibited by stressors or stress hormones, which could lead to deficient estradiol production. One aspect of inhibition occurs as a result of reduced transcription and translation of Kisspeptin encoded by the Kiss1 gene.

To further investigate Kisspeptin neurons more efficiently, a specialized animal model is needed in which Kisspeptin cells can be isolated and evaluated at the transcriptomic level. This new animal model is a cross between Kiss1Cre animals and Sun1 green fluorescent protein (GFP) flox animals, which allows great advantages compared to existing approaches to analyze gene regulation within Kisspeptin cells.

This research project first sought to validate a new transcriptomic mouse model by developing recombination primers of SunGFP for genotyping purposes. Additional goals are to utilize quantitative PCR and immunohistochemistry to quantitatively and qualitatively measure Sun1GFP within Kisspeptin cells. This animal model will provide a useful tool for researchers to understand how stress alters estrogen production and to develop medications to prevent estradiol loss or symptoms from a lack of estrogen, such as osteoporosis, delayed puberty, and infertility.

Taeho Jeong

Physics (specialized with Astro), UC San Diego

UC Scholars

Mentored by Professor John T. Hwang, Mechanical and Aerospace Engineering

Design optimization of lithium-ion batteries for eVTOL aircraft to improve cycle life under safety constraints

The interest in electric vertical take-off and landing (eVTOL) aircraft grows due to its reduced environmental impact enabled by the electric propulsion system and the ability

to alleviate traffic congestion in dense, urban areas. However, current battery technology impedes the immediate application of eVTOL. One challenge is that the batteries have lower energy densities than conventional combustion engines. Additionally, the take-off and landing phase of the aircraft requires a high current rate (C-rate) that can overheat the battery. The high temperature significantly deteriorates the battery cycle life and can cause a catastrophic failure called battery thermal runaway. Given the challenges, I proposed a large-scale gradient-based optimization approach to design the properties (e.g., C-rate, separator's thickness, electrode's particle size, thickness, porosity, diffusivity, and conductivity) of battery cells to achieve a compound objective of maximizing battery cycle life and energy density, subject to a safe range of temperature between 60°F and 130°F. This optimization involves a large number of design variables within a multiphysics model and complex derivative computation required for gradient-based optimization. Thus, I implement the optimization that fully automates the derivative computation in a modular architecture using an open-source gradient-based optimization framework called OpenMDAO and a high-performance partial differential equation solver called FEniCS. We anticipate this project provides the design of battery cells for eVTOL aircraft to improve aircraft safety during missions with strictly imposed temperature constraints and reduce the cost by increasing battery cycle life.

Neelay Joglekar

ECE: Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Michael Yip, Electrical and Computer Engineering

Simulation and Control of Continuum Catheter Robot

Catheter robots are one of the many emerging instruments of automated surgery. These are soft, flexible robots, so, unlike rigid robots, they need complex control methods to capture their unpredictable movement. I am implementing a simulation and a simulation-based control algorithm for a cable-driven continuum catheter robot. I am using PyElastica, a python library that simulates elastic rods using Cosserat Theory, as a base for my simulation and adding extra functionality to fully simulate a catheter robot. I have nearly completed a collision constraint between elastic rods and imported meshes. Currently, I am adding actuation forces that mimic the movement of a cable-driven catheter. I am also exploring possible control algorithms for the catheter robot that guide the robot on the optimal path through a tube-like environment. Creating such a simulation-based control method for catheter robots is essential for automating catheter surgeries.

Daniel John

Bioengineering, UC San Diego

Undergraduate Research Scholarships

Mentored by Dr. Weg Ongkeko, Medical School; Department of Surgery

The Immune Landscape of COVID-19 and Cardiovascular Disease

COVID-19 has affected over 180 million people and has accounted for 3.9 million deaths across the world. Important clinical factors that result in worse COVID-19 outcomes have been identified, including obesity, COPD, asthma, and more. Patients with cardiovascular disease (CVD) are also at significant risk for severe COVID-19. COVID-19 ICU patients have been shown to exhibit an immune response similar to that of venous thromboembolism (VTE) patients, a CVD that manifests in blood-clotting and restriction of venous blood flow. Cardiomyopathy is a CVD in which myocardium are abnormally enlarged by immune factors including cytokines and inflammasomes, which also play significant roles in COVID-19 pathogenesis. Lastly, coronary artery disease (CAD) results from buildup of fat deposits, severely restricting blood flow. High levels of leukocytes and cytokines are exhibited in both COVID-19 and CAD. Thus, the goal of this study is to investigate similarly dysregulated immune pathways between COVID-19 and VTE, cardiomyopathy, and CAD, which may reveal key pathways responsible for worse COVID-19 outcomes in patients with these CVDs. RNA-sequencing datasets for each cardiovascular disease were downloaded from the GEO accession database, which included sick patients and healthy controls. RNA-sequencing data for patients with COVID-19 and healthy controls were downloaded from BioBank. We used the Kruskal-Wallis test to determine differentially expressed genes in VTE and cardiomyopathy patients, and GEO2R software to analyze CAD and COVID-19 patients. Significantly dysregulated genes in CVDs and COVID-19 were then computationally profiled for correlation to other pathways and co-expression with other genes.

Ravi Johnson

Electrical Engineering, UC San Diego

Triton Research & Experiential Learning Scholars (TRELS)

Mentored by Dr. Reza Esmaili, Electrical and Computer Engineering

Wind Turbine Off-grid System

As the power grid adapts to a changing climate, power shut-offs have become an increasingly common tool to lower the risk of fires on windy days. However, this tool inconveniences those customers who have to go for hours or even days without power. One solution to minimize the disruption to customers is to establish a backup power system, which can not only supply power during outages but also reduce energy costs

during peak hours. In this project, such a system is implemented using a wind turbine and lead-acid battery storage system. In addition, the power conversion circuitry to regulate the turbine output, charge the battery bank, and perform the DC/AC power conversion is explored, with particular emphasis on the flexibility and repeatability of the system through the use of off the shelf control micro-controllers. The system is also modular, allowing for the scaling of any individual part of the system without any change to the control scheme. This application can hopefully be scaled to power not only the one house included in this project but entire neighborhoods if necessary.

Jasmine Jung

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Sonya Neal, Biological Sciences

Uncovering the Novel Cellular Stress Response to Misfolded Membrane Proteins

The endoplasmic reticulum (ER) is an organelle responsible for folding membrane proteins and secretory proteins. Proper protein folding is important because the proteins need to be correctly folded to function and unchecked accumulation of misfolded proteins can be harmful to cells. If misfolded proteins are not degraded, it can lead to protein aggregation, which is common among neurodegenerative diseases. To prevent this, the ER is equipped with a protein quality control pathway called ER-associated degradation (ERAD). 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. My study will determine whether clinically relevant proteins found in human diseases such as antitrypsin deficiency and cystic fibrosis elicit stress through the use of growth assays. Along with this, I plan to continue to explore the mechanisms by which misfolded membrane accumulation impacts cells and how cells adapt to this stress.

Kira Kawano

Marine Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Octavio Aburto, SIO

A Time Around a Plate: Serving Science for Sustainable Fisheries

Many oceanic habitats are rapidly declining in the face of anthropogenic climate change, threatening the ecosystem and communities that depend on them. With the combined impacts of overfishing and climate change, commercially important fish populations are struggling to recover. Although this threat is well understood in the scientific

community, the general public fails to reciprocate the same level of urgency. My project will aid in the conservation effort by using art to communicate issues that threaten oceanic ecosystems to the general public. This process will involve sorting through publications focused on threatened fish species and extracting key ideas that will be used to create infographics that amplify the message. This series of infographics describes the life cycle of various commercially important species and educates the public to become more aware of the time and energy the ocean invests in putting food on our plates. By using art as a new language for science communication, it can serve as a tool to bridge the language gap between researchers and the public.

Jacob Kelber

Chemistry, UC San Diego

MRSEC REU or RIMSE

Mentored by Professor Joshua Figueroa, Chemistry/biochemistry

Synthesis of Trianilinophosphines Via Phosphorus Trichloride and Lithium Anilide Precursors

Primary triaminophosphines (ie. $P(NHR)_3$) exhibit unique reactivities that allow them to become the active precursors in metal-phosphide nanoparticle synthesis, and the direct use of these compounds may allow for a more reliable and tunable nanoparticle synthesis. However, these compounds are not well characterized, and an efficient and reliable synthetic pathway has not yet been discovered. To meet this challenge, we are pursuing the synthesis of trianilinophosphines by nucleophilic routes. In this presentation, the synthesis of trianilinophosphines by the treatment of lithium amides with phosphorus-based electrophiles is described. The characterization of reaction products via 1H and ^{31}P NMR spectroscopy, along with single-crystal X-ray crystallography, is discussed. Most importantly, this presentation will focus on the determination of reaction conditions that lead to electronically differentiated trianilinophosphines in good yields. Also presented will be studies aimed at using new trianilinophosphines to produce and modulate the properties of metal phosphide nanoparticle materials.

Jeffrey Keller

Molecular and Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Xin Sun, Pediatrics

Mutation of Phenylalanyl tRNA Synthetase Subunit Beta (FARSB) Causes Non-translational Disease

Certain mutations of FARSB, a Phe-tRNA synthetase, cause multi-organ disease in humans, often affecting the lung, brain and liver. However, these mutations do not affect translation, which suggests that FARSB has non-translational cellular functions. Mice with compound mutant FARSB (Farsb(R305Q/-)) weigh significantly less than their wild type siblings by 4 weeks, yet only develop induced-Bronchus-Associated Lymphoid Tissues (iBALTs) in the lungs after 20 weeks. The presence of other histological phenotypes, either in the lung or in other organs has not yet been investigated in mice. Characterizing the phenotypes caused in multiple tissues is important for understanding the non-translational functions of FARSB and for developing potential treatments for human disease. We characterized the phenotypes of multiple tissues across different ages by assessing marker gene proteins and RNA quantities. Notably, we found that Farsb(R305Q/-) mice gain extensive fucosylation throughout alveolar type 1 and 2 cells, while their control siblings show no such fucosylation. The drastic change in glycosylation may contribute to the disease phenotype and suggests that FARSB may play a role in regulating glycosylation in specific cell types, either through regulation of genes related to the process of glycosylation, or through interacting with the enzymes that catalyze this process.

Rishaan Kenkre

Bioengineering: Bioinformatics, UC San Diego
Creating Scientists to Address Cancer Disparities Program
Mentored by Dr. Olivier Harismendy, Oncogenomics

Racial, Ethnic and SocioEconomic Disparities to Access Cancer Targeted Therapies Using Real-World Evidence Analysis

Targeted therapy consists of a treatment that utilizes drugs designed to hit specific biological processes that are dysregulated in cancer cells and not in normal cells. A molecular test such as DNA sequencing is typically ordered to identify the altered process and precisely select the right drug for a given patient. As a consequence, targeted therapy drugs are more effective and less toxic than traditional treatments, but their cost represents a significant financial burden for the patient. This literature review explores the influence of socioeconomic status (SES) and race/ethnicity on the access to

effective cancer treatments, especially targeted therapy drugs. The literature review identified articles using the PubMed, JSTOR, EBSCOhost, and Google Scholar databases with the keywords cost, cancer, treatment, expensive, race, ethnicity, underserved, communities, minorities, targeted therapy, and underprivileged. Reference lists cited within the papers were additionally reviewed to render a comprehensive literature review of the topic at hand. In addition to the literature review, analysis of the impact of SES and race/ethnicity on targeted therapy cancer treatments will be performed on a medical registry containing molecular and clinical data of 5,000 patients called the Aggregated Registry for Molecular Oncology Research (ARMOR). This presentation will summarize the findings from the literature review and delineate the ARMOR analysis of the influence of SES and race/ethnicity on access to targeted therapy. Recommendations for future research will also be presented.

Merve Kilic

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Sujit Dey, Electrical and Computer Engineering

Deep Learning Enabled Millimeter Wave Beam Management for Outdoor Networks

Driven by new applications such as edge-rendered AR/VR, Autonomous Driving, and the growth of Machine-to-Machine communications, the required capabilities of wireless communication have grown exponentially. Millimeter Wave (mmWave) communications is a promising solution for this problem due to its large bandwidth enabling high throughput. When implementing mmWave networks, one of the biggest challenges is beam management because the high frequency incurs higher path loss and vulnerability to blockages that must be mitigated with careful beam management. Machine learning based solutions have been shown to account for site specific geometry in order to create zero overhead beam management policies -- the key focus of this project is evaluating how generalizable these learning approaches are. The majority of learning solutions can only be evaluated in restricted scenarios. However, this isn't indicative of the wide range of heterogeneity seen by cellular networks today. This project extends the prior simulation studies by adding additional radio configurations, such as mobile handsets, enabling the evaluation of learning approaches in rich (and more realistic) environments. In order to undertake a larger scale simulation study, it was necessary to improve simulation speed and therefore an approach was created that simplifies the world model by as much as 94% without impacting the fidelity of the simulated environment.

Stephen Kim

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

Parallel Data Center Circuit Switching

Traffic demand in data centers is growing at incredible rates. This comes in turn with a worldwide increase in demand for switching speed and capacity. Therefore, there is an increased need for an efficient solution to handle large amounts of data traffic and extremely high data rates. One proposed solution is to introduce optical circuit switches in lieu of or in conjunction with the already present electrical packet switches. Optical switches have a much higher bandwidth, but they incur a significant reconfiguration cost. Previous works have modeled an entire optical data center switch network as a single optical switch abstraction. However, in many cases, an optical data center switch network is better abstracted as a set of parallel optical switches. The research problem that arises surrounds scheduling a traffic demand matrix across the parallel optical switch abstraction to minimize the makespan across parallel optical switches.

In this work, we first consider the decomposition of a given traffic matrix D into a linear combination of permutation matrices, where the decomposition is based on the combination of the Frank-Wolfe algorithm and the Birkhoff+ decomposition algorithm. We then consider scheduling permutations across the parallel switches to minimize the maximum workload amongst the s parallel optical switches. We also consider duplicating (splitting) a matching across multiple switches in shorter durations. Overall, these problems are NP-hard, and we have formulated fast polynomial algorithms that substantially outperform known approaches in terms of makespan and throughput (in a given time window) for different parameter and workload settings.

Abril King

psychology, University of San Diego
McNair Scholars Program
Mentored by Dr. Kristen McCabe, psychological sciences

The Impact of Benevolent Sexism on Women's Mental Health, Romantic Relationship Satisfaction and Work Satisfaction

Benevolent sexism (BS) attributes positive qualities to women while reinforcing damaging gender roles. However, little is known about how these experiences impact women's mental health, job, and relationship satisfaction. The current study

hypothesized that in both work and romantic relationships, more frequent experiences of BS would be associated with adverse mental health and decreased work and relationship satisfaction. We also hypothesized that mental health symptoms as well as reduced job and relationship satisfaction associated with experiencing BS would be moderated by how negatively a woman perceives such events. Participants were 244 women recruited through MTurk who completed measures of experiences/perceptions of BS as well as symptoms of depression/anxiety, relationship satisfaction, and job satisfaction. Consistent with our hypotheses, regression analysis revealed that women who reported more frequent experiences of BS in either work or romantic environments reported worsened mental health, controlling for age, income, and education. Further regressions demonstrated that more frequent experiences of BS at work were associated with decreased work satisfaction but had no effect on relationship satisfaction. Women's perception of BS in either context did not moderate mental health symptoms or job satisfaction; however, positive attitudes towards BS in romantic relationships were related to greater relationship satisfaction when BS was experienced in those relationships. Our results suggest that regardless of women's perceptions, BS may negatively impact women's mental health and job satisfaction, while its relation to romantic relationship satisfaction is dependent on women's attitude towards BS in romantic relationships.

Maia Kirkegaard

Molecular and Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Karen Oegema, Biological Sciences

Understanding the Relationship between TPXL-1-based Regulation of Aurora A, Interphase Microtubules, and Cortical Contractility

Cortical contractility in cells allows for cell shape-change events, such as the physical split of a dividing cell into two daughter cells; regulation of contractility is crucial because failure to cleave a dividing cell into two can lead to an incorrect amount of genetic material within daughter cell(s) which increases the risk of developing cancer, and can lead to infertility. In mitosis, Aurora A is activated by the microtubule binding protein TPXL-1, and TPXL-1 helps localize Aurora A to astral microtubules where it directs inhibition of contractility of the cell cortex; however previous work suggested that in *C. elegans*, TPXL-1 does not play a role in the regulation of Aurora A in interphase. Preliminary work in the Oegema lab suggests that localization of Aurora A to interphase microtubules is dependent on TPXL-1, but how it impacts cortical microtubule organization and contractility remains unclear. My project will use the *C. elegans* embryo as a model system to understand how TPXL-1 impacts cortical contractility and the organization of interphase microtubules. To investigate how loss of TPXL-1 may alter the presence or organization of interphase microtubules and contractility, I will use spinning disk confocal microscopy to examine embryos containing

genetically encoded fluorescent protein fusions to either a microtubule subunit or a membrane-binding protein domain that have been depleted of tpxl-1 via RNA-interference, allowing for live-imaging of cortical microtubules and membrane dynamics. These experiments will allow me to contribute to our understanding of TPXL-1-based Aurora A regulation of cortical microtubules and contractility.

Marcellus Kirkland

Sociology, Morehouse College

STARS

Mentored by Lane Kensworthy, Sociology

Capitalism, Socialism, & Communism: Are They All Doomed to Fail?

For the last (roughly) two centuries, three economic doctrines have dominated both the world, as well as social thought: capitalism, socialism, and communism. Despite there being multiple, real life, examples of how well these doctrines function as working systems, there is still much debate on which economic doctrine reigns supreme. The ongoing debate is largely because no system built from any of the aforementioned doctrines has proven to be without shortcomings. Each has succeeded and failed in different ways. This raises the question: What constitutes “success” for an economic system? Some argue that the success of a system is contingent upon how well the citizens of a society are taken care of under the system. Others argue that it is contingent upon the economic growth and power a nation experiences under the system. Often, economic systems governed by the aforementioned doctrines are cited for succeeding in one category of success, while failing in another.

This now raises a new question: Is it possible for an economic system to succeed across all fronts, or is failure, in one way or another, always inevitable?

This research seeks to determine if economic systems under the aforementioned economic doctrines, are equipped to simultaneously serve the best interests of a state, while meeting the needs of its people. This is done via the examination of the various social outcomes yielded by these systems across multiple societies. Both qualitative and quantitative statistics, used to measure these outcomes, are examined throughout the research.

Nakhul Kisan

Electrical Engineering and Economics, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Pragathi Balasubramani, Psychiatry

Mapping Cognitive Brain Functions at Scale

We wish to see the relationship between cognitive and physiological states. Past research has localized anxiety, depression, and other mental illnesses to sections of the brain using electroencephalogram (EEG) recordings while patients played video games. By considering more biosignals, such as electrogastrogram signals (EGG) which are signals from the stomach, we are able to get a more accurate prediction on a patient's mental state. As a result, we can compare these predictions according to previous models which looked at EEG signals or if there is some interference from bodily state. We preprocessed both of these EEG and EGG recordings in a similar fashion (sliding window to reduce noise and manifold dimensional reduction) and then ran some learning algorithms to predict hunger and anxiety scores. The Bayesian Hierarchical Framework will be used to understand the relationship between the learned weights in each data type. This result is useful because we are essentially creating a more robust model of cognitive states.

Ryan Koch

Ecology, Behavior, & Evolution, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Sara Jackrel, Biological Sciences

Studying the Algal Microbiome to Help Predict and Mitigate the Impact of Harmful Algal Blooms Amidst Global Environmental Change

Microcystis aeruginosa, a freshwater cyanobacteria responsible for harmful algal blooms worldwide, poses a serious risk to both humans and wildlife that threatens to worsen with increases in the frequency of blooms due to climate change and cultural eutrophication. Previous studies completed by the Jackrel Lab have demonstrated this cyanobacteria's resilience in the face of changes to environmental stressors. This project aims to understand the mechanisms behind this adaptability, specifically whether it arises from the host or its surrounding microbiome. In doing so we hope to facilitate the prediction and mitigation of future blooms of *M. aeruginosa* in at-risk areas through an improved understanding of its behavior. We used the Joint Genome Institute's Genome Online Database (GOLD) Integrated Microbial Genomes & Microbiomes (IMG/M) system to identify genes encoding heat shock and phosphate-related proteins within the host's microbiome. All samples were collected from freshwater lakes across Michigan with

varying nutrient concentrations (eutrophic, mesotrophic, or oligotrophic). Results were tabulated in Microsoft Excel and visualized using the ggplot2, plyr, and dplyr packages in R. Following these initial visualizations we narrowed our scope down to three primary taxa, Aquidulcibacter, Bacteroidetes, and Planctomycetes, that contain representatives across all three nutrient groups. Analysis using the emmeans and dunn.test packages in R allowed us to identify two proteins, phoU and hsp70, that exhibit statistically significant differences between the various nutrient gradients. We aim to understand the implications of this relative to our initial query as we continue to visualize and examine our data.

Megan Korhummel

Psychology, San Diego State University
Creating Scientists To Address Cancer Disparities Program
Mentored by Dr. Vanessa Malcarne, Psychology

Barriers to genetic testing in men with an increased risk for prostate cancer associated with BRCA1 and BRCA2 mutations

It is widely accepted that BRCA mutations are linked to an increased risk for breast and other cancers primarily associated with women. However, BRCA mutations have more recently been associated with an increased risk in prostate cancer in men. Specifically, the BRCA2 germline pathogenic variant has been significantly associated with a higher risk of aggressive prostate cancer leading to early-onset disease and/or a higher mortality rate. There are numerous barriers to accessing BRCA related genetic testing. These include financial costs, availability of testing, a lack of knowledge of genetic testing needs, and fear of knowing the results as well as the possibility of their misuse. Due to the common association between BRCA and women, it is possible that men may face additional barriers.

This narrative literature review explores barriers to BRCA testing that men face by examining articles found using PubMed/Medline, CINAHL, PsycINFO, and ERIC. Among the keywords used were prostate cancer, BRCA, men, genetic testing, cancer, and education. Reference lists of key articles were also reviewed to find additional relevant articles. In this presentation, the literature review will summarize these findings and highlight implications found. Recommendations for future research regarding strategies for reducing barriers to BRCA testing faced by men will be provided.

Dalia Koujah

Physiology and Neurosciences, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities Program
Mentored by Dr. Georgia Sadler, Surgery

Barriers to Breast Cancer Screening for Arab-American Women

Arab American women are more likely to be diagnosed with advanced stage breast cancer and have significantly lower breast cancer screening rates than non-Hispanic white women. The lack of a distinct category for Arab Americans in the census has made research on cancer outcomes scarce as there are no ethnic identifiers or federal funding allocated to research and community interventions in this population. As a result, studies have utilized a variety of methods to collect data from Arab-Americans in the US, from developing their own ethnic surname databases to seeking out trusted community leaders to help with recruitment. Recent studies have identified a multitude of factors including culture, spirituality, linguistic and financial barriers, social support, and acculturation that impact medical mistrust and screening behaviors of Arab-American women. My literature review integrates the findings of these studies to identify the most consistent barriers to screening, in order to identify culturally competent interventions that address these barriers. Specifically, my literature review investigates the cultural and spiritual barriers to breast cancer screening for Arab-American women, as well as how acculturation contributes to medical mistrust and health behaviors for these women. This literature review identifies articles using PubMed, Ethnic News Watch, and CINAHL using keywords Arab-American, cancer, screening, and barriers. Due to limited search results, criteria were broadened to include studies since 2012. Findings will be discussed in a poster presentation.

Marcella Ku and Ryan Park

General Biology / Human Biology, UC San Diego
Moores Cancer Center Biorepository
Mentored by Dr. Sharmeela Kaushal, Moores Cancer Center Biorepository

Assessment of RNA Quality and Quantity in relation to Tumor vs. Stromal presence in Formalin Fixed paraffin embedded (FFPE) Breast Cancer Tissue for Sequencing

Marcella Ku, Ryan Park, Pauline Tran, Mason Kyle, BS, Edgar Masmila, PA,
Alfredo Molinolo, MD, PhD, Sharmeela Kaushal, PhD

Biorepository and Tissue Technology Shared Resource (BTTSR), Moores Cancer Center,
University of California, San Diego

High quality tumor RNA is a crucial component performed for applications such as transcriptome analysis to further advancements in treatment. Fresh-frozen or fresh tissue is proven to be ideal for high quality RNA extraction; however, obtaining fresh tissue is not always plausible. Hence, FFPE tissue remains the ideal specimen type for most sequencing assays. Stromal component is another potential factor that can influence RNA quality and quantity. This study aims to determine RNA quality extracted from FFPE tissue in relation to stromal component amount and apply these findings on RNA sequencing research.

Archival breast cancer FFPE tissue from MCC Biorepository was evaluated by pathologist via H&E staining. 10 micron thickness curl-ups were cut from tissues with varying tumor percentages and deparaffinized via QIAGEN deparaffinization solution. RNA was extracted using the RNeasy FFPE kit via QIAcube. Quality assessment of purified RNA was performed by Nanodrop and Agilent 4200 TapeStation system.

Patients consented and tissues were procured under Biorepository protocol #181577. Four FFPE breast cancer tissue blocks were identified in respect to the stromal component. We selected tissues with the following tumor percentages: 15%, 30%, 75%, and 90% for RNA quality and quantity assessment. In a 2016 study for frozen, normal and tumoral colon tissues, higher RNA Quality Index (RQI) was found in tumor tissue with higher stromal than tumor count (Galissier *et al.*, 2016). We aim to establish a RQI for breast cancer tissue to determine the most ideal tumor to stromal ratio for RNA sequencing.

Anny Lam

Pharmacological Chemistry, UC San Diego
Genentech Scholars Program
Mentored by Dr. Carlo Ballatore, Pharmaceutical Chemistry

Phenylpyrimidines as Candidate Molecules for Anti-schistosomal Treatment

Schistosomiasis is a disease caused by parasitic trematode flatworms belonging to the genus *Schistosoma*, which affects nearly 200 million people, especially in developing countries. Recent studies have identified a novel phenylpyrimidine small molecule that exhibits relatively potent anti-schistosomal activity at concentrations that are non-toxic to mammalian cells. Preliminary structure–activity relationship (SAR) studies have been conducted confirming that phenylpyrimidines hold considerable promise as potential anti-schistosomal treatment. The primary objective of the proposed studies will be to further elucidate the SAR and SPR (structure-property relationship) of the existing lead compound and to ultimately identify one or more biologically active congeners that may be appropriate for future in vivo efficacy studies. As part of this lead optimization effort, one or more thiophen-2-yl-pyrimidine derivatives will be designed, synthesized, characterized and evaluated for anti-schistosomal activity in vitro.

Keeley Lanigan

Ecology, Behavior, Evolution, UC San Diego

Undergraduate Research Scholarships

Mentored by Professor Jonathan Shurin, Ecology, Behavior, Evolution

Zooplankton microbiomes: how their adaptation to food quality changes is essential to ecosystem services of alpine lakes

Environmental conditions, such as temperature and elevation, shape the ecology of alpine lakes. At the base of the food web, energy from primary producers (i.e. plants, phytoplankton) is essential to lake ecosystem productivity and biomass. The lakes that we are surveying in the Sierra Nevadas host a genus of zooplankton called Daphnia, which are essential to the ecosystem as they transfer energy from producers to higher consumers such as fish. It is hypothesized that high elevation lakes rely mostly on phytoplankton as their source of energy; but at lower elevations, where there is more plant life, their source of energy is mostly terrestrial input from trees. In both these environments, Daphnia have been able to survive and thrive. We suspect that their survival success is facilitated by adapted microbiomes (i.e. bacteria and other microbes) that live in Daphnia's gut and allow it to obtain energy from its food. Little is known about how the gut microbiomes of Daphnia are able to adapt to different environmental conditions. Our main objective is to understand how gut microbes alter the response of zooplankton to food quality and, in turn, shape food webs and ecosystem health. This research is essential because, depending on how well the microbiomes of the Daphnia will adapt to a change in the food quality in the lakes, these nutrient changes have the potential to alter lake ecosystem productivity and the transfer of energy to higher trophic levels.

Viena Le

Chemistry, UC San Diego

Creating Scientists To Address Cancer Disparities Program

Mentored by Georgia Sadler, Surgery

Factors Explaining High Cervical Cancer and Low Screening Rates Among Victims of Sexual Abuse

Studies have shown that women who have been victims of sexual abuse are more likely to be affected by cervical cancer than women who have not been sexually abused. Multiple factors have been identified as possible contributors to this increased risk of cervical cancer, but the real causation remains unclear. Low screening rates linked to the identification and the treatment of precancerous cervical lesions are recognized contributors of this increased risk, and it has been noted across many studies that sexual

abuse is positively correlated to lower screening rates in women, though the reasoning for these lower rates remains ambiguous. This narrative literature review identifies articles using the following databases: PubMed, CINAHL, and PsychAbstract, as well as original documents sourced from the articles that were found. The following key search words were used: cervical cancer, sexual abuse, childhood sexual abuse, cervical dysplasia, sexual assault, cervical neoplasia, cervical screenings, sexual trauma, sexual violence, gynecological care. The presentation will summarize the findings from the literature review, discuss other possible contributing factors, provide recommendations for future research and suggestions for ways to optimally support this patient group.

Nicolette Le

Global Health, UC San Diego
Youth Enjoy Science (YES)
Mentored by Dr. Georgia Robins Sadler, Surgery

The Impacts of Financial Barriers Among Underrepresented College Students on Cancer Disparity in the US

The National Institutes of Health recognizes that a well-diversified workforce in the health and sciences is necessary to reducing the nation's cancer disparities. The UC San Diego Moores Cancer Center hypothesized that it could help expand the diversity of the health and science workforce, while helping students in its programs recognize and address health disparities to contribute to reducing the cancer burden. Since 2002, Science Education Enrichment Programs have been hosted by the UC San Diego Moores Cancer Center to provide experiential learning and laboratory experience to low income, first generation, and racially/ethnically underrepresented students. Surveys completed by 378 students included questions about their perceived barriers to completing college. Responses were analyzed across gender, ethnicity, race, students' place of birth, and admission status. Financial barriers were identified as the biggest problem that would make it difficult for students to complete college. Though widespread, financial concerns were statistically more prevalent among community college transfer students, indicating a need for greater support to facilitate transfer students' successful completion of college. Community college transfer students come from exceptionally diverse backgrounds that can benefit the health and science workforce. Further research in this area is needed to more adequately support community college students' education and career trajectory as they transfer to 4-year universities and matriculate to graduate school.

Chloe Le

General Biology, UC San Diego

Triton Research & Experiential Learning Scholars (TRELS)

Mentored by Professor Christoforos Mamas, Educational Studies

Inclusivity at UCSD: Exploring the relationship between teacher identity and course content

The student population at UCSD grows more diverse each year; however, the diversity of professors grows at a much slower rate. Many of these professors teach courses that encompass personal subjects such as identity, culture, and ethnicity. And every UCSD student is required to take at least one of these courses to satisfy the DEI requirement. Quite often, students will find themselves in a class where their professor cannot personally identify with the subject they are teaching. This study analyzes how the student's learning experience is impacted based on whether or not the professor shares the same background as their course content. Utilizing a case study approach with UCSD as the subject of interest, students and professors alike will be surveyed and interviewed to better understand the current state of inclusive education at UCSD. Preliminary findings have shown that it is easy for minority students to feel objectified and devalued in classes where the professor cannot relate to the course content. The experiences shared by both students and faculty will reveal what more can be done to include students in their own education in order to promote their learning and confidence in that course.

Leya Ledvin

Neurobiology, UC San Diego

Undergraduate Research Scholarships

Mentored by Dr. Cole Ferguson, Pathology

Regulation of Heterochromatin by Ubiquitin Signaling during Brain Development

Disorders of brain development can result from dysregulation of widely varied molecular pathways and the identification of >800 monogenic forms of intellectual disability (ID) has been a critical contribution to our understanding of pathways regulating brain development. This project is a continuation of the Ferguson lab's exploration into the role of ubiquitin signaling in the regulation of neuronal fate through the regulation of chromatin and epigenetic state. We previously described 9 probands with moderate ID due to homozygous null mutation of APC7, a core subunit of the Anaphase Promoting Complex (APC). APC is a ~20 subunit E3 ubiquitin ligase with central roles during mitosis and neuronal differentiation. We have uncovered a specific role for APC7 in the stable recruitment and ubiquitination of APC substrates such as Ki-

67 and Aurora B. We went on to develop and characterize a knock-in mutant mouse, using unbiased proteomics to uncover a major pathogenic role for APC in regulating heterochromatin formation through the novel substrate Ki-67. We found that APC7 is critical for the functions of the APC that are required following mitotic exit, but not for mitotic progression. We also found that mutation of the non-mitotic substrate binding coactivator Cdh1 phenocopied the effect of APC7 loss, whereas loss of the mitotic coactivator Cdc20 caused a distinct phenotype. This project revealed an entirely novel function for the APC in regulating chromatin in post-mitotic neurons, but we still have questions about the molecular regulation of heterochromatin by ubiquitination and more specifically, the role of Aurora B kinase.

Dahae Lee

Medicine, Anatomy and immunology, Seoul National University of Medicine, South of Korea

MRSEC REU or RIMSE

Mentored by Michael. J. Sailor, Chemistry and biochemistry

Investigation of quantitative measure of the uptake pSi fusogenic nanoparticles (FNP) in cell culture by time-gated photoluminescence.

Porous silicon (pSi) fusogenic nanoparticles (FNP) are capable of delivering payloads directly into the cytoplasm by fusion with the cellular plasma membrane. Photoluminescence is intrinsic to the silicon-silicon oxide skeleton, and can be used to directly report on the location of the nanoparticle carrier within cells or biological tissues. pSi photoemission occurs on a microsecond time scale, where fluorophores and intrinsic tissue autofluorescence emissions take place in the nanosecond regime. This property of pSi allows for time-gated imaging and is ideal for studying nanoparticle biodistribution within tissues that display having a high degree of autofluorescence, such as the retina. The aim of the present work is to investigate pSi nanoparticle photoluminescence and to monitor and quantify cell uptake of pSi FNP by time-gated imaging. In this study, pSi nanoparticles will be synthesized ~75 nm in diameter and thermally oxidized in deionized water. The resulting photoluminescence will be monitored over time for optimization using a 365 nm LED excitation. The finalized photoluminescent particle formulation will then be coated with fusogenic polyethylene glycol phospholipid lipid membrane. The human retinal pigment epithelial cell line RPE19 will be incubated with the optimized FNPs and imaged using time-gating with an ultra-high speed camera in a 96 well plate format. These results will be compared with quantitative nanoparticle controls and fluorescent markers for cell viability to calculate uptake efficiency. If effective, these methods will be expanded to measure the intraocular pharmacokinetics of FNPs in tissues and to determine biodistribution in histological sections.

Abby Lee

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Jessica Wang-Rodriguez, Pathology

Intratumor microbiome influence on gastrointestinal cancer progression

While there has been extensive research into the microbiome's role in cancer progression, much of this research has focused on the gut microbiome. Only more recently, have we found that microbiota at tumour sites previously thought to be sterile, such as the breasts, lungs, bladder, pancreas, and prostate, are also associated with cancer. As such, in this project, we have chosen to explore the bacterial and archaea microbiome's role in several gastrointestinal cancers: colon adenocarcinoma (COAD), pancreatic adenocarcinoma (PAAD) and rectum adenocarcinoma (READ). Using large-scale RNA-sequencing data of cancer samples and adjacent normal samples, as well as clinical data corresponding to these patients, we have identified intratumor microbial presence, explored associations between individual microbe abundance to clinical variables, immune infiltration and immune pathways, and characterized beta and alpha diversity measures of the bacterial and archaea microbiome. Understanding the microbiome's role in cancer pathogenesis and progression will allow us to identify key microbes that can be employed as prognostic targets in the future, potentially benefitting more than 200,000 patients who are affected by these cancers every year.

Rachel Lee and Rachel Myers

Biochemistry/Chemistry, UC San Diego
MRSEC REU or RIMSE
Mentored by Professor Michael Sailor, Chemistry & Biochemistry

Improving Drug Loading of Rifampicin in Porous Silicon Nanoparticles for Tuberculosis Treatment

Tuberculosis (TB) is an infectious, airborne disease that is caused by *Mycobacterium tuberculosis* and affects the lungs. Currently, there are many strains of TB that are resistant to antibiotics resulting in long treatment periods. These treatments are difficult to sustain, as many affected individuals stop their treatment midway. This causes more antibiotic resistance and contributes to the risk posed by TB worldwide. TB is difficult to treat because it is difficult to penetrate the lesions that harbor the bacteria. This project focuses on using peptide-targeted porous silicon nanoparticles as a delivery vehicle for the antibiotic rifampicin, with the goal of delivering higher doses to TB-infected tissues locally without exposing the body to toxins through the bloodstream. Here, we explore techniques to design and characterize porous silicon nanoparticles to improve the drug

loading of rifampicin and promote its slow release. The ability of the hydrocarbon n-octadecylsilane to improve drug loading and retainment is studied, along with the addition of an amine group to enable chemical modification of the nanoparticle surface. If successful, this approach will reduce the treatment period while increasing the efficacy of the drug.

Jina Lee

Biology with a specialization in Bioinformatics, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Joseph Pogliano, Molecular Biology

Profiling jumbo phages through bioinformatics

Jumbo phages are phages with large genomes that seem to form a nucleus-like structure in the center of the bacteria it infects. This project does multiple bioinformatics analyses of the Erwinia jumbo phage Ray, including analysis of Ray proteins and its homology to other eukaryotic/prokaryotic proteins and phylogeny.

Athena Leisching

Cognitive Science Specialization Neuroscience, UC San Diego
STARS
Mentored by Dr. Lara Rangel, Cognitive Science

Dynamic dentate gyrus recruitment during the formation of distinct memories

The dentate gyrus (DG) within the hippocampus is an essential structure for the formation of new memories. Specifically, the dentate gyrus is thought to play a key role in memory formation by creating unique representations for similar yet different events. These unique representations can then be used to associate even very similar events with distinct outcomes. However, little is known about how the dentate gyrus's cellular mechanisms are involved with this distinction and at what key intervals this involvement occurs. We performed in vivo electrophysiological recordings of DG local field potential (LFP) activity as rats completed a task that requires them to differentiate a location as distinct from other similar locations within an arena. Rat LFPs demonstrated a unique and inverse relationship between theta (4-12Hz) and beta (15-35Hz) oscillations at key intervals when rats approached rewarded spatial locations. We examined the extent to which these oscillatory dynamics coincided with successful task completion. Additionally, an analysis on LFP rhythms occurring in tandem with specific task-induced exhibited behavior, such as object-approaching, scanning, and rearing, may yield critical periods for dentate gyrus participation in the formation of distinct memories.

Jacqueline Leon

Chemistry, University of California, Merced
CAMP Scholar at UC Merced
Mentored by Dr. Liang Shi, Chemistry and Biochemistry

Modeling Amide-I Vibrational Circular Dichroism of Peptides

Vibrational circular dichroism (VCD) is an effective technique to study the characteristics of amide-I vibrational mode of peptides and thus determine their secondary structures. However, the structure-spectrum relationship for the VCD spectra is yet to be established. Theoretical modeling plays an important role in connecting the peptide structures to their infrared (IR) spectra, and such work is similarly needed for the amide-I VCD spectra of peptides. To ensure the validation of our vibrational frequencies and transition electric dipoles, all of which are pivotal components to stimulating VCD, we begin with simulating the amide-I IR spectra for a series of peptides, including those with well-defined secondary structures. The analyses of the molecular dynamics simulations and IR spectra will allow us to not only compute the VCD spectra but help us gain insight on the molecular origins of the observed VCD spectra features.

Melissa Lepe

Aerospace Engineering, UC Irvine
STARS
Mentored by Dr. Ingrid Tomac, Structural Engineering

Hydrophobic particle-air-water mixtures in post-wildfire mudflows

as those presented by mudflows occurring after forest fires is an area that is not understood. Particles present in post-wildfire mudflows are classified as hydrophobic, such that they have a tendency to attach to particles of air to form agglomerates. The use of high-speed cameras will be used to capture and analyze the forces and behavior at different stages in the process. The captured images and videos will be analyzed in Matrix Laboratory (MATLAB) using a GeoPIV-RG image analysis module. The following process will allow for understanding of the hydrophobic particle attachment. The experiments created in this step will be fundamental for the future goals of this project. While also understanding the attachment and behavior of particles, it is also fundamental to understand the role gravity plays in agglomerate size and characteristics. By understanding the effects of gravity on soil particles, it is possible to predict future behavior of mudflows and implement systems that prevent catastrophic fatalities. Subsequently, finalized models of these mixtures will be created and tested in microgravity conditions. With the results of the microgravity tests, it will be possible to determine a relationship between shear rate and mixture composition. The long-term

goal is to develop and improve infrastructures impacted by mudflows by predicting and modeling its behavior.

McKenna Lewis

Computer Science, UC San Diego

Undergraduate Research Scholarships

Mentored by Dr. Kathleen Curtius, Division of Biomedical Informatics, Department of Medicine

Quantifying epigenetic drift in gastrointestinal pre-cancers to predict age of premalignant onset in patients for improved early cancer detection

The project I plan to continue this summer focuses on quantifying epigenetic drift in gastrointestinal (GI) normal tissues and associated pre-cancers. The primary aims of this project are to 1) measure tissue aging in different anatomical regions of the GI tract using genome-wide DNA methylation arrays, (2) create tissue-specific molecular clocks for colorectal adenomas that estimate the age of onset of premalignancy, and (3) identify the role of differential biological aging by considering tissues from cancer patients and matched gene expression data from a subset of samples. A secondary aim of this project is to create a software package that makes it possible for users to input different datasets of normal and pre-cancer tissues, process the data, and produce results from analyzing the data with visualization outputs. Specifically, the package would comprehensively either process/take processed data as input, and quantify DNA methylation in regions of the genome which could help determine which regions are drifting with age and which are static with age at certain CpG sites and islands.

Bowen Li and Vince Ly

Pharmaceutical Chemistry / Molecular and Cell Biology, UC San Diego

UC Scholars

Mentored by Dr. Luis Arturo Medrano Soto, biological science

Characterization of ECF Type ABC Transporters

The ATP-binding Cassette (ABC) superfamily consists of efflux systems (classified into ABC1, ABC2, and ABC3 types), and uptake systems whose membrane proteins are proposed to be related to ABC2 type porters. Unlike most uptake systems, which have one or two functionally equivalent membrane subunits that form a homo- or heterodimer functioning with an extracytoplasmic receptor, a subset of ABC uptake subfamilies known as Energy-coupling Factor (ECF) are composed of two functionally dissimilar and sequence divergent membrane components: the S (substrate recognition) and T (transducer) subunits which lack extracytoplasmic receptors. The purpose of this

study is to apply bioinformatic methodologies, most of which were developed in the Saier Lab, to characterize the ECF subset of ABC families in terms of their topology of transmembrane segments (TMSs), repeat units, conserved motifs and domain organization, as well as to investigate if there is detectable homology between 1) the S and T subunits and 2) ECF and ABC2 porters. Hydropathy profiles generated with the programs WHAT and AveHAS will be used to perform topological analyses. Repeat units will be identified with the programs AncientRep and HHrepID. Conserved motifs will be searched with the programs MEME/MAST. Pfam domain organization will be analyzed using getDomainTopology and the HMMER suite. Homology between the S and T subunits, as well as between ECF and ABC2 transporters will be investigated with the programs Protocol2 and Hvordan. Protein trees will be generated with mkProteinClusters.

Thomas Lim

Religious Studies, Linguistics, UC San Diego

UC Scholars

Mentored by Dr. Dayna Kalleres, Literature, Study of Religion

Alternative Salvation: Final Fantasy and Its Critique on Institutional Religion

Relegated to the realm of entertainment, video games are considered vapid; although enjoyable, they lack intellectual weight. This project opposes that sentiment. I explore how digital games criticize the politicization of religion, with an emphasis on Christian hegemony. In assessing the game Final Fantasy X (hereafter FFX), I illustrate how the Christian idea of salvation as an event enacted not by political-religious institutions, but by the protagonists opposing them. Salvation is presented as a solution to the apocalyptic and oppressive intentions ironically carried out by the religious institution that ostensibly promotes redemptive practices. I use anthropologist Victor Turner's idea of liminality to examine the game's narrative structure and characterization of protagonists. By inhabiting a liminal status that liberates them from religious ideology, protagonists reenter institutional-religious spaces to dismantle them, all while delineating the harmfulness of religious institutions.

While this project is concerned with how religious oppression is expressed in digital games, it is equally concerned with how games reflect real-world anxieties about religious oppression. My project contributes to discussions regarding the digitization of religion, specifically how video games exist as a medium through which people have and understand religious experiences. It also complicates current debates regarding technological development, as FFX offers criticisms against technology despite it relying on technology to be played.

Hsu Lin

Joint Major in Mathematics and Economics, UC San Diego
STARS
Mentored by Dr. Emanuel Vespa, Economics

Searching for a Risk Parameter

One aspect that contributes to discrepancies between the predictions of classical economic models and the decisions of real-life agents is the stability of risk preferences. While the models assume that individuals are rational and should exhibit stable risk preferences, human beings may differentially assess choices given different frames despite unchanged expected payoffs. (Here, a frame refers to the mode of eliciting risk preferences; for instance, selecting between lotteries compared to deciding to purchase insurance.) In particular, our research is interested in the stability of risk aversion given decisions with varied expected payoffs (i.e., within frame) and given different elicitation methods (i.e., across frames). We collect data via a randomized experiment with cash incentives—the participants are aware that their choices in the experiment impact their real-life compensations. Preliminary results suggest that risk preferences are stable within frames, and that risk perception is not frame-independent. Understanding this theoretical framework has implications on future experimental research in behavioral economics: in decision-making and related scenarios where risk preferences must be controlled, it is important to accurately interpret subjects' apparent risk attitudes depending on the elicitation method.

Tzu-chien Lin

Psychology, UC Los Angeles
Center for Research Computing & iSURE at UND
Mentored by Drs. Teresa Ober, Ying Cheng, and Paul Brenner, Psychology

The Effect of Informal STEM Experience on Interest and Career Aspiration in Computer Programming Among Middle Schoolers: A Mediation Analysis

Interest in STEM+C, a predictor of career aspiration, generally decreases during middle school, which may be due to the lack of informal STEM experience and the low science achievement values the students and their families have (George, 2006; Jones et. al, 2021; Shahali et. al, 2019; Young, Ortiz, & Young, 2017). This study explored the relationship between middle schoolers' informal STEM experience (iSTEM), resources (i.e., time, material, social), and interest and aspiration in computer programming (CP) careers. It was hypothesized that iSTEM can be modeled as a single latent factor, students' iSTEM scores would vary based on resources, and interest would mediate the association between iSTEM and career aspirations in CP. Survey responses were

collected by the Curated Pathway to Innovation project, a web app designed for middle schoolers to learn about and foster interest in CP. Participants (N=636; Mean age=13.5 years) were from 15 sites in the US. Mean scores were computed for each scale and resource variables were dichotomized. R Studio was used to perform analyses. The results generally support the hypotheses: iSTEM fit well on a single factor model, iSTEM scores differ based on most resource variables, and interest appeared to partially mediate the association between iSTEM and career aspirations, with a significant indirect and total effect, after controlling for resources. Greater informal STEM experiences are directly and indirectly associated with interest and aspirations in STEM. Providing more opportunities for informal STEM experiences may combat the declining interest in STEM among middle schoolers.

Sabrina Lin

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Julian Schroeder, Cell and Developmental Biology

Identifying Putative Candidates Involved in Stomatal Movement

In the past six decades, atmospheric CO₂ concentration measurements recorded in the Keeling Curve show that CO₂ is rising at an alarming rate. Plants, a major source of CO₂ turnover, contribute to ecosystems by turning CO₂ into usable oxygen for other species. Internal carbon dioxide regulation is vital to plant health; without it, plant growth, function, water-use efficiency, and leaf heat stress will affect plant vigor. Additionally, rising atmospheric CO₂ is reducing plant-atmosphere gas exchange globally. Current literature suggests that plants exhibit a sensing mechanism for the CO₂ response in guard cells that control the opening and closure of stomata in the leaf epidermis. Many genes implicated in CO₂ signaling have been identified and characterized in the model organism, *A. thaliana*, which play a role in this pathway by encoding factors like protein kinases (Zhang et al., 2018). While it is known that high concentrations of CO₂ will cause stomatal closure, many signaling factors in plants have yet to be discovered and further explored. Our current research involves identifying novel factors involved in CO₂ signaling through conducting two complementary genetic screens: gain-of-function using Full-length cDNA Over-eXpression (FOX) and reduced function using an artificial microRNA (amiRNA) library. We will isolate, confirm and characterize CO₂ response mutants in the CO₂ signaling network. Ultimately, the goal is to learn more about the CO₂ signaling pathway with regards to stomatal movement and by doing so, improve water usage and stress resilience of plants in light of climate change.

Michelle Liu

Molecular and Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Anne Hiniker, Pathology

Optimizing a chemical-genetic approach to define substrates of PKC

Protein kinase $C\alpha$ (PKC α) is a serine/threonine kinase that binds to second messengers Ca²⁺ and diacylglycerol, causing a series of downstream events that suppress cell proliferation. Recently, gain of function missense mutations in PKC α resulting in increased kinase activity have been identified in some patients with Alzheimer's disease (AD), a neurodegenerative disease characterized by amyloid- β (A β) protein aggregates and synaptic degeneration. To understand the cellular basis of PKC α -mediated AD pathogenesis, this project seeks to identify kinase substrates of AD-associated PKC α mutants (PKC α -AD). To achieve this, we are applying a chemical genetic kinase-substrate mapping approach to PKC α -AD and PKC α . We anticipate that this approach will allow us to identify novel kinase substrates of PKC α , some of which we hope will be specific to PKC α -AD. To validate the utility of this chemical-genetic approach for PKC α , we mutated PKC α 's "gatekeeper" residue, a conserved bulky amino acid, to a small non-polar amino acid to allow for specific ATP analogs that cannot be utilized by most endogenous kinases. We have generated PKC α and PKC α -AD constructs bearing the gatekeeper mutation M417A and are now measuring their kinase activity using an in vitro kinase assay. We are testing the ability of PKC α M417A and PKC α -AD M417A to phosphorylate a known PKC α substrate, MARCKS, using both ATP as well as a bulky ATP analog that should be selectively utilized by the M417A mutants. This validated analog-sensitive PKC α system can then be used in a complex protein lysate to label and identify substrates of PKC α and PKC α -AD.

Jeffrey Liu

Chemical Engineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Jessica Wang-Rodriguez, Pathology

Characterizing the fungal microbiome for thyroid cancer prognosis

Due to improved diagnostic capabilities, thyroid cancer has seen a rapid rise in the number of detected cases since the 1990s. Although thyroid cancer is found in higher rates among women, men disproportionately experience more severe cases than women, leading to a similar death rate relative to the general population. The reasons behind this clinical manifestation are not definitively known, and current medical advances are still unable to adequately determine the prognosis of cancerous tumors.

Recent studies have suggested that the fungal microbiome, also known as the mycobiome, promotes cancer development and changes during carcinogenesis. The goal of this project is to characterize the members of the intratumoral fungal mycobiome that may contribute to thyroid cancer and how the mycobiome differs based on thyroid cancer subtypes and gender. To do so, we will obtain thyroid cancer patient RNA-sequencing data from The Cancer Genome Atlas (TCGA) and use sequencing read alignment software to filter the data for fungal reads. We will look for fungi that are differentially abundant through computational analysis and correlate significant fungi with disease severity, immune-associated genes, immune cell infiltration, and immune and cancer pathways. We will also present some preliminary findings from the bacterial microbiome associated with thyroid cancer to highlight potential future directions for thyroid cancer therapeutics research.

Antonio Loaiza

Bioengineering: Biosystems, UC San Diego

STARS

Mentored by Dr. Aitana Castro, Dr. Aitana Castro / Bioengineering

Induction Medium Effects on the Development of Cerebral Organoid's Forebrain

The current techniques for growing cerebral organoids from Human Pluripotent Stem Cells (hPSCs) unveil the optimal environment for brain organoid development yet restrict opportunities for predetermination of forebrain fated cells used to study the complications associated with the region. The hPSC and neural induction medium, known for forming the ectoderm and later the anterior neuroectoderm (future forebrain), may influence the forebrain development based on the initial established conditions. Our research will be investigating the impact that hPSC's DMEM-F12 basal medium and neural induction's KSR supplement medium will have on the predominance of Brain-forebrain fate, as opposed to the current formula for hPSC and neural induction. We will examine if our hPSC medium will suppress the Nodal Pathway and allow the intrinsic differentiation of neuroectodermal progenitors. Succeeding, we will analyze the effects KSR supplement + SMAD inhibitors have on neural induction of the anterior neuroectoderm. This investigation will use SOX2 neuroectodermal immunostaining to quantify neuroectoderm development in hPSC mediums and PAX6 immunostaining to test for anterior neuroectodermal movement during neural induction. This experiment tests the influence that the initial condition of hPSC and neural induction mediums have upon promoting the development of the forebrain. Our findings may uncover the pivotal supplements needed to elaborate the forebrain and unveil the deducing factors that drive congenital forebrain diseases in underdeveloped forebrains.

Amy Loeber

psychology, UC San Diego
Creating Scientists To Address Cancer Disparities Program
Mentored by Dr. Sadler, Surgery

Exploring the Impacts of Cis-normative Structures on Transgender Men with Breast Cancer

Cis-normative structures within medical facilities have been found to be exclusionary against transgender men with breast cancer. Transgender male patients noted a lack of knowledge surrounding transgender topics, leading to hesitancy in pursuing breast cancer-related resources and uncertainty about who to turn to for more information regarding breast cancer for transgender individuals. This narrative literature review was conducted through databases such as PubMed, PsycINFO, and ProQuest. Articles from these databases were found by inputting keywords such as trans/transgender, trans/transgender men, breast/breast cancer, dysphoria, transphobia, mammograms, and discrimination. Reference lists of key articles were also reviewed. This presentation will highlight the lack of representation of transgender models, neutral terminology, and transgender knowledge within medical environments, with a focus on breast cancer clinics. Additionally, it will present possible solutions for improving how patients are addressed and treated to facilitate the creation of a more inclusive environment for all patients, regardless of their identification. Suggestions, as well as potential examples for future research, will be discussed.

Angelina Lopez

International Business, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Professor Jill Gladstein, Director of Synthesis Program, Seventh College

Investigating the Climate Consciousness Among High School Students in Salinas, California

Rich in culture, Salinas, California is a Mexican-American, low-income-family-dominated community. The adolescents of this community are often preoccupied with working jobs, caring for relatives, while battling with systemic marginalization--demonstrated by the below-par education opportunities, food insecurity, and simultaneous active gang violence, and over-policing. Since Salinas relies on farmwork--and has already seen repercussions such as unbreathable air quality as a result of 2020 California fires--and will most definitely undergo more consequences due to climate change, it is essential to initiate climate conversation among the youth in order to raise a climate-conscious generation that defends their community in the face of exploitation and oppression.

Thus, I will assess their current climate knowledge and what aspects of their community limit and/or encourage climate discourse amongst themselves, amongst their families, and at school. Because knowledge about climate change is directly related to how accessible spaces to learn and discuss it are within the community, I will examine not only how much they know about the crisis, but what prohibits and/or inhibits their conversation about it. Their level of climate awareness and access to climate discourse spaces will be measured by digital surveys, circulated through social media and physical posters around the City of Salinas. Individuals who respond to the survey will have the opportunity to participate in an in-person interview, which will allow them to share their in-depth relationships with the climate crisis. Further, I will use the collected data to explore strategies to encourage climate change discourse among the adolescent population.

Rebeca Lopez

Biochemistry/Chemistry, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Erik Romero, biochemistry/chemistry

Activation of Aminoboranes using Lewis Bases

Methods permitting the introduction of two functional groups onto C-C double bond feedstocks in one step are prized in agriculture and medicine. We aim to find the cheapest, most sustainable methods to generate carbon-boron and carbon-nitrogen bonds. Little research has been done using aminoboranes (ABs), which contain discrete nitrogen-boron bonds. The coordination of a Lewis base (LB) to the boron atom of an AB is hypothesized to activate the nitrogen fragment toward electrophiles. However, if the LB is overly basic, then the boron group itself cannot be introduced onto the product and will be lost as waste. The degree of activation of the AB in the presence of various LBs will be ascertained using ^{11}B NMR spectroscopy. Relative to the chemical shift of the uncoordinated AB, a large change suggests a greater activation of ABs. In contrast, no change indicates no activation. As the basicity of LBs decreases, their coordination to boron may exist in an equilibrium that is faster than the NMR timescale. In this case, no change in the chemical shift will be observed in the ^{11}B NMR spectrum at room temperature. Using variable temperature NMR, a lower ambient temperature will slow this equilibrium to enable potential observation of AB activation. In this study, we will investigate neutral amines, pyridines, phosphines, and ionic salts such as phenolate, acetate, triflate, and others to identify the best LB for AB activation.

Carolina Lopez

Human Biology, UC San Diego

STARS

Mentored by Dr. Fadel Zeidan, Anesthesiology

The effects of compassion-based mental training on brain mechanisms that support pain-relief, the cultivation of empathy, and the development of compassion

Empathy, defined as the sharing of another person's emotion is a prerequisite for compassion.

Compassion is not only the sharing of another person's emotion, but it is also the desire to enhance an individual's well-being. While there is significant variability in interpersonal dispositional compassion, there is evidence that has demonstrated that mental training interventions such as compassion and mindfulness meditation increase behavioral and neural markers of empathy. However, the brain mechanisms that support the enhancements in empathy and compassion through these mental training interventions remain unknown. Additionally, there are no studies that have identified the biomarkers of compassion and empathy as a function of training frequency. The goals of the study are to determine the behavioral and neural mechanisms supporting the cultivation of empathy and development of compassion by examining the effects of three different mental training interventions: Compassion Cultivation Training (CCT), Mindful Self-Compassion (MSC), and Mindfulness-Based Stress Reduction (MBSR). A standardized pain empathy evocation paradigm will be utilized during functional Magnetic Resonance Imaging (fMRI) to determine if mental training increases behavioral and neural empathetic responses when viewing a stranger compared to a romantic partner experiencing pain. We predict that MSC, CCT, and MBSR will reduce self pain and will enhance empathy towards a stranger. Due to the ongoing chronic pain and opioid epidemic, it is important to determine the effectiveness of mental training interventions as well as the neural correlates of pain reduction and empathetic concern.

Steven Luong

Biochemistry and Cell Biology, UC San Diego

McNair Scholars Program

Mentored by Dr. Michael David; Professor of Molecular Biology, Department of Biology

The effects of Human Schlafen-11 Protein on SARS-CoV-2 Viral Replication

In mammals, an important biological pathway in counteracting viral infections is the production of type I interferons and the activation of interferon-stimulated early response genes (ISGs) upon viral infection. Recent research has identified a specific type of ISGs known as Schlafen genes for which their role in counteracting viral infections

remains poorly understood. This project seeks to understand the effects of human Schlafen-11 protein expression on SARS-CoV-2 viral protein production. Using in vitro culture methods, we demonstrate that transfection of plasmid DNA constructs containing human Schlafen DNA and Spike Protein DNA into HEK 293T and 293 SLFN 11 knockout cells has a diminishing effect in overall spike protein production. We show that human schlafen-11 but not human schlafen-5 exerts an inhibitory effect on the wild-type SARS-CoV-2 Spike protein expression while no such effect is observed in the case of SARS-CoV-2 codon-optimized (CO) spike protein.

Rachel Luu

Mechanical Engineering, UC San Diego

McNair Scholars Program

Mentored by Marc Meyers, Mechanical and Aerospace Engineering

Bioinspired Models of Horse Hooves for Drop Tower and Compact Tension Testing

Biological materials present an abundance of structures that can serve as an inspiration for designs of new synthetic materials for various technological applications. In particular, the horse hoof yields outstanding mechanical properties with excellent fracture control mechanisms. Thus, the hoof was studied for inspiration in designing high impact resistant, compressive, and tensile strength materials. The horse hoof structure consists of a hierarchical assembly of helical, layered, tubular and cellular microstructures. In order to deepen our fundamental understanding of these microstructures, we identified the most prominent features through prior research into the hoof's energy absorbent properties. Then, numerous models were designed with varying metrics of the structures such as tubule reinforcement and tubule shape, size, and density gradients. Models were fabricated using multi-material additive manufacturing and their characterization provided a comprehensive understanding of how tubular and gradient features affect fracture. The bioinspired models were tested using drop tower and compact tension, exhibiting behavior similar to the observed phenomena in the hoof. Findings regarding these bioinspired models provide insight into the complexity of the hoof structure and offer guidance for future bioinspired technology. This work was supported by the National Science Foundation Mechanics of Materials and Structures Program (Grant Numbers 1926353 and 1926361).

Erick Macario

Chemical Sciences, UC Merced
California Alliance for Minority Participation (CAMP)
Mentored by Dr. Rudy M. Ortiz, Molecular Cell Biology

5 Weeks of Oral Cannabidiol Improved Blood Glucose Tolerance in Otsuka Long-Evans Tokushima Fatty (OLETF) Rats

Nearly 31 million Americans suffer from type II diabetes (T2D), which is one of the leading causes of metabolic syndrome (MetS). Cannabidiol (CBD) has been shown to ameliorate increased body mass, a MetS risk factor, suggesting that CBD may have profound metabolic benefits. However, the effects of CBD on blood glucose intolerance, which is associated with metabolic dysfunction, hasn't been investigated. The Otsuka Long-Evans Tokushima Fatty (OLETF) rats contain a CCK mutation that manifests a phenotype that closely mimics progressive human MetS and resultant T2D. We hypothesized that oral CBD ameliorates hyperglycemia in OLETF rats. Glucose tolerance was measured by an oral glucose tolerance test (oGTT) in 3 groups of rats: (1) control, Long Evans Tokushima Otsuka (LETO), (2) untreated OLETF, and OLETF + CBD (175 mg/kg/d x 5 wks). CBD treatment reduced the oGTT area under the curve (AUC) 2.5% compared to untreated OLETF. The AUC in the CBD-treated group was 34% lower than OLETF at 10 minutes, delaying the spike in blood glucose suggesting that CBD reduced the initial absorption of glucose. In addition to the delay in the spike, CBD also increased glucose clearance rate after 60 min, 2.6 mg/dL/min compared to untreated OLETF at 1 mg/dL/min with reduced levels at 120 min, 209 mg/dL and 268 mg/dL, respectively. Collectively, CBD appears to modestly improve glucose tolerance by either facilitating glucose uptake and/or utilization.

Daniel Maldonado Naranjo

Mechanical Engineering, UC San Diego
STARS
Mentored by Dr. Sylvia Herbert, Mechanical Engineering

Integrating Simulink Models to Reachability Analysis for Safe Control of Novel Aerial Vehicles from NASA

As autonomous systems are implemented into industries, there will be demand for new technologies that enhance quality of life, productivity, and safety. Safety is a critical aspect of autonomous systems because they often encounter unknown environments, disturbances, obstacles, etc. This focus on safety has led to further development of safety analysis methods such as reachability analysis. Reachability analysis is used to find the set of states from which a system can guarantee safety while reaching a goal.

Reachability analysis is important because people need to trust a robot's ability to perform tasks in an efficient and safe manner. Being able to apply Hamilton-Jacobi (HJ) Reachability Analysis to new vehicles/robots/systems would help in performing system safety analysis. The goal for this summer is to implement Simulink models, which do not rely on explicit mathematical formulations for system dynamics, to the reachability toolbox. We aim to use a current reachability tool box and a simple dynamic system to create a Simulink model. Using a simple dynamic system will allow us to verify if the Simulink implementation works. Once the Simulink implementation works, we expect to try a more involved dynamic system. The ultimate goal of this project is to utilize this Simulink model integration to perform safety analyses for novel vertical takeoff and landing vehicles in partnership with NASA. An overview of the approach, a summary of the results, and results on the application to a more complex system will be presented.

Ameya Mandale

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Pragathi Balasubramani, Department of Psychiatry

Mapping Cognitive Brain Functions

We wish to see the relationship between cognitive and physiological states. Past research has localized anxiety, depression, and other mental illnesses to sections of the brain using electroencephalogram (EEG) recordings while patients played video games. By considering more biosignals, such as electrogastrogram signals (EGG) which are signals from the stomach, we are able to get a more accurate prediction on a patient's mental state. As a result, we can compare these predictions according to previous models which looked at EEG signals or if there is some interference from bodily state. We preprocessed both of these EEG and EGG recordings in a similar fashion (sliding window to reduce noise and manifold dimensional reduction) and then ran some learning algorithms to predict hunger and anxiety scores. The Bayesian Hierarchical Framework will be used to understand the relationship between the learned weights in each data type. This result is useful because we are essentially creating a more robust model of cognitive states.

Hieia Manely

Public Health, UC San Diego
Creating Scientists To Address Cancer Disparities Program
Mentored by Georgia Sadler, Surgery

Barriers to Breast Cancer screening faced by Immigrant Muslim women in the United States

Immigrant Muslim women in the United States get screened for breast cancer at lower rates compared to other cultural groups. The aim of this study was to examine barriers faced by these women. A narrative literature review was conducted using PubMed, EBSCO, and PsycINFO databases using keywords Muslim/Islamic, women/woman, breast cancer screening/mammography, and immigrant. The reference lists of key articles were reviewed. The review identified various socio-cultural barriers that prevent this population from obtaining breast cancer screening. Gate keeping, predominantly by male counterparts, on women's health and a lack of knowledge regarding mammogram practices make it difficult for Immigrant Muslim women in the United States to participate in these screening processes. Language barriers and cultural and religious beliefs also influenced their screening decisions. This presentation will highlight the findings of the literature review and possible solutions to combating these barriers.

Katya Marchetti

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Paul Grossfeld, Medicine

Investigating the Role of Erythroblast Transformation Specific (ETS1/ETS2/ETV2) Genes in Hypoplastic Left Heart Syndrome

Hypoplastic Left Heart Syndrome (HLHS) is a congenital heart disease characterized by a malformation of the left ventricle and associated blood vessels with strong evidence of a genetic basis. The ultimate goal of this project is to identify HLHS associated genes that will allow us to uncover the basic mechanisms underlying the pathology of HLHS and lead to effective treatments. Candidates include Erythroblast Transformation Specific (ETS) genes, a family of transcription factors primarily responsible for differentiation, proliferation, and angiogenesis. ETS1 is hypothesized to be responsible for balancing cell fate determination between the myocardium and endocardium in the cardiac mesoderm. ETS2 and ETV2 are hypothesized to be responsible for cellular proliferation and angiogenesis where a loss of function could also potentially lead to HLHS.

For this project I am exploring the role of ETS/pnt transcription factors in heart development and function using two model organisms, the zebrafish *Danio rerio* and the fruit fly *Drosophila*. In zebrafish I used PCR to confirm the genotype of ETS1, 2 & ETV2 CRISPRed larvae that exhibited abnormal cardiac phenotypes, which were quantified using Semi-automatic Optical Heartbeat Analysis. In fruit flies, cardiac knockdown of the ETS homolog pointed (pnt) caused structural remodeling. I analyzed myofibril organization in hearts of pnt mutants stained for F-actin with phalloidin using ImageJ plugin MyofibrilJ. Analyzing the striated muscle fibers responsible for cardiac contraction could reveal a structural basis for contractile abnormalities found in fish and flies.

Guadalupe Marmolejo

Education Studies, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Thandeka Chapman, Education Studies

Bilingualism in the Latino Student Population

English as a second language (ESL) instruction is not a “one size fits all” (Khan, 2019, p. 376) situation. Students that come from low socioeconomic status families, immigrant students or students that come from immigrant families, and minority students come with different sets of skills and have different learning styles. Thus, my project will focus on interviewing high achieving bilingual college level Latino students to find out what they think about bilingualism in regard to their identity and their education. These interviews focus on how the interviewees look at bilingualism as a positive and negative feature of their identities as well as finding out what types of support they wish they had experienced as a bilingual student when they were in the K-12 system. Ultimately, I use these interviews to develop recommendations on how teachers, schools, and districts can better serve the needs of these students by taking into consideration the students’ bilingual identity as a strategy that could help them to better learn English as well as to avoid being othered. Altogether, the interviews and my recommendations will make a case towards increasing the availability of bilingual education programs and how these programs can help bilingual students to become academically strong and active and participating citizens who bring about positive changes to society.

Esmeralda Marquez

Electrical Engineering, San Diego State University
Creating Scientists to Address Cancer Disparities Program
Mentored by Dr. Hakan Toreyin, Electrical and computer engineering

Wearable Technology in Cancer Prevention and Care.

The improvement and growth of wearable technology are paving a way to better cancer prevention and care. Research is examining how wearables may contribute to the prevention of cancer, as well as how cancer patients, their caregivers, and healthcare providers can benefit from the use of wearables. This literature review will explore the possible ways that wearable technology systems can be of use in prevention and treatment of cancer, including monitoring weight control, limiting ultra-violet radiation (UVR) exposure, promoting physical activity, reducing smoking behavior, and assisting pain management. PubMed, Google Scholar, and CINAHL databases were searched using keywords such as wearables, cancer prevention, biosensors, monitoring, cancer care, and clinical trials. Findings will be further discussed and evaluated in this presentation. Suggestions for further research on the role of cancer wearables in cancer prevention and treatment will be provided.

Denia Marquez

Philosophy, UC San Diego
McNair Scholars Program
Mentored by Monique Wonderly, Philosophy

Addiction, Attachment, and the Ethics of Grief in Recovery

Theorists often characterize grief as a response to an irrevocable loss, usually from the death of a person of special significance to us. Interestingly, however, we also seem to grieve when we suffer from non-death-related losses (e.g., the loss of a romantic relationship) and non-human losses (e.g., losing a pet). In cases that lack these two paradigm features, many still report experiencing a constellation of grief responses that closely track the phenomenological features of bereavement. Here, I consider the case of the recovering addict who reports grieving over losses associated with no longer being able to practice their addiction. As such, the addict's loss is not strictly irrevocable, is not of a person and a death, and is of an object that, at least arguably, should not be seen as positively significant. I argue that such responses can, nevertheless, represent genuine, appropriate grief. First, I draw on insights from the psychological research on bereavement and review the affective features that are central to the grief presented in addiction recovery cases. I then tease out important links between the psychological phenomenon of attachment security and the presence of identity-constitutive aspects in

drug addictions to illustrate the role of grief in recovery. Next, I address worries that the relevant type of grief might hinder recovery or conflict with moral norms. Lastly, I draw out important ethical implications from the discourse on disenfranchised grief to show how they can inform the clinical objectives of both grief therapy and addiction treatment.

Sebastian Marroquin

Chemistry in Material Science, California State University, Long Beach
MRSEC REU or RIMSE
Mentored by Tod Pascal, NanoEngineering

Exploring Phase Transitions in Nanoconfined Media From First Principles

Metal-Organic Frameworks (MOFs) are materials made of metal clusters and organic ligands that can form one, two, or three-dimensional structures. By changing the metal ion, organic ligand, or the reaction conditions, the MOF can be altered for different applications, such as gas capture, drug delivery, and water harvesting. There is increased interest in liquefying gas molecules for electrochemical devices that can function at low temperatures due to their low freezing point. Confining gas molecules in the nanoscale environment within the MOF leads to dramatic changes of their physical and chemical properties, specifically the critical pressure and temperatures required for phase transitions.

Carbon dioxide (CO₂) and methane (CH₄) are two of the most prevalent greenhouse gases and are major drivers of human induced climate change. Direct removal of these gases from the atmosphere is one approach being explored to mitigate some of the extreme effects of global warming, and storage in MOFs is a promising avenue. In this work we will be using a computational approach to predict the phase transition (capillary condensation) conditions for CO₂ and CH₄ inside UiO66, one of the most popular MOFs. We quantify the phase behavior from extensive, atomistic computer simulations and calculation of the self-diffusive properties, which shows discontinuous behavior as a function of increasing pressure, the signature of 1st order phase transitions. We use these simulations to investigate the optimal storage conditions for these gases, and show that by varying the chemistry of the organic linker, even higher storage capacities can be realized.

Ashley Marshall

Mathematics with a double concentration in Biology and Chemistry, Xavier University of Louisiana

STARS

Mentored by Dr. Frances Contreras, Education Studies

UC Doctoral Programs: The African American Experience

This research focuses on the African American doctoral experience in the University of California (UC) school system and how the doctoral programs can be adjusted to be more inclusive and welcoming for African Americans who are enrolled at these universities. The UC Doctoral Experience Survey was used as a way to analyze how the African American students feel in regard to the resources and support they have been provided along their journeys to achieving their doctoral degrees. Identifying what areas the surveyed students believe need improvement is critical to the process of adjusting the programs to be more comprehensive for them. Bringing attention to the feedback of the African American doctoral students and actually putting action behind the suggested strategies that were found during this research will likely promote the enrollment and retention of African American doctoral students in the UC school system.

J Martin

Philosophy, UC San Diego

Triton Research & Experiential Learning Scholars (TRELS)

Mentored by PROFESSOR SAL NICOLAZZO, Literature

Trans Romanticism

The idea of Nature has come under scrutiny. Deconstructive, posthumanist and transfeminist theorists argue that Nature is a concept used primarily to justify oppressive social relations. My experience as a trans person validates this; the notion that we are “unnatural” is highly pervasive and obviously harmful. Yet we live in a moment where it is difficult to consider anything to be “Natural”. Industrialism has spread worldwide, pharmaceuticals have altered human biochemistry, people have intimate relationships with technology, and the sites we call “Natural” are being destroyed, maintained and/or changed by human activity. It is in these conditions that I encountered Romantic poetry in William Wordsworth, Charlotte Smith, Erasmus Darwin, etc. This period’s poetry is concerned primarily with Nature, and is seen as a reaction to an industrialization. My project is an autotheoretical account of my encounter with Romanticism, as a trans person, in the style of memoir/criticism hybrids like Paul Preciado’s “Testo Junkie”. It will attempt to do a few things. One will be to begin to generate an ecocritical and technofeminist account of what it means to

encounter “Nature” as a trans person, asking how can we reinterpret “Nature” in a manner that is productive and non-hegemonic? It will then ask how this reinterpretation alters our understanding of “trans”. This will draw on the work of Paul Preciado, Eva Hayward, and Timothy Morton. The project will in turn use Romantic Works as inspiration for such productive models of the concept of “Nature”.

Ivette Martinez

Education Sciences and Sociology, UC San Diego
McNair Scholars Program
Mentored by Dr. Makeba Jones, Education Studies

‘I Wish I Would Have Taken More Advantage of GEAR UP’: Looking at the Impact of Federal Educational Intervention Programs on Latinx Students

The Hispanic/Latinx population in the United States has grown dramatically in the last few years. Today, they are our nation’s largest ethnic/racial minority. However, despite their growing numbers, Latinx students continue to be underrepresented in postsecondary education. This paper focuses on the impact of Gaining Early Awareness and Readiness for Undergraduate Programs (GEAR UP) on the educational experiences of Latinx students. GEAR UP has been around since 1998, at high poverty schools, where at least half of the students receive free or reduced meals (Standing et al., 2008). I have interviewed nine former GEAR UP students who identify as Hispanic/Latinx, and are currently juniors and seniors in college, as well as one GEAR UP Coordinator. Their experiences have helped me further investigate the elements from the program that have positively impacted the educational experiences of Latinx students and their families, and conversely, what the program could do in order to better serve and support them. It is essential to study this issue thoroughly as we would like to see that the make up of our universities is reflective of our population, and Latinx students deserve to be in these spaces. However, it is also important to consider that this study is not generalizable since it focuses on the experiences of only a selected group of participants who were a part of GEAR UP in southern California, but their stories provide valuable insight.

Deisy Martinez

Cognitive and Behavioral Neuroscience, Business Psychology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Karen Dobkins, Psychology

Who are the People who Engage in Dishonest Behavior at UC San Diego and Why do They Do It?

Students are often in high-stress, high-temptation environments, allowing themselves to rationalize actions and choices in a manner that minimizes the gaps separating their moral standards from their real actions. This separation between the self and the action taken has led to increased academic dishonesty. Literature has shown that morally transgressive behaviors take on different forms and those who choose to transgress do not always transgress in all domains. Given individual differences in each person's willingness to engage in dishonesty, we aim to investigate what the differences are that facilitate violating one's academic integrity. A proposed motivator to academic dishonesty has been stress and anxiety regarding grades. The current study will measure academic stress to see if this is associated with the tendency to be dishonest; This will be done through an online task from which individuals can earn money. Although an online task does not have as much at stake as a test in an academic class, we consider it a proxy for overall tendency to cheat. We will also look at the effects of psychological and academic entitlement, which is the perception that one is entitled to higher grades than earned, regardless of effort. We aim to further understand the relationship that academic stress and academic entitlement have with each other, as well as with an overall tendency to engage in dishonest activity. The data will be analyzed through a multiple-linear regression with the outcome measure being the extent to which an individual will choose to cheat.

Beatriz Martinez-Martin

Biology, University of San Diego
McNair Scholars Program
Mentored by Dr. Nicole Danos, Biology

Athletic performance and injury susceptibility in mothers

Every year, approximately 4 million babies are born in the United States, meaning that 6.3% of women aged 15-44 become mothers. Most women (57.6%) breastfeed their baby for 6 months. We know that pregnancy and lactation hormones alter skeletal muscles and connective tissues, yet little is known about the effects of pregnancy and lactation on a woman's muscular system especially after going back to daily routines and exercise. It has been suggested that the increased hormonal levels, in particular

relaxin and estrogen, can lead to overuse injuries. On the other hand, mothers who are elite athletes often perform better when coming back from a pregnancy. The objective of this study is to bridge the gap in our understanding of the effects of pregnancy and lactation on athletic performance and injury susceptibility in mothers. Our approach is to administer a survey to collect epidemiological data to establish what kinds of joint injuries women sustain after pregnancy. Additionally, we search databases to collect names of mothers that are elite athletes, in order to document whether there is an advantage to performance after giving birth. The data gathered from both the survey and databases will help guide us to the relationship between exercise and injury susceptibility in elite athletes and the average mother. This study opens further research to create a baseline in which physicians can determine at what point exercise can cause injury to a mother.

Dylan Martirano

Psychology, California State University, Northridge
STARS
Mentored by Dr. Melinda Owens, Neurobiology

What do College Biology Students Know or Misunderstand About the COVID-19 Vaccine's Content, Function, and Side-Effects?

There are many misconceptions about how COVID-19 vaccines work and the side-effects that may ensue. Given the many COVID outbreaks at colleges, we were interested in examining college students' knowledge of how the COVID-19 vaccine functions and their perceptions of the side-effects. In April 2021, we recruited 525 participants taking University of California San Diego biology courses for Advanced Biology Majors (ABM), Entry Biology Majors (EBM), and Non-Biology Majors (NBM). Participants completed an electronic survey for a nominal amount of extra credit. Participants were asked whether they agreed with COVID vaccine misconceptions, such as if a vaccine includes a tracking device or can alter DNA. They were also asked to explain how a COVID vaccine works. We are interested in the correlation between the levels of students' expertise, the extent of their knowledge about how the vaccine works, and whether they believe in certain side-effects. We predict that ABM will be more knowledgeable than EBM and NBM about the content of the vaccine, how it works, and its side-effects. We also hypothesize that those who are knowledgeable about how the vaccine works may still have misconceptions about its side-effects. Currently, we are analyzing student knowledge of the COVID vaccine contents and functions and correlating their responses with their level of expertise and whether they agree with certain side-effects. We hope these findings will shed light on how college biology instructors can best target misconceptions about COVID vaccines to students of different levels.

Keanu Ray Masga

Chemistry and Biology, UC San Diego

MRSEC REU or RIMSE

Mentored by Dr. Jinhye Bae and Dr. Tod Pascal, MRSEC

Swelling and Deswelling Kinetics of Poly(N-isopropylacrylamide) Hydrogels

With a wide range of biomedical and industrial applications including functional membranes synthesis, biosensors, tissue engineering, drug delivery, and tertiary oil recovery, Poly(N-isopropylacrylamide) (PNiPaam) hydrogels exhibit unique characteristics that vary based on changes in temperature, additives, and intermolecular interactions. PNiPaam is a thermally responsive polymer that undergoes a phase transition above its lower critical solution temperature (LCST). In phase transitions occurring above the LCST, a change of hydrophilicity to hydrophobicity of the polymer chain is observed; an inverse change of hydrophobicity to hydrophilicity will also be observed below the LCST. Exploring the mechanism in PNiPaam hydrogel systems through molecular modeling will illustrate the relationship of the changes in transition temperature and the chemistry of the polymer and its additives. We will present the efforts of a joint experimental and computational investigation of the connection between additives and transition temperature changes. Measurements of the swelling and deswelling ratios of hydrogels at varying temperatures and additive concentrations will be combined with modeling data of the molecular mechanisms and intermolecular interactions of PNiPaam, additives, and water during their swelled and deswelled states. Establishing the link between chemical kinetics and transition temperature change will reveal how additive concentration can affect molecular structures and LCST to develop specific critical temperature characteristics in hydrogels. Thus, bridging the gap between the molecular interactions and critical temperature change phenomena has the opportunity to expand the application of hydrogels for drug delivery techniques via nanoengineering.

Lenny McCline

Chemical and Biomolecular Engineering, UC Los Angeles

MRSEC REU or RIMSE

Mentored by Professor Jon Pokorski, Nanoengineering

Materials Optimization for Non-Refrigerated, Self-Administered, Mass-Produced, and Painless Microneedle Vaccine Devices

Current vaccination methods require constant refrigeration and administration by a healthcare professional, which greatly hinders vaccine distribution. The development of non-refrigerated, self-administered, and mass-producible vaccines would increase

global access to such medicines and assist in a rapid, equitable worldwide response to future pandemics. To this end, melt-processed, solvent-free microneedle arrays that deliver virus-like particle (VLP) vaccines can be shelf-stable for months without refrigeration and are a promising avenue for vaccination efforts. From a design perspective, self-administered microneedles must be composed of a rapidly water-soluble polymer that molds into needles strong and sharp enough to penetrate skin. Existing water-soluble polymers have limitations based on melting point, melt viscosity, mechanical strength, and speed of dissolution. We report on our efforts to optimize the polymer formulation in order to achieve sufficient and consistent payload delivery. Candidate polymer formulations were evaluated on melt viscosity using rheometry. Promising candidates were made into microneedle arrays using a lab-designed bench-top vacuum injection molding device. The microneedles were examined for sharpness using Scanning Electron Microscopy (SEM), payload release was evaluated using fluorescence assays, and mechanical strength was assessed through porcine skin penetration assay. The success of these studies will allow for future in-vivo tests to be conducted. Injection-molded microneedle devices could significantly increase the speed and diversity of global access to life-saving medicines.

Brice McKane

Marine Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Greg Rouse, SIO

Two New Deep-Sea Species of worms (Sabellariidae, Annelida)

Sabellariidae, known as honeycomb or sandcastle worms, are bottom-dwelling filter-feeding marine worms that live at a variety of depths and build protective tubes out of sand and other materials. In this presentation, we describe two new sabellariid species in the genera *Gesaia* and *Phalacrostemma*. The worms were collected at depths between 250 and 600 meters on seamounts in a remote area of the South Pacific near Rapa Nui (Easter Island). The *Phalacrostemma* specimens were found attached to the spines of sea urchins, *Stereocidaris nascaensis*. Morphological descriptions of the new species are accompanied by a phylogenetic analysis using cytochrome c oxidase subunit 1 (COI) sequence data. The biogeography of these genera is also examined.

Clara Medina

Environmental Engineering, UC Merced

UC LEADS

Mentored by Dr. Colleen Naughton, Department of Civil and Environmental Engineering

Equity of Wastewater Monitoring of SARS-CoV-2 in California

During the span of the ongoing coronavirus disease 2019 (COVID-19) pandemic, the scientific community has fostered a responsibility and standard to provide accessible public health resources within their communities. Continuing the methods of the “COVIDPoops19” global dashboard of wastewater monitoring for SARS-CoV-2, the goal of this research was to perform a geospatial equity analysis of COVID-19 Wastewater Based Epidemiology (WBE) in the U.S. state of California. Methods included a combination of government-provided data, standard literature review, webinars and conferences, and database keyword searches. There are 12 universities, 9 public dashboards, and 48 of 384 wastewater treatment plants monitoring wastewater for SARS-CoV-2 within their communities and counties. Considering the monitoring inequities in disadvantaged communities throughout the state, WBE cannot be solely dependent on publicly accessible data with the many gaps that present themselves in the income, linguistic, educational, and health access disparities. Much of the wastewater monitoring in rural areas particularly in the Central Valley of California hardest hit by COVID-19 in the state with lower vaccination rates. Also, little monitoring is occurring in Northern California. Similar to access to COVID-19 clinical testing and vaccinations, there is disparity in access to wastewater testing that can often provide an early warning system to outbreaks. This research demonstrates the need to consider equity when determining locations for environmental monitoring.

Capalina Melentyev

Bioengineering, UC San Diego

Genentech Scholars Program

Mentored by Dr. Frank E. Talke, Mechanical Engineering

Optimal Active Material Concentrations on Antimicrobial Coatings for Inhibiting Biofilm Formation on Urinary Catheters

Catheter associated urinary tract infection (CAUTI) is one of the most common healthcare complications, accounting for approximately 30% of hospital infections. With extended catheter use, bacteria can accumulate on the surfaces of the urinary catheter and form biofilms.

Biofilms act as a microenvironment where bacteria can survive and replicate, leading to increased antibiotic resistance. To prevent biofilm accumulation, antimicrobial coatings consisting of a mix of PDMS, Ag and Ag₂O were developed.

In this study, a number of antimicrobial coatings were manufactured and analyzed using a scanning electron microscope (SEM) with a backscattered electron (BSE) detector to study the particle distribution and distance between heavy metal particles. Different ratios of Ag to Ag₂O were used in the coating formulations to determine the optimal concentration of active material for biofilm inhibition. Additionally, improved manufacturing methods were developed using computer aided design (CAD) software and additive manufacturing techniques such as 3D printing. In the presentation, the experimental techniques used in this research project will be described. Preliminary results will be discussed and future plans for testing different concentrations of active material in antimicrobial resistance tests will be described.

Jennifer Mendez

Bioengineering, University of California, Merced
CAMP

Mentored by Professor Rudy Ortiz, School of Natural Sciences

5-Week Oral Cannabidiol Reduces Systolic Blood Pressure in Metabolic Syndrome (OLETF) Rats

Cardiovascular disease (CVD) is the leading cause of death in the U.S. (1/4 deaths annually) and is the main outcome of metabolic syndrome (MetS) which effects more than 30% of the U.S. population. Among those with MetS, more than 85% have high blood pressure (hypertension). Inflammation and oxidant-associated damage are directly tied into hypertension. Cannabidiol (CBD) is a non-psychotropic cannabinoid that has demonstrated anti-inflammatory and strong antioxidant activity. We hypothesize that oral CBD administration (150mg/kg/dx5 wks) will attenuate early onset of hypertension in a rat model of MetS, Otsuka Long-Evan's Tokushima Fatty (OLETF). Systolic blood pressure (SBP) was measured in 3 subgroups, Long-Evans Tokushima Otsuka (LETO) control group (n=1), OLETF (n=1), and OLETF+CBD (n=3) via surgically implanted radiotelemeters [DSI]. High SBP (>130mmHg) is an indicator of hypertension. Our preliminary data shows that 5-week administration of CBD reduces SBP area under the curve by 3.9% over 35 days. At the start, the SBP for LETO, OLETF, OLETF+CBD was 136+/-1mmHg, 144+/-1mmHg, and 145+/-1mmHg respectively. During the last 3 days, OLETF had a 2.7% increase (148+/-1mmHg) in SBP while OLETF+CBD had a 3.5% decrease (140+/-1mmHg) from the start of the study. CBD is shown here to provide partial amelioration of hypertension if administered at the MetS stage of disease progression which suggests that it may have additional cardiovascular benefits not measured here.

Amaya Mendez-Molina

Chemistry, UC San Diego
Creating Scientists To Address Cancer Disparities Program
Mentored by Dr. Georgia Sadler, Surgery

Cultural barriers of diagnosing and treating cancer within the indigenous Hispanic community

Indigenous Hispanic women are commonly affected by cervical and breast cancer. Their beliefs and attitudes contradict modern practices and they oftentimes do not feel comfortable seeking treatment from modern practitioners. Common risk factors include fatalism, language barriers, and culturally patterned ideas, such as punishment for immoral behavior or loss of a soul. This narrative review of the scientific literature identified relevant articles using such databases as PubMed and Elsevier. The search was conducted using such keywords as: indigenous, Hispanic/Latino/Latina, breast cancer, cervical cancer, spirituality/religiosity, curanderos, access, and cultural barriers. The English and Spanish versions of those words were used when available. This presentation will discuss the findings from this literature review and highlight implications. Recommendations for future research will also be provided.

Benjamin Mendoza

Psychology, California State University, Fullerton
STARS
Mentored by Dr. Judith Fan, Psychology

Measuring and improving graph literacy in college-level statistics students

Understanding how to draw appropriate inferences from data visualizations is an increasingly important skill for all educated citizens to acquire in the 21st century. The current study has two goals: the first goal is to validate and refine existing instruments used to measure this skill in college students taking introductory statistics courses. The second goal is to leverage this instrument to advance theories of the underlying cognitive mechanisms that support graph comprehension in a wide variety of contexts. To achieve these goals, we will first conduct a replication study combining the 12-item graph literacy scale employed by Galesic and Garcia-Retamero (2011) with 12 new items taken from exams used in an introductory statistics course. We will analyze data from the replication study to estimate how robust and stable estimates of graph literacy have been over time, by comparing our results to those from Galesic and Garcia-Retamero (2011). Next, we will conduct a factor analysis to partition these items into subsets of questions that people either consistently succeed or fail on, providing a data-driven way to identify distinct mental processes and skills that may together constitute graph

literacy, as well as evaluate existing cognitive theories of graph comprehension. Taken together, results from such studies will help provide college educators with better tools for measuring the acquisition of graph literacy, as well as contribute to knowledge about how people learn to read and interpret graphs effectively.

Nancy Mendoza Estrada

Clinical Psychology, CSU Northridge

STARS

Mentored by Dr. Lisa Eyler, Department of Psychiatry

The Examination of the Relationship Between Levels of Loneliness and Cognitive Performance During the Coronavirus Pandemic in Older Adults

Psychosocial factors are critical to older adults' cognitive health and functioning. Loneliness is a public health risk and is exacerbated during a pandemic, although social contact through video technology might buffer negative effects of isolation and loneliness. Older adults who are isolated or who report feelings of loneliness have poorer cognitive functioning. Through the Stay-at-home Wellness Ecological Momentary Assessment in Late Life (StayWELL) study, we are examining well-being and psychosocial traits in a group of healthy (> 65 years) older adults across the course of the coronavirus pandemic. In the Summer and Fall of 2020, participants completed self-report surveys administered via cell phone, online questionnaires, and cognitive assessments administered via videoconferences, including measures of short-term and working memory, verbal fluency, and verbal episodic learning and memory. One of the mobile surveys included the UCLA Loneliness Scale to measure self-reported loneliness across the previous two-weeks. Additionally, the survey included questions regarding participants' use of video technology for social interactions. Our study aims to examine the relationship between levels of loneliness and cognitive performance during the coronavirus pandemic in healthy older adults and possible moderators of this association. We will test the following hypotheses: 1) higher loneliness will be associated with lower cognitive composite scores, and 2) the relationship between loneliness and cognitive composite score will be strongest among those with no use of video interactive technology, slightly less for those with moderate use, and the weakest relationship will be observed among those with high video technology use.

Judy Mohamad

Mechanical Engineering, UC San Diego
STARS
Mentored by Dr. Mike Tolley, Nanoengineering

Pneumatic Foam Jamming Feet for Stabilizing Walking Robots

Small irregularities in uneven terrain induce body instability in walking robots. Walking robots with completely rigid limbs often slip and can't maintain balance when walking on uneven terrain because their limbs slip off of irregularly shaped obstacles and the foot essentially digs itself into the ground, instead of making forward progress. To ensure a walking robot can maintain traction on the ground it is walking on, its limbs must deform to some degree upon stepping on uneven ground. However, robot legs must maintain some stiffness in the direction the robot is walking in order to generate enough force to push off the ground. Thus, in this project, we aim to develop compliant feet that collapse anisotropically, maintaining stiffness in the horizontal direction but deforming vertically to absorb ground impact. We incorporate foam and rigid elements and use a pneumatic system to actuate the robot feet. We expect to generate a larger push off force by incorporating rigid elements as opposed to using a uniformly soft structure. If the compliant feet are able to sufficiently deform upon stepping on terrain irregularities and allow a robot to maintain traction on rough ground, they may be integrated into robots used in exploration to improve their adaptability to uncertain environments.

Noura Mohamed

Chemistry/Biochemistry, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Gulcin Pekkurnaz and Haoming Wang, Division of Biological Sciences

Spatial Regulation of Glycolytic Enzymes on Mitochondria in Neurons

Age-related neurodegeneration is increasingly at the forefront of current healthcare challenges due to aging population growth, and mitochondrial damage is at the crossroads of many neurodegenerative diseases. To better understand this relation, it is essential to elucidate the specific molecular pathways behind mitochondrial stress and their dependent cascades. Pekkurnaz lab discovered that glycolytic enzymes can be spatially organized on mitochondria to enhance neuronal metabolic efficiency. The overall goal of this project is to study the mitochondrial mechanisms of glycolytic enzyme compartmentalization, "glycosome" formation, in mammalian neurons, and how age-like chemically induced mitochondrial damage alters this pathway. Neuronal metabolism is tightly coupled to mitochondrial positioning in a process regulated via the

metabolic sensor enzyme O-GlcNAc transferase (OGT). Pekkurnaz lab showed that OGT co-regulates mitochondrial trafficking rate and the glycolytic enzyme brain hexokinase (HK1) positioning on mitochondria. This modification of HK1 by OGT is key for this newfound coupling for neuronal metabolic efficiency. It is known that both OGT and mitochondrial functions decline in many age-related neurodegenerative diseases. This research focus is to examine how mitochondrial dysfunction and damage affects HK1-mitochondria coupling and metabolic homeostasis in neurons. We hypothesized that mitochondrial membrane potential regulates the rate of glycosome formation on mitochondria. Chemical agents were used to alter mitochondrial membrane potential, and fluorescent microscopy methods alongside western blots were used in glycolytic enzymes quantification across differing membrane potentials. While this investigation has yet to be completed, our preliminary data suggest an inverse relation between mitochondrial damage and glycolytic enzyme localization on mitochondria.

Asim Mohiuddin

NEUROBIOLOGY, UC San Diego

INDEPENDENT STUDY UNDER PI NO CREDIT

Mentored by DR. MARIPAT CORR, RHEUMATOLOGY, ALLERGY & IMMUNOLOGY

Drivers of Chronic Symptoms In Mouse Arthritis

Rheumatoid arthritis is an autoimmune disease that results in painful swollen joints and can lead to permanent chronic deformities. Pain can persist after the resolution of detectable inflammation, and often has the characteristics of neuropathic pain. Here we sought to use existing data on neuropathic pain and map it to data relating to the K/BxN serum transfer model of arthritis. Previously described genes identified in mouse models and human disease of being associated with pain were entered into String DB; a program with a data base that maps the quality and quantity of known interactions between proteins. Based on connectivity and relevance to the desired connection several genes were chosen as potential critical intersection points for the development of neuropathic pain. To validate the proteins at the nodes of this virtual model I looked at existing data in the K/BxN model from the lab for three proteins identified as key nodes in StringDB: IL-10, type I interferon receptor (IFNAR1), and Toll-like receptor (TLR)4. Using a statistical analysis program I then compared the relative ankle swelling and mechanical sensitivity curves to test if the modelling program presented valid hypotheses. Compared to wild type mice these three proteins appear to be involved in the evolution of both swelling and pain in the arthritic mice. Our data suggests that the regulation of pain and swelling in arthritis may have key intersection points that would be amenable as therapeutic targets to existing and novel therapeutics.

Shoh Mollenkamp

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

Real-time SARS-CoV-2 phylogenetics

Since the beginning of the COVID-19 pandemic around December 2020, scientists and public health practitioners have sequenced the SARS-CoV-2 virus genome and over 2 million virus samples have been sequenced so far. This has enabled us to track the evolution of a pathogen in real time. However, the amount of data has pushed the current bioinformatics tools to beyond their limits. To handle this, an ultrafast phylogenetic placement tool, called UShER, was created. The project seeks to improve UShER to be able to continue tracking the evolution data in real-time as the number of samples continues to increase. One way that our tool has to be improved for placing newly-sequenced SARS-CoV-2 samples is by hiding the large overhead involved in loading the mutation-annotated tree (MAT) object from a file. MAT is a tree object that also stores the lists of mutations at each node. There is a web tool that uses UShER that allows users to add a new sample into an existing MAT. For this tool, a MAT is currently loaded from a file every time a new query is sent to the web tool, which can take several minutes since the tree size is so large. However, the tool can incorporate a new sample in less than a couple seconds, on average. By pre-loading this MAT, we can cut the time it takes to load the MAT and allow the web tool to provide results a lot quicker.

Nicholas Monroe

Public Health, San Diego State University
Creating Scientists To Address Cancer Disparities Program
Mentored by Dr. Malcarne, Psychology

Disparities pertaining to Wilms Tumor patients in different cultures and socioeconomic backgrounds

Wilms Tumor occurs almost exclusively in children between the ages of 3 and 4 and rarely beyond age 18. When detected early, it is highly curable. It is easily identified by parents and providers as the tumor protrudes below the skin. This ease of discovery increases the likelihood of being discovered in its earliest stages when cure is most likely. Long term side effects are generally limited to visible surgical scars on the abdomen and back. If the tumor is not in the early stage, chemotherapy offers an additional promising treatment option. Wilms Tumors are diagnosed more often in children born to families of lower socioeconomic status, making it difficult for them to access the care at a children's hospital. For most children in the United States, the cost

of the care will be covered, but not the other ancillary expenses that accompany a geographically distant health venue. This is a particular concern because low-income families rarely have the resources to travel to children's hospitals. This narrative review of the scientific, peer-review literature explored what interventions have been developed to assure that low-income children receive optimal cancer care. This review identified articles using PubMed, CINAHL, and PsycINFO databases and such key words as: disparities, ethnicities, Wilms Tumor, multicultural, socioeconomic and treatment. Reference lists of key articles were considered. The findings discussed in this literature review will detail relevant implications and explain practical statistics. Future research resources will be available during the conference.

Eduardo Montano

AEROSPACE ENGINEERING, UC Irvine

STARS

Mentored by Dr. Michael Frazier, Mechanical & Aerospace Engineering

The use of the Moire affects structural multistability in metamaterials coupled via magnetic interaction.

Mechanical vibrations and waves are everywhere in everyday life. Engineers attempt to control vibrations and waves for practical purposes such as for communication, protection, or comfort. Most materials possess inherent dynamic properties stemming from a atomic-/micro-structure that is difficult to manipulate, and thus, offers little control over the vibrations and waves within the material; however, metamaterials allow engineers to control the dynamics of the material by directly tailoring its 3D-printable, internal architecture. Thus, rather than be limited by chemistry as is the case for traditional materials, metamaterial dynamics is only limited by the state-of-the-art in 3D-printing technologies which continues to advance. However, once fabricated, the metamaterial properties are unchanging; therefore, wave and vibration dynamics are considered to be fixed. It is desirable for materials to exhibit multiple functions, requiring a change in performance that is impossible with the fixed architecture. The Moire effect and structural multi-stability offer a path toward tunable microstructures. The adjustable wave vibration allows for a metamaterial to have multiple types of behavior. Multi-stable metamaterials are stacked to create the Moire effect and coupled via magnetic interactions. This is expected to cause the vibration and wave propagation to change with the angle of twist of the microstructure.

Martin Montiel

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

Moving with the times: alternative cancer treatments for children.

Cancer treatment can be an invasive and traumatizing experience. Children can be particularly affected by the symptoms of their disease, as well as the harsh side effects of treatment. Multiple studies have suggested that an effective method for helping young patients deal with the challenges of this debilitating disease is playing video games. With over 90% of children playing video games, this treatment option can be an effective tool in helping young patients overcome the hardships presented with a cancer diagnosis. A literature review will be conducted using multiple databases including APA PsycINFO, Pubmed, The Journal of Medical Internet Research and The Journal of Education and Health Promotion with the keywords Video Games, Children, Adolescents, Cancer, Treatment, Alternative, Comfort, Disparities, Digital, Management, Challenges and Medium. The results presented will highlight the possible contributions of video games to cancer management in children. Implications for children from lower socioeconomic and ethnic minority communities will also be discussed.

Brooklyn Moore

Political Science - International Relations, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Stephen Rawling, Division of Infectious Diseases & Global Public Health

Changing Treatment : A look into the advancement for transgender healthcare procedures

Spaces within American are designed to reflect a Cisgender normative outlook. However, these outlooks can lead to long term harm when a member of the transgender community is introduced to said spaces. Healthcare, along with education, housing, and the workforce, are all spaces that have been designed to meet the needs of cisgendered bodies and lack a sense of inclusiveness. This research is focused on providing training and transgender education for healthcare professionals to better create a space for transgender bodies in areas that have not been inclusive. The research conducted was centered around a series of interviews with members of the San Diego transgender community about their experiences operating within these medical spaces which allowed for a direct feedback about how to better change current practices. The outcome of these interviews, combined with examining successful training and/or practices, will then be turned into a lecture/training manual to be

presented to local medical facilities such as the San Diego VA. The goal of this research is to advance the transgender healthcare directive, and create a better system of affirming care by normalizing and educating individuals on how to better include the transgender community.

Francisco Morales

Electrical Engineering, UC San Diego

MRSEC REU or RIMSE

Mentored by Professor Michael Sailor, Chemistry and Biochemistry

Effect of Porous Silicon Microparticle Size on HIV Pre-Exposure Prophylaxis Loading Capacity

Porous silicon microparticles (pSiMPs) have nanometer scale pores capable of being loaded with drugs. Prior work has established that pSiMPs can be loaded with contraceptive drugs, and this materials system has been explored as a long-acting, controlled release platform for intramuscular or sub-cutaneous drug delivery. Some contraceptive drugs can increase risk of HIV infection, creating a need for platforms that release a contraceptive and an HIV prevention medication simultaneously.

Here, we will explore the loading of a pre-exposure prophylaxis (PrEP), HIV-preventative drug in pSiMPs. We will systematically vary the pSiMP preparation conditions to control surface area, pore size, and surface chemistry, with an aim of maximizing drug loading capacity. The pSiMPs will be synthesized via established electrochemical corrosion and ultrasonication steps, and the resulting materials will be characterized by porosimetry, optical reflectance, Fourier-transform infrared spectroscopy, light microscopy, and scanning electron microscopy. Model drugs will be loaded into the microparticles by melt infiltration, and the process will be evaluated by differential scanning calorimetry and thermogravimetric analysis.

This investigation will explore the effect of pore size and porosity on drug loading, in order to inform future studies of the two-drug combined drug release platform.

Ola Hatem Mohamed Elmoatasem Mostafa

Molecular and Cell Biology, UC San Diego

UC Scholars

Mentored by Dr. Enfu Hui, Cell and Developmental Biology

Investigating the Driving Factors of PD-1 Clustering

Previous studies have shown that some membrane proteins in T cells (eg. LAT) cluster into micron-sized droplets upon activation. In addition, those droplets are thought to create isolated physical and chemical compartments that facilitate downstream

signaling. Recent studies have shown that the immune checkpoint receptor, programmed cell death protein (PD-1) forms micro-clusters upon ligation with its ligand (PD-L1) that acts as hotspots of inhibitory signaling. However, it is unclear whether the cluster formation is driven by the extracellular-, transmembrane-, or intracellular-domain (ICD) of PD-1. In addition, there is not enough information about the biochemical and physical compositions of those clusters. In this project, we will test the hypothesis that the ICD of PD-1 is sufficient to drive protein clustering. In addition, we will test whether the interactions among PD-1, SHP2 and the Src family kinase Lck are sufficient to drive PD-1 clustering. We aim to reconstitute the fluorescently labeled, phosphorylated ICD of PD-1 to a planar lipid bilayer and observe its behavior over time by itself and upon the addition of Lck, SHP2, or both. Results from this study will provide preliminary data to determine the driving factors of PD-1 cluster formation, which in turn, may provide novel insights to the PD-1 signaling mechanism.

Alyssa Mugavero

Sociology & Interdisciplinary Humanities, University of San Diego
McNair Scholars Program
Mentored by Dr. Carlton Floyd, English

Framing What We See and Know: Empathy as a Socio-Cultural Solution to Indifference

How we make meaning of what is around us is predicated upon the stories we invent. We know how to get around in the world because we collectively rely upon what has been conventionally and conceptually established as reality. This collectively possessed reality maps out for us the nominal ways of thinking and being within various social scenes. An analysis of various socio-cultural theories from Antonio Gramsci, Noam Chomsky, and George Lakoff suggests that we invent our realities or facts of life from, or within, the very language we use in our everyday lives to explain and understand our experiences. We consider texts by Octavia Butler, Ursula Le Guin, among others to explore the limits of empathy and altruism within the current ways that our language frames our reality. We focus on science fiction writers as it offers a more malleable view of reality than other kinds of texts. Given our current state of national and global and socio-political and socio-economic indifferences, we find that socio-cultural practices of empathy and altruism seem to be much needed, and yet our language seems to restrict these forms of human connectivity commonly correlated with concepts such as community. The writer, James Baldwin, prompted this inquiry when he noted in “The Evidence of Things Not Seen,” the need to “excavate” the concept of community, which he thought meant “our endless connection with, and responsibility for, each other,” but rarely saw evident in the world except among those “submerged” within the reality we have created.

Kimberly Mundy

Pharmaceutical Science, North Carolina Central University
UC-HBCU Pharmacy
Mentored by Conor Caffery, Pharmaceutical Sciences

Profiling the degradome of the parasite responsible for Human African Trypanosomiasis

Kimberly Mundy*, Lawrence Liu, Anthony O'Donoghue, Conor Caffrey
Skaggs School of Pharmacy and Pharmaceutical Sciences, UC San Diego

*Presenting author

Human African trypanosomiasis (HAT) is a neglected tropical disease that threatens 65 million people in the sub-Saharan Africa. The disease is caused by the flagellated protozoan, *Trypanosoma brucei*, and is transmitted to humans by tsetse flies. Current drug therapy relies on a handful of outdated and toxic drugs, and, for some, resistance is well-established. The disease is invariably fatal if not treated properly and new drugs are needed. Proteolytic enzymes (proteases) are validated anti-infective drug targets, including for *T. brucei*. However, apart from a small number of well-characterized *T. brucei* proteases, the protease landscape or 'degradome' in the parasite is not well characterized and from which new drug targets may be discovered. We have assembled a library of 150 fluorogenic peptidyl substrates with which the *T. brucei* degradome will be profiled. The library, assay and data arising, including in the presence of selective protease inhibitors, will be discussed. The proteolytic profiles that emerge will form the basis for a deeper characterization of the responsible proteases with a view to understanding their roles in parasitism by *T. brucei* and their potential as drug targets.

Tiffany Murga Duarte

Bioengineering, UC Merced
UC LEADS
Mentored by Roberto Andresen Eguiluz, Materials Sciences and Engineering

Optimization of ECM Ligand Patterning on Polyacrylamide Hydrogels

Tiffany Murga Duarte, Nawshin Sultana Jenifar, Roberto Andresen Eguiluz,
School of Engineering, University of California, Merced

Polyacrylamide hydrogels are used to prepare substrates of controlled stiffness to explore extracellular matrix (ECM) effects on epithelial cell function. The surface of these hydrogels are relatively simple to functionalize with different ECM components, such as collagen or fibronectin, making them very versatile once it is transferred onto

the hydrogel. In this project, we will control the shape (circular), size, and the number of arrays of the ECM ligands, and optimize the protocol to obtain high reproducibility. The presented approach does not require photolithography approaches. Optimization is important to observe the epithelial cell function clearly under the microscope. The ECM-ligand patterned hydrogels will then be plated with cells, to yield a cell monolayer within a controlled geometry and cell colony size. These cells will be used for an in vitro model to mimic the alveolar epithelium in the lungs where smoke will be introduced and the effects will be recorded.

Avani Mylvara

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Joe Pogliano, Molecular Biology

Investigating CasPhi Infiltration of the Phage Nucleus

Jumbophage (bacteriophage with genomes >200 kb) protect their genome from host defenses including CRISPR-Cas systems by enclosing it within a protein-based compartment constructed by the phage called the phage nucleus. Recently, a novel Cas enzyme, CasPhi, was identified in metagenomic sequences of diverse jumbophage and can cleave double-stranded and single-stranded DNA at sites specified by a guide RNA. We hypothesize that CasPhi may have been adapted as a weapon against nucleus-forming phage in phage-phage competition. Jumbophage with CRISPR-Cas systems carry spacers against other phage, indicating their role in phage competition, and because CasPhi is smaller than other Cas enzymes, it may be able to enter the phage nucleus unlike larger enzymes. Our goal is to investigate whether CasPhi can enter the phage nucleus and destroy the jumbophage DNA. In our experiments, we will infect *Pseudomonas aeruginosa* cells expressing CasPhi with nucleus-forming jumbophage PhiKZ and use a variety of techniques to determine whether CasPhi can infiltrate the phage nucleus and inhibit phage replication. We will use plaque assays and bacterial growth curves to determine whether targeting the major capsid protein gene of PhiKZ with CasPhi inhibits phage replication. In addition, we will demonstrate whether fluorescently-tagged CasPhi enters the PhiKZ phage nucleus during infection using fluorescence microscopy. Knowledge gleaned from these studies will be critical to understanding whether the phage nucleus can protect viruses from Cas enzymes made by competing phages.

Valli Nachiappan and Nicholas Rowlett

Computer Engineering / Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Nathan Hui, Electrical and Electronics Engineering

Smartfin

Nearshore waters are some of the most difficult areas to measure wave dynamics due to the dynamic wave environment, lack of buoys, and inaccuracy of satellite measurements near the coast. Currently, data gathering buoys are too far from the coastline, and too sparsely located to perfectly predict the wave height near shore due. It is expensive, aesthetically unappealing, and oftentimes impossible to place large amounts of buoys near coastal areas. This project plans to prove that the Smartfin has the potential to provide accurate near shore wave height measurements. The Smartfin is a surfboard fin that contains an inertial measurement unit and GPS receiver, and can be attached to most longboards. A Kalman filter is used to refine and fuse inertial data, which is in turn used to calculate wave height through spectral analysis. Prior research on the Smartfin indicates that the fin has the potential to produce wave height data closer to the coastline than a buoy and satellite. Our goal is to explore methods of determining wave height using inertial data gathered with a smartfin utilizing Kalman Filters and Spectral Analysis.

Naike Ngassam

Political Science, Spelman College
STARS
Mentored by Tom Wong, Political Science

Society vs. The Unhoused

It is interesting to think about the resources we use everyday, without giving it much thought. However, for individuals who lack those same benefits, the absence is felt through the overall quality of life they experience. International and National laws state that adequate housing is considered to be one of the most fundamental human needs. However, Unhoused/Homeless individuals' human rights are breached everyday, as they navigate society without a secure place to live. Findings will indicate that lack of legal advocacy within American laws and policies, have led to the criminalization of homelessness. As a result, there has been a detrimental impact on the unhoused/homeless individual's environment, physical and mental well-being, and safety. These crucial discoveries reveal that efforts to address and end homelessness will require thoughtful legislation and significant involvement from local, state, and national governments.

Huy Nghiem

Computer Science, University of Southern California
STARS
Mentored by Dr. Jason Fleischer, Cognitive Science

Towards Generation of Predictive Knowledge Graphs in Biology using Machine Learning

Word Embeddings (WE) -- numerical vector representations of token (words) -- have been a popular technique in Natural Language Processing (NLP). Even though WE are trained on word co-occurrence, it has been shown that they capture latent semantic information of tokens. WE trained on scientific literature has even allowed researchers to predict the results of experiments that had yet to occur, because the WE captured information about the results of similar experiments that were already published. On the other hand, Knowledge Graphs (KG) -- graphical representations of entities and their relationships -- have also been useful in extracting information from scientific literature, especially in biology ontologies. Due to their inherent nature that deals with multiple items, KGs often exceed WE techniques in their versatility in expressing relationships with other entities. Our work further explores this line of research by training a model on Pubmed databases capable of producing KGs that are predictive of future discoveries. We hope to present our findings as a proof-of-concept for an automated approach to survey and summarize vast amounts of scientific literature.

Tin Nguyen

Molecular and Cell Biology, UC San Diego
Creating Scientists To Address Cancer Disparities Program
Mentored by Dr. Georgia Sadler, Surgery

Factors explaining higher cancer rates in Vietnamese immigrants in the United States

Vietnamese immigrants who live in the United States have a higher cancer incidence rate for most major cancers, such as stomach, liver, lung, and cervical, compared to the Vietnamese people living in Vietnam. Some factors that could be contributing to the higher cancer incidence rate in the Vietnamese immigrants are dietary differences, alcohol and tobacco consumption, lower education, lack of access to healthcare, and pre-existing conditions, such as Hepatitis B and Hepatitis C. This narrative literature review identified articles using PubMed, CINAHL, Embase, and Ethnic Newswatch databases, and used such keywords as Vietnamese, immigrant, cancer rates, and cancer incidence. References found in key articles were reviewed and included when appropriate. The presentation will include a summary of findings from the literature review, recommendations for strategies that could be implemented to reduce the disparity, and a discussion of the implications for future research.

Khoa Nguyen

General Biology, UC San Diego

Colors of the Brain

Mentored by Dr. Richard Daneman, Department of Neuroscience

Blood brain barrier regulation of neurotransmitter metabolism and behavior.

Blood vessels of central nervous system (CNS) possess unique properties, together termed blood-brain barrier (BBB), that tightly restrict the movement of molecules between the blood and neural tissue. Many of these properties are manifested in the endothelial cells (ECs) of CNS capillaries, which, which limit the paracellular and transcellular movement of molecules through specialized tight junctions, reduced transcytosis, efflux transport, and import nutrients with substrate-selective transporters. Therefore, the BBB regulates molecular microenvironment of the CNS optimal for synaptic transmission. To identify genes important for BBB function, the Daneman Lab compared the transcriptomes of brain ECs and peripheral organ ECs. They identified that neuronal genes critical for dopamine and serotonin metabolism (Ddc, Maa, and Maob) are highly enriched in brain ECs. They identified found that brain endothelial Ddc and Maa function as an enzymatic buffer to the brain uptake of the dopamine precursor, DOPA, and are critical for social behavior. To understand how EC dopamine metabolism regulates brain function, I will analyze the transcriptomes of brain regions linked with social behavior from mice exposed to novel social interaction and with either Maa EC-specific deletion or control allele. I will use immunohistochemistry and RNA in situ hybridization to determine the expression and spatial localization of candidate genes. My goal is to identify the genes, biological pathways, cell types, and brain regions regulated by BBB dopamine metabolism. My study may identify how the BBB regulates neuronal function and how BBB dysfunction may contribute to dopamine-linked disorders, including autism, schizophrenia and Parkinson's disease.

Kendrick Nguyen

Electrical Engineering, UC San Diego

Electrical and Computer Engineering SRIP

Mentored by Professor Karcher Morris, Department of Electrical and Computer Engineering

Appealing to High School Students in Developing Early ECE Technical Skills: Pairing ECE with Creativity

ECE 5 is a hands-on course designed to introduce students to electrical engineering and practical skills. Although many students can proudly attest that the course has provided

confidence in furthering their skills outside of class, many had also wished that they had been exposed to an experience similar in high school. Bringing ECE 5 Curriculum to High School was proposed to launch a tailored ECE 5 course to a local underrepresented high school. The project is intended to engage students with problem solving and engineering concepts and to collaborate with teachers of different subjects, fostering a close community.

In addition to the ECE 5 content at UCSD, we plan to address the more diverse student pool with projects by incorporating tools for imagination. According to Behjat and Marasco, the lack of creativity or cross-disciplinary components to Science, Mathematics, Engineering, and Technology (STEM) are significant dangers to students' interests and comprehension. Thus, we developed an addition to the old ECE 5 curriculum that expands on the Communications depth, incorporating Radio Frequency (RF) and the classic board game Battleship. Gamifying an ECE topic is an opportunity to combine collaboration, competition, and learning. As planned to launch the course by Spring 2022, additional mini projects, portfolios, and open-ended projects will be incorporated. Future work includes the testing of newly developed modules with current and former ECE 5 students. The feedback will be useful in preparing for a successful high school ECE 5 program.

Anh Nguyen

General biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Xi Fang, Medicine

The role of Taffazin in mitochondrial architecture

Barth syndrome (BTHS) is an X-linked mitochondrial lipid disorder caused by mutations in Tafazzin (TAZ), which encodes a mitochondrial acyltransferase required for cardiolipin (CL) remodeling. Cardiomyopathy is a major clinical feature in BTHS. Mutations in Taz that result in inefficient CL remodeling. Heart biopsies from BTHS transplant patients revealed mitochondrial malformations and dysfunction. However, little is known as to the detailed molecular mechanisms by which Taz deficiency leads to cardiomyopathy. To address this question, we have generated a floxed Taz mouse line and used it to generate cardiomyocyte (CM)-specific Taz knockout (cKO) mice. The preliminary data showed that, at 4 months of age, loss of Taz in CMs resulted in severe dilated cardiomyopathy and reduced mitochondrial respiration. To assess the effect of Taz deficiency on mitochondrial ultrastructure, we performed transmission electron microscopy (TEM) analysis on Taz cKO and control hearts at 2 months of age, prior to overt cardiac dysfunction. Our results revealed a pronounced heterogeneity in the mitochondrial population with mitochondria displaying variable morphology and disorganized cristae structures in Taz cKO hearts. Interestingly, in cKO hearts, we observed a substantial number of "onion-shaped mitochondria". In this proposal, I will

perform detailed quantification analysis of TEM images in Taz cKO and control mice. I will also determine the detail molecular mechanism in which loss of Taz result in “onion-shaped mitochondria”. This study will contribute to our understanding of the role of TAZ at molecular, cellular, physiological levels, and may ultimately suggest potential therapeutic approaches.

Tai Nguyen

Physics, UC San Diego
Undergraduate Research Scholarships
Mentored by Javier Duarte, Physics

Finn/hls4ml merge

The goal of this project is to improve the compatibility between hls4ml and FINN, the two frameworks used to deploy ML on FPGAs. One of the options is to work on creating a common intermediate representation (IR) using ONNX for reduced precision, or quantized, neural networks (QNNs) for use in FPGAs. So when a deep neural network is implemented, it can be written as a mix of hls4ml code and FINN code which will come together to make a graphic design through Vivado IP integrator. Essentially having these two languages work together offer a bridge if one were to switch from programming from hls4ml to FINN or vice versa. Newer users would then find themselves having an easier time getting introduced into translating code into FPGA firmware and being able to easily switch between hls4ml and FINN libraries.

There is also some expectations on how to make a tiny, more easier to build version of the finn-hls4ml merger project. This would be called TinyMLPerf and would be a scaled back version of the more optimistic route of merging two completely different languages. This would essentially be on a much smaller scale than the regular merger of Finn and hls4ml and its purposes would be to output a sweet spot between speed and accuracy. The main goal for this project would be efficiency.

Ida Nikjeh

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

Racial/Socioeconomic Exclusions and Disparities in Stem Cell Medicine

Disparities in stem cell medicine are found in African American and low socioeconomic communities. There is a lack of diversity in genomic research, an insufficient number of donor matches, and reduced acceptance of stem cell cancer treatments in African Americans. Furthermore, low socioeconomic communities compared to high

socioeconomic communities face financial barriers to cord blood banking. Bridging these disparities will improve clinical care, survival rates, and genetic research. This narrative literature review identified articles using PubMed, JSTOR, and CINAHL databases using these keywords: African American/Black, stem cell medicine/treatment, inequalities, socioeconomic, cord blood banking, and genomic research/data. The reference lists from key articles were reviewed. The presentation will synthesize the information gathered during the literature review and discuss how the barriers can be addressed to increase participation in research studies, the number of donor registry matches, and the use of stem cell treatments by African Americans. Future implications and proposed solutions to reduce these disparities will be presented, along with recommendations for future research studies.

Armin Nouri

Cognitive Science, UC San Diego

STARS

Mentored by Dr. Tsung-Ting Kuo, Health Department of Biomedical Informatics

Cross-Institutional Logging of Patient Data-sharing Consents on Blockchain Using Smart Contracts

According to the Health Insurance Portability and Accountability Act (HIPAA), data sharing for clinical research might be allowed with appropriate measures to protect Personal Health Information (PHI) and with informed consent from patients. However, manually obtaining patients' data sharing consents for cross-institutional clinical studies can be a challenging task. For example, a patient may agree to share certain types of data (e.g., demographics and family history) with a study conducted by UCSD, and not with another study conducted by a for-profit company. Although traditional central database systems can be used to collect patients' data sharing preferences in an electronic way, these systems are vulnerable to failure if this central node is down, whether due to scheduled maintenance or malicious attacks. To address this issue, we plan to develop a patient preference logging system on blockchain (decentralized without a single-point-of-failure) and relevant smart contracts (self-executing code stored on blockchain). Existing studies mainly focus on proposing a system for a single institution, while we aim at developing a cross-institutional system with emphasis on improving the scalability of the data storage on-chain. We will evaluate the performance of our system using the data from the blockchain track of the iDASH 2021 secure genome analysis competition (<http://www.humangenomeprivacy.org/>).

Amber O'Brien

Psychology with specialization in developmental, UC San Diego
Creating Scientists to Address Cancer Disparities Program
Mentored by Dr. Georgia Sadler, Department of Surgery

Investigating the existence of disparities in the quality of life among pediatric brain cancer survivors of low socioeconomic status

Cancer is the second leading cause of death among children and adolescents. Brain cancer recently surpassed leukemia as having the highest cancer mortality rate, and brain cancer survivors are subjected to cognitive and behavioral deficits in comparison to other cancer survivors decreasing quality of life outcomes. This narrative review of the literature explored potential sociodemographic disparities in quality of life for children with brain cancer and their families, with a focus on survivorship and long-term survival. A literature review was conducted of all major databases such as PubMed, PsycINFO, EBSCOhost, Google Scholar, and ProQuest. Key terms used for this search included: Pediatric Brain Cancer/Tumor, Socioeconomic/Low-income/Poverty, Religion/Religiosity/Religious beliefs, Parental Influence/Expectations. Studies support the effectiveness of intervention treatments such as cognitive rehabilitation, speech therapy, and cognitive behavioral therapy for improving quality of life. Disparities in insurance coverage between privatized and public insurance decrease the accessibility of these additional treatment options. Other relevant factors influencing quality-of-life outcomes included parental influence and education, ethnicity, parental religious beliefs, and type of treatment. These findings indicate the importance of reducing barriers to resources that improve the quality of life for brain cancer patients and their families.

William O'Farrill Colon

Biological Anthropology, San Francisco State
STARS
Mentored by Amy L. Non, Genetics

A New Public Health issue: The Anti-Vaxxer Era An analysis of Vaccine Hesitancy among Mexican Descent living in Southern California

Despite the elevated risk of contracting the COVID-19 virus by racial and ethnic minorities in the US, immigrant groups tend to have the lowest vaccination rates per state (3.4% in average). According to the World Health Organization (WHO), immigrants living in the US are less likely to be vaccinated for most diseases, and with the highest levels of hesitancy related to COVID-19 vaccination. In May of 2019, the WHO had declared vaccine hesitancy—the reluctance to vaccinate despite the availability of

vaccination services—as one of the top 10 threats to global health. In this study, we look further into the different sociodemographic variables and personal experiences pertinent to sentiments towards Covid-19 vaccination. Our intention is to understand the factors that contribute to these responses towards COVID vaccines. We are analyzing data from a birth cohort of mothers of Mexican descent living in southern California. Data were collected through various questionnaires about prenatal and postnatal factors, including socioeconomic conditions, discrimination, and stress early in the pandemic (n=194, March-May 2020), and a follow-up survey. We will specifically examine where they gather their health information (Internet, television, social media, etc), along with other sociodemographic characteristics. The goal of this study is to identify factors that influence vaccine hesitancy, which can be used to inform strategies for the dissemination of public health information and improving access to vaccines among vulnerable populations. We hypothesize strong correlations of vaccine hesitancy among the data collected and the sociodemographic characteristics of the participants.

Brenda Ochoa

Molecular & Cell Biology, UC San Diego
Creating Scientists to Address Cancer Disparities Program
Mentored by Dr. Georgia Sadler, Surgery

Addressing Environmental Health Disparities in Hispanic Children of Farmworkers Diagnosed With Pediatric Acute Lymphoblastic Leukemia

Hispanic children in the United States possess the highest rates of acute lymphoblastic leukemia (ALL) diagnoses and are more likely to undergo poor outcomes (e.g. treatment resistance/toxicity and lower survival rate). Four genes have been identified to be potential links for leukemia risks in Hispanic children; however, epigenetic modifications resulting from pesticide exposure must be analyzed further in preventive and long-term healthcare. Since the majority of agriculture workers identify as Hispanic, first- and/or second-hand, (residential and/or occupational), pesticide exposure may have an association with ALL. A narrative literature review was conducted using articles from NCBI, PubMed, Google Scholar, and ScienceDirect using keywords Latinx/Hispanic Children, Children of Hispanic/Latinx Farmworkers, Epigenetics/Epigenomics, and Pesticide Exposure. This presentation will evaluate the research findings in the fields of environmental health and genetics while drawing attention to environmental injustice and cancer disparities. Research methods in these particular fields may play a pivotal role for future treatment, prevention, and long-term care for pediatric ALL.

Shawn Ogden

Cell and Molecular Biology, San Diego State University
Multidisciplinary Educational Approach to Reducing Cancer Disparities Program
Mentored by Dr. Scott Kelley, Bioinformatics

Effects of the gut microbiome on polycystic ovarian syndrome: relationship to endometrial cancer deaths in African American women

There has been a growing number of studies supporting the association between an imbalance of the bacteria levels in the gut microbiome and an increased risk of polycystic ovarian syndrome (PCOS) in women. PCOS diagnosis increases the risk of endometrial cancer, also known as uterine cancer. African American women and white women have the highest incidence rates of PCOS; however, African American women have the highest PCOS mortality rates. Similar patterns are observed in endometrial cancer incidence rates affecting African American and white women, with African American women having the highest endometrial cancer mortality rate. This literature review will evaluate how the changes in the gut microbiome in PCOS patients affect the risk of endometrial cancer and increased mortality rate for African American women. Articles published since 2016 were found in PubMed, CINAHL, and Google Scholar using the search terms: AA women, cancer, gut microbiome, endometrium*, uterine*, and PCOS. Reference lists of these articles were searched for additional key articles. The American Cancer Society and National Cancer Institute were used to provide cancer statistics for endometrial cancer. This literature review will provide more insight into the disparity of how AA women are disproportionately affected by both PCOS and endometrial cancer mortality rates. This presentation will condense the findings of this literature review and include suggestions for future research.

Sydney Olfus

biology, San Diego State University
SDSU-UCSD Cancer Partnership Scholars Program
Mentored by Vanessa Malcarne, Psychology

Suicidality Concerns in Women with Gynecologic Cancers

Cancer patients are at a higher risk of suicide when compared to the general population. In particular, women with gynecologic cancers are at a higher risk of suicidal ideation when compared to women with other malignancies. Women with gynecologic cancers are understudied and methods to identify and treat gynecologic cancer patients experiencing suicidal ideation are poorly understood. This literature review examined characteristics and quality of life factors related to increased risk of suicidal ideation in women diagnosed with gynecologic cancers. Searches included all cancer stages and

treatment phases. Articles under review were identified using PubMed, PsycINFO, CINAHL, Google Scholar, and GenderWatch databases. Major search terms included: gynecologic cancer, suicidality/suicidal ideation, depression, anxiety, and sexual dysfunction. Other sources were identified using reference lists from core articles. The findings of this literature review will identify factors that put this population at high risk for suicidal ideation.

Gerardo Ontiveros Cortes

Chemistry B.S., UC San Diego

McNair Scholars Program

Mentored by Olivia Graeve, Mechanical and Aerospace Engineering

Thermal Conductivity of Water-Based Alumina Nanofluids

In the present work, we studied the thermal conductivity enhancement of water-based alumina nanofluids with varying volume concentrations of alumina nanopowders. The motivation for this study is the promising use of alumina nanofluids as potential heat transport systems for a variety of applications, including nuclear reactors, heat, ventilation and air conditioning systems, and computer hardware. Our study focuses on the relation of particle size, pH, stability, and nanoparticle volume fraction of water-based alumina nanofluids, with respect to thermal conductivity, with the goal of determining nanofluid enhancement in thermal conductivity with respect to water. Solution stability was addressed by analyzing the particle size distributions and the z-potentials of the nanofluids using dynamic light scattering. Our experiments consist of three independent samples of concentrations between 2.0 and 5.0 vol.%, with each sample being tested for z-potential, pH, and thermal conductivity. Our results indicate that alumina nanofluids have excellent solution stability with alumina concentrations up to 5.0 vol.%, while the particle size distribution is slightly greater than the nominal 100 nm particle diameter specified by the manufacturer of the nanopowders. In addition, it was verified that thermal conductivity increased linearly with powder volume fraction. Ongoing experiments will analyze nanofluids prepared with powders of lower nominal particle sizes. We expect to see significant enhancements in thermal conductivity, potentially making alumina nanofluids into promising candidates for a variety of engineering applications in the future.

Nora Nickoel Ortega

Counseling and Guidance, CSU San Bernardino
STARS
Mentored by Dr. Miguel Villodas, Psychology

Adverse childhood experiences and academic attainment: The role of future expectations among at-risk youth

Adverse childhood experiences (ACEs) are associated with lower academic attainment. Although diminished future expectations among youth at-risk for ACEs are a plausible explanation for this link, limited research has examined their role in this association. The purpose of this study is to examine the extent to which future expectations during adolescence mediate the association between ACEs and educational attainment in early adulthood. Participants in this study included 480 youth-parent dyads from the Longitudinal Studies of Child Abuse and Neglect (LONGSCAN) who enrolled in the study age 4 and completed follow-up measured between ages 24 and 27. Participants identified from diverse backgrounds (i.e., 28% White, 53% Black, 5% Latinx, 14% mixed/other), and more than half of the participants identified as female (i.e., 62% female, 38% male). LONGSCAN is a five-site consortium of studies that examines possible causes as well as consequences of adversity in youth identified as being at risk for maltreatment. For this study, child protective services records and parents reports were used to assess youth's experiences of ACEs beginning at the age of 4. At the age of 14, youth reported their future expectations, and between the ages 24 - 27, the young adults reported their academic attainment. We hypothesized that ACEs would be associated with lower academic attainment in young adulthood, and that this association would be mediated by more negative future expectations among youth during adolescence. This study may inform prevention and early intervention programs aimed at enhancing the educational achievement of at-risk youth.

Gabriela Ortega-Arvizu

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

Leaf blowers linked to lung cancer in Hispanic men landscape workers

Lung cancer is the leading cancer in Hispanic men. A contributing factor in the United States is hypothesized to be leaf-blowers used in landscape maintenance. These machines emit millions of harmful toxic pollutants into the air, such as hydrocarbons, carbon monoxide, and particulate matter (PM) with the potential to damage the human body. This narrative literature review identified articles that explored the correlation

between gas leaf-blowers and risk of developing lung cancer. PubMed, CINAHL, and Google Scholar were among the databases searched for relevant articles. Among the keywords used were: Hispanic men, lung cancer, landscape, urban agricultural workers, and pollution, gardener, and particulate matter. This presentation will outline the findings from this literature review, describe proposed solutions including pending legislation banning leaf-blowers, and offer recommendations for additional research.

Andrea Padilla

General Biology, UC San Diego
Multidisciplinary Approach to Reducing Cancer Disparities Program
Mentored by Dr. Veronica Cardenas, Moores Cancer Center, Psychology

The Power Religion and Spirituality Hold in the Dying Process for Latinx Advanced Cancer Patients and Their Loved Ones

According to the Pew Research Center, 59% of U.S. Latinx view religion and spirituality as an important part of their lives. This especially plays a role during a major life event such as the end of life or dying process. Cancer is the second leading cause of death in the U.S. Latinx population. This qualitative study entitled Su Voz (Your Voice) interviewed ten Latinx advanced cancer patients, with a life expectancy of less than two years, along with their ten caregivers to investigate their views and beliefs about death and explore their acceptability of having conversations surrounding the topic of death. Patients and caregivers participated in semi-structured interviews and completed a quantitative questionnaire. All interviews were transcribed then coded in Dedoose 9.0.15, a qualitative data analysis software, identifying key themes and quotes. A prominent theme that surfaced was the significance of religion on the dying process. This presentation summarizes key findings and highlights implications for future research.

Anthony Palazzolo

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Prasad Gudem, Electrical Engineering

Orientation Tracking of Boomerang Flight Behavior Using Onboard IMU Technology

Used for both hunting and entertainment all across the world, boomerangs have played an integral role in human history for thousands of years. In that time, enthusiasts have become familiar enough with the behavior of these objects that they can empirically predict their flight path with great accuracy. Physicists, however, still lack a complete understanding of what causes the strange phenomenon of a boomerang's changing

trajectory. In order to better understand this phenomenon, our team came together to try and predict and verify the behavior of boomerangs in motion. To do this, we created a team made up of physicists and aerospace engineers to work on equations to predict boomerang behavior, and a team of electrical engineers to create hardware that can track and record the behavior of boomerangs in flight. My role in this project was to track and record the orientation of the boomerang in flight without interfering with the boomerang's natural behavior. To do this, we made use of Inertial Measurement Units (IMU's) to track the boomerang's orientation over time and record its data onto an onboard microSD card. This data was then analyzed using specialized matlab tools after each throw of the boomerang, giving us an accurate reading of the object's orientation throughout its flight. Through this research, we have gained not only a better understanding of IMU tracking technology, but also moved one step closer to understanding the perplexing trajectory of boomerangs as well.

Emma Palmer

Ecology, Behavior & Evolution and Marine Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Daniel Metz, Scripps Institution of Oceanography

*Social Organization in the Freshwater Trematode, *Haplorchis pumilio**

Several marine species of trematodes – parasitic flatworms – are known to have a defensive “caste” that protects the host snail from infection by other parasites. We present here the first evidence of such social organization in a freshwater parasite, *Haplorchis pumilio*. Morphological analysis showed that *H. pumilio* soldiers possess disproportionately enormous defensive structures in comparison to the reproductive caste and other documented trematode soldiers. Attack trials pitting *H. pumilio* castes against both conspecific and heterospecific enemies confirmed that the putative soldiers were much more aggressive than members of the reproductive caste. Whole-colony censuses show that the soldier caste of *H. pumilio* is small, but comparable to that of other socially organized trematode colonies. We conclude by comparing our findings in this study with other, closely related trematodes that do not show strong evidence of social organization.

Destiny Parker

Biology Pre-Med, University of Maryland Eastern Shore

STARS

Mentored by Dr. Zhao Yunde, Cell and Developmental Biology

Influence of growth regulator concentrations on in vitro rooting and plant regeneration in Vitis

Grapevine varieties grown worldwide for wine production are extremely ancient and valued for their enological characteristics. Genetic improvement of grapevines using conventional breeding techniques results in the development of varieties that are intermediate between the parent vines with loss of valuable enological traits. Precision breeding of grapevines results in genetic improvement through the mitotic cell division pathway. This results in the addition of valuable traits without disrupting existing desirable characteristics of elite wine and table grape cultivars.

Precision breeding of grapevine is possible due to the successful development of in vitro regeneration protocols along with gene insertion protocols to add and/or edit desirable traits. In the current study, the effect of four concentrations of indole butyric acid (IBA) on root development of in vitro proliferated grapevine shoots will be studied. In vitro micropropagation cultures were obtained by culturing single node shoot tips on C2D4B medium. Following shoot proliferation and elongation, the shoots were excised and placed on C2D4B medium containing either 0, 0.5, 1.0, or 2.0 μM IBA. We will record the number of days required for root production, number of roots, and root length in the various treatments. Following rooting, plants will be transferred to sterile potting mix and hardened under conditions of high relative humidity. The identification of efficient rooting treatments should enable the rapid regeneration of in vitro shoots and enable testing of plants developed through precision breeding.

Kanksha Patel

Bioengineering: Biotechnology, UC San Diego

Undergraduate Research Scholarships

Mentored by Dr. Karsten Zengler, Pediatrics and Bioengineering

Genome-Scale Metabolic Modeling of Picochlorum Renovo

This project focuses on the green algae *Picochlorum renovo*, which is a recently isolated fast-growing organism with capabilities to thrive under high salinity and temperature. Such properties make *P. renovo* an ideal microalgae for future sustainable applications using bioproducts and production of bioenergy. The metabolism and growth phenotypes of this algae can be understood and predicted through metabolic

reconstruction. These metabolic models are essential in revealing information about pathways, transport systems, and metabolism for organisms like *P. renovo*.

The model will be manually curated by extracting metabolomic data from bio-databases and organizing the data into compartments. To assess the model's performance and assure accuracy, it will undergo validation where multiple parameters (e.g. growth phenotypes, uptake and secretion rates) will be tested in mathematical simulations. Once the model is completed, studies will be performed to determine the behavior of *P. renovo* in various conditions. Such studies have potential to further characterize organism behavior for eventual modifications to maximize efficiency.

Erica Peng

Bioengineering: biotechnology, UC San Diego
UC Scholars
Mentored by Liangfang Zhang, Nanoengineering

Nanotechnology for Universal Influenza a Vaccination

Despite advancements in the clinical management of viral infections, the continued emergence of novel influenza viruses poses a substantial threat to global health. While the current vaccination approach against influenza can be an effective measure for reducing infection and mortality rates, the vaccines require periodic updating to accommodate for the frequent antigenic shift that is observed. This requires scientists to make predictions regarding which influenza strains will be dominant during the upcoming flu season, and failures in this difficult process can lead to suboptimal vaccine formulations. A powerful strategy to overcome this limitation is the development of a universal influenza vaccine that can confer protection against numerous strains at once. One such approach leverages the conserved domains of the virus that are present across most influenza subtypes. With the ability to enhance immunogenicity and prolong immune responses, novel nanotechnology vaccine platforms have the potential make the concept of a universal influenza vaccine a reality. In this review, we will first provide a brief overview of the most promising influenza antigens used to elicit broad immunity. Following that, we will discuss current nanotechnology approaches that have been explored for creating a universal influenza A vaccine, with a focus on polymeric nanoparticles, virus-like particles, and self-assembling protein nanoparticles.

Yixuan Peng

Applied Mathematics, UC San Diego

UC Scholars

Mentored by Professor Alexander Cloninger, Mathematics

Analysis of Return Time in Diffusion Maps

Dimension reduction is critical to find the low dimensional ways in which data varies in an otherwise high dimensional space. In particular, diffusion map has been a powerful tool in reducing dimensionality, by embedding datasets into Euclidean space whose coordinates can be computed using the eigenvectors and eigenvalues of a diffusion operator. In the study of diffusion maps, anomalies are small collections of points that subtly but consistently deviate from the bulk of the data. Detection is important in many applications (such as cancer detection) and is especially difficult when the data is too high-dimensional to be visualized. As a result, in this research we analyze the return time, which is an important measurement to identify the anomalies in diffusion maps. Return time is the total time spent starting from a point x , take a random path, and finally returns back. In our research, we derived a formula to characterize it. This new formula of return time provides a new scoring system to assign distance scores for different data points in the diffusion map. As a result, it can provide a different way of defining the distance between two data points, compared to only measuring the sum of squares of eigenvectors.

Alexander Perez de Leon

Nanoengineering, UC San Diego

CAMP

Mentored by Dr. Sheng Xu, Nanoengineering

Efficient Quasi-2D/3D Perovskite Light Emitting Diode

Organometal halide perovskites have demonstrated optoelectronic properties which make them a promising material for semiconductor devices, especially as a potential emission layer in light-emitting diodes (LEDs). Herein is a report of an efficient Quasi-2D/3D layered perovskite light-emitting diode. Excellent charge carrier mobilities and low exciton binding energies are factors found in perovskites that contribute to low non-radiative recombination rates, which is imperative for efficient LED operation. Additionally, high crystallinity and low defect density bolster perovskite's efficiencies as a light-emitting material. In order to further outperform trapping and the forthcoming nonradiative recombination, quasi-2D perovskites can be used to incentivize additional radiative recombination.

Mitchell Pernia

BA Biology, San Diego State University
Creating Scientists To Address Cancer Disparities Program
Mentored by Dr. Eunha Hoh, Environmental Health

Oral Microbiome of Non-smoking Children Exposed to Thirdhand-Smoke Compared to Adult Smokers and How it Could Ultimately Lead to Oral Cancer

Thirdhand smoke (THS) is the residue left lingering from cigarettes. This residue can be left behind on clothing, skin, appliances, and other areas where someone previously smoked. THS differs from secondhand smoke because it is unseen by the naked eye and it lingers on surfaces long after the smoke dissipates into the air. Research has found that smokers have an increased risk of developing oral cancer due to the changes that occur in their oral microbiome. The change in the oral microbiome can also be seen in non-smoking children when exposed to THS. However, the specific differences between children exposed to THS and an adult smoker's oral microbiome remain unclear. This literature review will focus on how non-smoking children's oral microbiome is altered -- such as bacteria present/count -- when exposed to THS in comparison to a smoking adult. Articles were found and reviewed using the databases PubMed and Google Scholar using keywords such as oral microbiome, thirdhand smoke, oral cancer, and children microbiome. Relevant articles were also identified from the Thirdhand Smoke Research Center database. Citations from key articles were reviewed. This presentation will summarize the key findings on this topic and propose future directions for research which will allow for a better understanding of the implications of THS exposure in children and the development of oral cancer.

Hai Pham

Biology and Psychology, University of Houston
STARS
Mentored by Dr. Alon Goren, Department of Medicine

Characterizing The Roles of Mitotic Associated Histone Deacetylation

Mitosis is a tightly coupled process which preserves the integrity of cell identity throughout multiple rounds of cellular divisions. Key characteristics of this process include a sharp decrease in transcription, condensation of chromatin, and the steady loss of histone acetylation levels. In a prior study, our group used small-molecule inhibitors for various histone deacetylase (HDAC). By detection of immunofluorescence and ChIP-seq analysis, it was determined the key regulators implicated in the mitotic levels of H3K9ac were HDAC2, HDAC3, and SIRT1. Curiously, while metagene analysis found that H3K9ac occupancy near promoters, enhancers, and insulators showed a

remarkable global surge, ChIP-seq data revealed acetylation did not occur near relevant regulatory regions. In order to address this inconsistency and to determine the spatial activity and genomic context by which H3K9ac increases, we aim to map HDAC2 and HDAC3 binding sites with ChIP-seq data. Next, seeking to corroborate the specificity between small-molecule inhibitors and the deacetylases of interest, we employ siRNAs to silence HDAC to validate the likelihood of off-target silencing due to small-molecule inhibitors. Additionally, we incorporate the novel imaging platform JUMP-CP to profile cell populations treated with experimental perturbations in open reading frames and CRISPR/Cas9 knockouts. Collectively, the diversity of genomic, molecular, and cellular imaging techniques will provide valuable insight into the mechanism by which HDAC2, HDAC3 and SIRT1 affect the epigenetic landscape during mitosis.

Phillip Pham

Biochemistry and Psychology, University of Houston

STARS

Mentored by Dr. Kathleen Curtius, Department of Medicine

Determining whole genome doubling in low-pass sequencing of ulcerative colitis

Patients diagnosed with inflammatory bowel disease (IBD) have an increased risk of developing colorectal cancer (CRC) when compared to colitis-free individuals. Notably, colitis-associated CRC (CA-CRC) has key molecular differences when compared to sporadic CRC (S-CRC). Ploidy abnormalities are known to co-occur with the development of human cancers, but their outcome and evolution to CA-CRC is not well characterized in precancerous lesions. Specifically, we are interested in how CA-CRC is implicated with whole-genome doubling (WGD), a phenomenon where the cell divides and generates daughter cells with two copies of the chromosome complement. Cells that undergo WGD must adapt to the abnormal tetraploid state and this mechanism of adaptation may provide researchers with the opportunity to understand how lethal specific tissues are to their host. To determine the interplay between IBD and WGD, we performed low-pass whole genome sequencing on formalin-fixed paraffin embedded tissue samples from across 67 patients with long-standing (at least 9 years since diagnosis) ulcerative colitis. Several regions of carcinoma, neighboring precancerous mucosa (dysplasia) and normal IBD were surgically removed and analyzed using whole genome sequencing. From this next-generation sequencing (NGS) data, we assess whether any doubling event is occurring in samples of carcinoma, dysplasia, or control samples using an in-house WGD classifier written in R. Establishing which tissues exhibit an enrichment for WGD may reveal how likely a tissue type is in developing CA-CRC and help inform the effort in the prevention of CA-CRC.

Vivian Phan

Human Biology, UC San Diego

Triton Research & Experiential Learning Scholars (TRELS)

Mentored by Dr. Sebastian Preissl, Cellular and Molecular Medicine

Single Nucleus Multiomic Profiling of Heart Tissue

Cardiovascular diseases, such as heart failure are the leading causes of morbidity and mortality worldwide. Regulatory DNA regions such as enhancers and promoters are important for controlling cell-type-specific gene expression within the human heart and misregulation of gene expression can result in cardiovascular disease. These regions are characterized by open chromatin which can be assayed using ATAC-seq, a method used to profile chromatin accessibility. Chromatin accessibility is the means to annotate regulatory DNA regions and variations within the chromatin landscape are linked to a range of diseases. Currently, there is limited information about the gene regulatory programs in human cardiac cell types associated with heart failure. This presents a major barrier in understanding the molecular basis of cardiovascular diseases.

Therefore, in my project, I will be profiling gene expression and chromatin accessibility in single cells of hearts from controls and donors with heart failure. With this information, the activity differences of regulatory DNA regions and gene expression between the control and failed heart samples will be analyzed. Overall, this work has great potential to provide new insight into the development and biomarkers of future cardiac therapies that are tailored to affect cell types and thus optimize treatment of specific cardiovascular diseases.

Maya Phillips

Sociology, Spelman College

STARS

Mentored by Dr. Mary Blair-Loy, Sociology

Roads to the Top

Racial inequality in the workplace has raised concerns amongst the U.S. public for decades. Complaints of microaggressions, unequal opportunity, and unfair treatment are regularly filed by employees of color in predominantly white work environments. This research studies the career paths of CEOs of varying racial identities in top-earning U.S. companies. The subjects of this research are the CEOs and members of executive committees at top-earning public and private companies in the United States. I will add a race variable to an existing data set using publicly-available photos and biographies of these individuals. I will then use descriptive statistics to draw out patterns in their career progressions. The factors shaping these patterns may include the age at which different

CEOs were promoted to corporate positions and how often they transferred companies throughout their career trajectories. This study of career paths to CEO positions will grant insight into the ways in which race operates in the corporate sector.

Napasorn Phongphaew

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Tse Nga Ng, Electrical and Computer Engineering

pH Sensor Using Organic Electrochemical Transistors

The development of Organic Electrochemical Transistors (OECTs) has been promising for various industrial applications, including ocean monitoring, because of its capability of measuring biological parameters in an aqueous environment and stability in high salinity concentrations. This research focuses on fabricating a flexible, sensitive, and cost-efficient biosensor device using the characteristics of the OECTs where the gate voltage modulates the current between the source and drain. The device is fabricated using silver ink as contact pads, PEDOT: PSS film as a semiconductor to form the transistor channel, and the same conductive PEDOT: PSS as a gate. This OECT relies on electrochemical doping and de-doping of an organic semiconductor film, PEDOT: PSS, which is in contact with an electrolyte. This degenerately doped p-type semiconductor resulted in the device working in the depletion mode where the cation from the electrolyte penetrated PEDOT:PSS film, influencing the de-doping in the semiconductor, consequently decreasing the source-drain current. The OECT device could measure pH to monitor changes in seawater quality. Modulating the channel length between the source and drain and changing the gate geometry within the low potential regime are being optimized to improve the stability and sensitivity of the device. Further application of this device is expected to determine the concentration of other relevant parameters such as ammonium ion (NH_4^+), Nitrate ion (NO_3^-), and Phosphate ion (PO_4^{3-}).

Naomi Pineda

Chemistry, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities Program
Mentored by DR. Christina Jamieson, Urology

Indoor Air Pollution as a Cancer Risk Factor Among Lower Socioeconomic Urban Populations

While the effects of outdoor pollution in lower socioeconomic populations have been extensively studied, indoor pollution has not. Indoor pollution could potentially be more

harmful because of degradation of chemicals with time. Some of the most common indoor air pollutants include p-DCB, chloroform, benzene, and other volatile organic compounds (VOCs). Exposure to these chemicals at home has been linked to an increased risk of lung and skin cancer. Lower socioeconomic urban populations often live in smaller and more crowded houses located in more polluted areas which subsequently affects the indoor air quality of their homes. These conditions increase the amount of hazardous air pollutants in their homes, which may lead to some types of cancer such as lung and skin cancer. This narrative literature review identified articles using PubMed and EBSCOhost using the keywords indoor air pollution, low socioeconomic status, low income, and cancer. The reference section of the key articles were reviewed. This presentation will summarize the findings and provide recommendations for future research and propose policy changes and community programs.

Tevykah Pouv

General Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Omar Akbari, Cell and Developmental Biology

Generating Dengue Resistant Transgenic Aedes Aegypti Mosquitoes Using HomeR Drive System

Mosquitoes are the world's deadliest animals, killing more humans than any other animal due to transmitting many vector-borne diseases. The leading strategy to control vector-borne diseases is the use of insecticides. However, mosquitoes have continued to evolve and develop insecticide resistance. This causes an urgent demand for alternative mosquito-control techniques that are long term, safe, and effective. This project aims to generate a transgenic line of *Aedes aegypti* mosquitoes carrying and expressing an antibody against Dengue virus. The transgene will be linked to a gene drive system known as the home-and-rescue split drive (HomeR) system that was originally developed for *Drosophila*. Once the lines are produced, further work evaluating the transmission of the transgene into a wildtype population and the efficiency of dengue blocking will be tested. The ability to edit populations of sexual species would offer substantial benefits to humanity and the environment.

Briana Prado

Earth Science and Chemistry, University of California, Santa Cruz

UC LEADS

Mentored by Dr. Lihini Aluwihare, Scripps Institute of Oceanography

Discovering Organic Chemical Indicators of Environmental Conditions at the Scripps Pier

The chemical composition of seawater has been observed to change with rain events, temporality, and the ecological distribution of microbial communities of the San Diego coast. A time series from Dec. 2014 - Jan. 2016 was analyzed using a non-targeted tandem mass spectrometry approach to characterize over 10,000 molecules off the Scripps Pier. Different statistical tools were used to identify robust trends in chemicals correlations to environmental factors. This analysis identified 100 compounds that were abundant during time periods defined by particular environmental characteristics. The identity of these compounds was examined by uploading mass spectra and comparing them to spectra in the Global Natural Products Social Molecular Networking (GNPS) library. The quality of the identification was manually examined by scrutinizing fragmentation patterns and examining existing web resources of library-IDs and analogs. The quality of identification was ranked from A-C, with A being the best match. Where library matches were partial, a further effort was made to classify compounds into general chemical classes. Primary literature provided more information on the biological, geological, and anthropogenic sources of these molecules and linked chemical composition to environmental conditions at the Pier. These data will continue to inform a global database on chemo-ecological relationships that are indicative of certain environmental conditions.

Jacqueline Puga

Mechanical Engineering, University of San Diego

McNair Scholars Program

Mentored by Dr. Gordon Hoople, Department of Integrated Engineering

A Symbol of Creativity, Craftsmanship, and Connection: Large-Format Sculpture Design

Artistry is a concept that is not usually explored in engineering yet is an invaluable skill that touches everything from product design to systems thinking. Creating the conceptual design sculpture for a large format sculpture requires connecting engineering knowledge with artistic vision. The initial phase required constant inspiration and creativity. The first step was to look at previous sculptures showcased throughout the world, such as at venues like "Burning Man," to understand the possibilities or limitations of the space provided. Sketching varied and numerous ideas is essential in the design phase since ideas can be integrated or reiterated. Once we

selected our proposed work, we created 3D renderings in Blender, which allowed us to consider dimensionality and spatial location. The three-dimensional renderings were placed in a virtual reality setting to understand how a spectator may experience the sculpture. Small-scale physical models were also created using Solidworks and a laser cutter to implement structural integrity principles and redefine limitations. The sculpture that has been defined thus far showcases a person with an open chest, symbolizing that there is more to a person than what is externally seen. Although the sculpture has not been finalized, preliminary ideas indicate that lungs will be conveyed inside the sculpture through lighting to emphasize the importance of the breath, especially as it pertains to the COVID-19 pandemic. In conclusion, the art installation will be showcased, and spectators will interact with the sculpture by climbing on it and seeing different angles of the sculpture.

Yana Pyryalina

Cognitive Science - Machine Learning, UC San Diego
UC Scholars
Mentored by Dr. Douglas Nitz, Cognitive Science

Neural Sharp-Wave Ripple Detection - Steps Towards Better Learning in Navigation

Spatial cognition is a fascinating task performed by the brain. It involves numerous elements like perception, memory, logic, attention, and requires truly complex interactions between brain regions. In part, spatial cognition is a function of the CA1 hippocampus memory center along with retrosplenial and parietal (perception and movement) cortices. The subiculum serves as an interface between these regions, yet neuroscientists know very little about its functions and methods of transforming information. One of the most intriguing subiculum phenomena is the Sharp-Wave Ripple (SWR), which plays a crucial role in memory consolidation and retrieval. Research by Dr. Gyorgi Buzsaki shows that artificially prolonging the SWR in rodents significantly improved animals' maze learning speeds. This finding opens countless new horizons - it points at opportunities to improve not only learning aids for struggling individuals, but also to expand the way humanity learns altogether. Expanding upon this finding, we are now exploring the SWR phenomena deeper, starting with the first steps of correctly identifying the Sharp-Wave Ripple in the sea of neural data. This research presents the computational filtering system developed to identify the Sharp-Wave Ripple, and discusses how our findings potentially change the way we look at the SWR phenomenon in the future.

Purnima Qamar

Psychology, UC Riverside

Kids Interaction and NeuroDevelopment Lab (KIND Lab)

Mentored by Dr. Kalina Michalska, Psychology

Parental negative emotionality moderates the relationship between affective empathy and depressive symptoms in Latina girls

Although empathy is usually seen as a protective factor for mental health, elevated emotional responses to others' distress cues can sometimes be overwhelming and lead to internalizing disorders like depression. In children, the relationship between empathy and depression may be further moderated by parental personality traits like neuroticism and biological factors like physiological hyperarousal (Tone & Tully, 2014).

In a sample of fifty-nine Latina girls (Mage = 9.7 years + 1.8) and their caregivers, we tested whether parental neuroticism moderated the relationship between empathy and depression, controlling for children's physiological arousal. As girls have an elevated risk of developing depression (Albert, 2015) and report greater empathy than boys (Michalska et al., 2013), they are an important population to study. Children reported on their empathy, depression, and physiological arousal. Caregivers' reported on their neuroticism.

Several findings emerged. In line with our hypotheses, we observed that depression was positively associated with children's empathy ($p = .030$), children's physiological arousal ($p = .001$), and parents' neuroticism ($p = .006$). Importantly, we also observed an interaction between parental neuroticism and child empathy on child depressive symptoms ($p = .018$). Follow-up simple slopes analyses revealed that for children with low and medium empathy, parental neuroticism was positively associated with child depression. However, for children with high empathy, parental neuroticism was not associated with depression. Thus, while high empathy may increase children's risk for depression, it may also be a protective factor against the negative effects of parent's neuroticism. Such findings may inform interventions for child depression that involve parenting training.

Anthony Quiroga

Computer Science, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Pat Pannuto, Computer Science and Engineering

Expanding Hardware Continuous Integration on the Tock Operating System

Currently, the hardware platforms that are supported by the Tock Operating System (OS) do not have a means of testing whether software updates work as intended. Right now, Tock OS only has functionality for testing if software compiles (i.e. no functional testing). In the absence of continuous behavioral testing, Tock has found errors accidentally introduced during final testing for every major release amongst its supported hardware. Thus, the research that is being conducted over the course of TRELS focuses on the implementation of Hardware Continuous Integration (CI) for the boards that are supported by Tock, which tests software on hardware continuously as updates are proposed for the OS. To achieve this, we develop a hardware-in-the-loop CI, driven by GitHub, but running on custom, Raspberry Pi-based “runners”. These runners are scripts that run code to test specific components of hardware such as whether LED lights flicker correctly. GitHub actions conduct jobs that support these runners, and are processed for every update that occurs in a GitHub repository that contains these GitHub actions. We currently have 1 board set up with 2 tests working, the goal is to generalize this infrastructure, first by increasing the number and diversity of hardware tests and then extending to additional hardware platforms. The current system uses Python test runners and C-based test applications on tested hardware to implement hardware CI.

Jocelyn Quiroz

cognitive science, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities Program
Mentored by Georgia Sadler, surgery

Mastectomy tattoos as a form of emotional healing following breast cancer treatment: a review of the literature

The abrupt physical changes that accompany breast cancer treatment, along with societal and cultural expectations of femininity, can create a sense of powerlessness in cancer patients. More recently, patients have been challenging the idea of postmastectomy bodies as abnormal. For example, some women who feel disembodied from their postmastectomized body are turning to the use of mastectomy tattoos as a form of emotional healing. This emerging phenomenon and the importance of health career providers’ understanding of its role in the process of healing and transformation

following a mastectomy will be discussed. This literature review identified articles using PubMed, Google Scholar, CINAHL, and PsycINFO databases using keywords: mastectomy, tattoos, abject. Reference lists of key articles were reviewed. To date, there have been few studies of mastectomy tattoos and recommendations for future research will be provided.

Faiza Qureshi

Marketing, University of San Diego
McNair Scholars Program
Mentored by Maria Kniazeva, Business, Marketing

From a Garment to a Piece of Art: Heritage & Enchantment in the Fashion Marketplace

This research seeks to understand how heritage and global fairytales specifically play a role in determining which garments can be considered art pieces, and how they get to a point where they can be considered art. Qualitative research based on the grounded theory development is used by analyzing datasets derived from six brands, analyzing the garments themselves in terms of craftsmanship, then analyzing the dress storytelling in terms of plot, characterization, and setting created around these pieces. Preliminary results indicate that heritage and enchantment present themselves through these garments as designers weave these tales of history and folklore into the collections. These visions are further carried out by creative directors through runway shows and advertisements that strengthen the aesthetic presence of the garment. The outcome of this study works to inspire and inform future fashion managers and marketers of how a fashion garment can be transformed into pieces of art through heritage and folklore. Further avenues of study would include classic literature's influence on how fashion can become art in the contemporary marketplace and how creatives throughout history perpetuate certain timeless elements in lifestyle goods.

Tanner Ragan

Mechanical Engineering, UC Merced
STARS
Mentored by Dr. Oliver Schmidt, Mechanical and Aerospace Engineering

Flow Characterization of Plasma Actuated Flat Plate

Noise generated by supersonic jets are powerful enough to cause hearing damage to personnel working on the aircraft carrier. The turbulent motion of the jet flow is the general cause of jet noise. Due to a lack of understanding of the mechanisms of noise generation, jet noise mitigation is currently a serious challenge. Development of plasma actuators have assisted in reducing sound. Furthermore, the implementation of this tool

inside a cavity will stabilize the plasma arc. However, the flow features of this configuration are unknown. The objective of this study is to identify the flow characteristics of a plasma actuated flat plate, where the actuation occurs inside the cavity. The flat plate models the interior of a twin-rectangular supersonic nozzle. Turbulent flow over the flat plate with a cavity is numerically simulated using large-eddy simulation. This will provide an understanding of the effects of the subgrid-scale model on the actuation signal produced by the actuator. Mesh refinement study will optimize the mesh resolution without exceeding computational power. The results of these simulations could identify salient flow features important to noise generation. As a result, the study would provide assistance to the long-term goal of gaining control authority over the large-scale coherent structures in the free jet outside of the nozzle for noise mitigation. This research is embedded in the ONR funded research under grant no. N00014-20-1-2311.

Natale Rahmon and Kiara Summers

Psychology, University of San Diego
Kevin Caden Memorial Diversity Research Grant
Mentored by Dr. Anne Koenig, Psychological sciences

How Gender Affects Perceptions of Safety Following Information About Sexual Assault

The topic of sexual assault is a prevailing social issue and this study focuses on gender differences in how USD students perceive their safety when they are informed about the crime rates of sexual assault. In particular, we compare how safe men and women feel in general, as well as after reading information about sexual assault or general crime rates in a 3 (crime information: sexual assault, general, control) x 2 (participant gender: male, female) between-subjects design. Participants who are randomly assigned to read about sexual assault, for example, learn about the definitions and rates of crimes such as rape and domestic violence at USD and in San Diego in the past few years. We hypothesize that women will feel more wary of going out at night and will feel the need to be safer after reading about sexual assault information compared to men. They may also feel less safe after general crime information because of the “shadow” of sexual assault in which other crimes create fear because of a potential link to sexual assault. Men, on the other hand, are expected to feel less safe after reading about general crime than sexual assault. Although women may naturally be more hyper aware of their surroundings in certain situations than men, it is important for men to understand how unsafe women feel in such situations. The results of this study will have implications for finding ways to promote safety and awareness among our community.

Frederick Rajasekaran

Math & Physics, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Jane Teranes, Scripps Institution of Oceanography

Engineering a Smart Irrigation System at UCSD

California is experiencing significant pressure on water resources due to agricultural use, population growth, and the risk of climate change causing more frequent and prolonged droughts. Currently, agriculture accounts for approximately eighty percent of all developed water usage in California. Thus, research, development, and implementation of water-efficiency measures in irrigation is of utmost importance to the future of agriculture in our state.

Here we report on a project to develop technology to improve irrigation water efficiency using a test case on the campus UC San Diego, specifically by building a smart irrigation system at Roger's Community Garden. Roger's Community Garden is one of several student-run gardens on campus which are important to campus life since they mitigate food insecurity in the community and provide students relief from academic stress. The developed irrigation system incorporates soil moisture data, temperature, humidity, and future weather conditions to optimally irrigate the plants, and is controlled with a central Raspberry Pi computer. The central computer collects data from the sensors over WiFi, processes it, and then communicates with the water distribution system to properly allocate the precise amount of water to nourish each plant. Once implemented, the exact amount of water saved by the system will be calculated. Not only does this project conserve water on campus, but it also acts as a prototype for similar endeavors that could be scaled up in the agricultural sector in California.

Joanna Ramirez

Child and Adolescent Development, California State University, Northridge
STARS
Mentored by Dr. Lindsey Powell, Psychology

Social Inferences from Helping and Hindering

How do babies reason about social relationships? We ask whether infants use information about the prosociality of two agents to determine who a third agent prefers. Infants will watch as a Protagonists builds a tower. Then, babies will watch alternating videos of one agent helping the Protagonist complete her tower and another agent preventing the Protagonist from completing her tower. In two test trials the Protagonist will engage with the Helper (expected), and in two other test trials the

Protagonist will engage with the Hinderer (surprising). Infants will be assigned to either the emotion condition where the Protagonist will smile at the other agents, or the approach condition where the Protagonist approach the other agents. Sixty-four 7-month-olds and sixty-four 13-month-olds will be recruited to participate over Zoom. Infants' looking time to the test trials (expected vs. surprising) will be analyzed using a repeated-measures ANOVA with condition (emotion vs. approach), age group (younger vs. older), first test trial (surprise first vs. second, and first helping and hindering event (helping first vs. second) as between-subject factors. We hypothesize that infants will be surprised if an agent engages with a hinderer over a helper, indicated by longer look to the surprising test trials. We expect the older group of infants to have stronger expectations, indicated by a larger difference in looking between the two test trial types. These results will shed light on how infants can use prosocial behaviors to infer social affiliation.

Sheemrun Ranjan

Psychology, UC Merced

CAMP (California Alliance for Minority Participation)

Mentored by Dr. Kristina Backer, Dept. of Cognitive and Information Sciences

Using Informative and Uninformative Retro-Cues to Observe the Interaction Between Auditory Attention and Working Memory

There has been an abundant amount of research examining the effects of both selective and reflective visual attention during working encoding and retention phases, respectively, on behavioral performance and neural activity. Unlike selective attention, reflective attention refers to attentional orienting to internal mental representations and is especially important for auditory perception. However, there have been few studies done to test the neural mechanisms underlying interactions between auditory reflective attention and working memory using similar delayed match-to-sample tasks, which is crucial to understand the strength and capacity of auditory attention. Using Informative and Uninformative retro-cues (i.e., cues that provide relevant or no relevant information, respectively, about an item for immediate retrieval), the current online study will observe the interactions between reflective attention and working memory using sounds that vary in temporal properties, specifically their amplitude modulation (AM) rate. It is expected that the use of reflective attention during encoding in working memory using Informative retro-cues should enhance the temporal precision of AM rate discrimination, relative to Uninformative retro-cues. Preliminary data from this online study revealed no differences in sound discrimination accuracy between the Informative and Uninformative retro-cues. A possibility for this null cuing effect is that participants were not given enough time to encode the sounds and effectively utilize the Informative retro-cues. Thus, in a follow-up experiment, we will adjust the timing of trial events to enable robust memory encoding of the sounds. We expect that Informative retro-cues will boost temporal precision of the auditory stimuli in this revised paradigm.

Mihaela Rascanu

Economics, UC San Diego
UC Scholars
Mentored by Professor James Rauch, Economics

The impact of the Egyptian Government's Energy Reforms

Egypt's energy production peaked in 2009. By 2014, Egypt's energy consumption exceeded its energy production, leading the country to begin importing natural gas. To stimulate production, the Egyptian government passed the Renewable Energy Law in 2014 and the Electricity Law in 2015, among other reforms intended to encourage the private sector to produce electricity from renewable sources and attract foreign investment in general. To reduce the growth of consumption, in 2014 the Egyptian government began reducing energy subsidies.

The most recent available data show that these policies are having their intended results. First, energy production has increased sharply since 2016 and by 2018 had nearly caught up to consumption. Second, energy subsidies have declined from 6.5 to 0.3 percent of GDP. Third, the percentage of firms experiencing electric outages decreased significantly from 80.9 in 2013 to 28.2 in 2020 and Egypt's rank in the Getting Electricity sub-index of the World Bank's Doing Business improved from 144 in 2016 to 77 in 2020. Fourth, foreign direct investment inflows to Egypt nearly doubled from 2014 to 2019 while remaining flat or declining in other North African countries. Fifth, foreign investment in the Zohr gas field has enabled Egypt to become a net exporter of natural gas. Finally, the Benban Solar Park and West Bakr Wind project are currently being built by foreign investors and will greatly increase the share of Egypt's electricity generated from renewable sources.

Nika Redburn

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dimitri Deheyn, SIO

Microgreens

The microgreens project will be used to sustainably grow microgreens to help fill nutritional gaps in students diets. The process of cultivation is fairly simple. We start out with the same steps by measuring out the seeds and soaking them in water for 6-12 hours. Each seed has a specific seed density in which you can optimize the amount of growing media, but still allow seed ample space to grow. The moisture initiates germination, but they need to be dried once again to be spread onto seed trays filled

with a mixture of compost (turned and sifted by yours truly) and coco coir. Finally, the seeds are misted and the seed trays stacked topped with a cement brick. This is the beginning of the black out phase. Microgreens are exposed to light after about 3-5 days and are thereafter kept moist using the bottom up watering method to prevent fungal growth.

The benefits of microgreens and sprouts are evident through scientific studies. According to the US National library of medicine and health “the metabolic profile of sprouts and microgreens of dietary species, revealing that they are good sources of bioactive compounds with health-promoting properties. Microgreens contain high levels of carotenoids, chlorophylls and organic acids, anti-diabetic and anti-cholinergic activity. Incorporating these tiny but mighty plants could greatly support a student population that may have nutritional deficits in their diets, possibly helping them do better in school and lead happier lives.

Grant Reeves

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Susan Ackerman, Neurobiology

Synaptic Localization and Upstream Regulation of GTPBP1 in Primary Hippocampal Neurons

Human mutations of GTPBP1 or GTPBP2, a homolog of GTPBP1 with a very similar function, present with neurodegeneration, microcephaly, retinal dysfunction, and a variety of other symptoms. Our lab recently discovered both unexpected synaptic localization of GTPBP1, and that GTPBP1 functions as a ribosome rescue factor. Deletion of GTPBP1 in mice results in ribosome stalling and widespread neurodegeneration. We know GTPBP1 or GTPBP2 mutant mice develop extensive neurodegeneration similar to humans, but we don't yet know how the upstream signaling pathways for these proteins are regulated. In this experiment we seek to determine the upstream signaling pathway responsible for the observed synaptic localization of GTPBP1. To test this we will treat primary hippocampal cultures with an inhibitor of each upstream signaling pathway, along with anisomycin, to determine which inhibitor can reverse the enhanced localization. Anisomycin is used in this experiment to induce ribosome stalling of translational elongation. The primary hippocampal culture that exhibits the lowest degree of GTPBP1 synaptic colocalization is the treatment that best inhibits GTPBP1's upstream signaling pathway. To determine the most effective inhibitor we will utilize immunocytochemistry and confocal imaging and analysis. This research is critical because people with GTPBP1 or GTPBP2 gene mutations have almost no chance to lead normal lives. This project would reveal the mechanism by which GTPBP1 is regulated in neurons, and that knowledge would bring us one step closer to developing a treatment.

Sarah Reyes

Psychology, California State University Northridge
STARS
Mentored by Terry Jernigan, Cognitive Science

COVID-19 Impact on Latinx Families, Home Environments, and Youth's Socioemotional & Physical Wellbeing

In 2018, previous research has shown that Latinx youth reported comparatively higher rates of sadness and hopelessness than their non-Latinx peers (e.g., White and Black counterparts), a consistent pattern that urgently needs to be addressed as the Latinx population is continuously growing and is now the largest racial-ethnic minority group in the United States. The Adolescent Brain Cognitive Development (ABCD) Study is a longitudinal, observational study of adolescent development with over 10,000 youth recruited at 21 sites throughout the nation. Utilizing existing data from the ABCD study, the proposed study will examine associations of factors such as how the COVID-19 pandemic influenced family and home environment outcomes (e.g., SES, cultural values, family structure) and how that contributes to racial-ethnic minority youth and adolescents' reports of socioemotional/mental wellbeing (e.g; symptoms of anxiety and depression) and their overall physical health. We expect to examine specifically, how mental and physical health outcomes in Latinx populations differ from those of non-Latinx populations (e.g., White counterparts). This study aims to contribute to the field of psychological and physical health disparities in underrepresented minorities with the goal of spreading awareness of Latinx health disparities as it is a major public health concern.

Angelita Rivera

Human Biology / Global Health, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Melinda T. Owens, Biological Sciences

Using Qualitative Analysis to Investigate the Impact of the Scientist Spotlight Homework Assignment on Ideas about Diversity and Science Identity in Under-Served Groups in STEM

Scientist Spotlight homework assignments decrease students' stereotypes of scientists and increase their ability to personally identify with scientists (Schinske et al., 2016). Therefore, students may be more likely to feel a greater sense of science identity and self-efficacy. These two factors have been shown to lead to increased persistence and retention in STEM (Estrada et al., 2018). In my research, I ask whether Scientist Spotlights can change student ideas about their own science identity and self-efficacy in

science. Using the scientific framework of the tripartite integration model of social influence (TIMSI), which states that students are integrated into the scientific community through strong self-efficacy, science identity and science values (Estrada et al., 2011), I have analyzed student responses to mid and post-course metacognitive questions about the impact Scientist Spotlights have had on them. These students are from Dr. Melinda Owens' Fall 2020 and Spring 2021 BILD 2 courses. When reading through these responses, I identified common themes on ideas around diversity, science efficacy, science values, and science identity. Analyses are ongoing, but if I can identify changes in these constructs linked to persistence and integration in the science field among an undergraduate introductory course population, I can demonstrate the potential of Scientist Spotlights might go beyond a short-term improvement of a sense of belonging and self-efficacy. They may improve retention in STEM by helping students of minoritized backgrounds feel more like they "belong" in their chosen fields, making the future scientific community more diverse.

Gonzalo Rocha-Vazquez

Political Science: Comparative Politics & Latin American Studies, UC San Diego
McNair Scholars Program
Mentored by Professor Simeon Nichter, Political Science

How Prisons Contribute to the Expansion of Criminal Activity in Brazil

Organized Crime is one of the most prevalent issues in Latin America, touching every aspect of peoples' lives. Studying Organized Crime is not only difficult for scholars and journalists but also dangerous. The lack of available information requires researchers to rely on in-the-field research: confiscated documents provided through connections with state officials and departments, in-depth interviews with locals of the area, and other related statistics collected by regional agencies. This study presents a different approach to studying crime, making use of the widely available data online. This approach to mapping criminal activity provides a much-needed way of collecting standardized results using widely available data. By examining crime at the state level, we can study the spread of gangs over the last 15 years. This study utilizes this data to test how the number of prisons in a state affects its susceptibility to criminal activity by a prison-based gang, using Brazil's Primeiro Comando da Capital (PCC) as a case study.

Evelyn Rodarte

Psychology and Cognitive Science, UC Merced
UROC - SURF
Mentored by Dr. Heather Bortfeld, Psychological Sciences

Known-Word Facilitation Effect of Artificial Speech Segmentation in Spanish-English Bilinguals

Researchers have established that monolinguals show a clear known-word facilitation effect in the segmentation of novel artificial speech. However, whether this effect holds in bilinguals has not yet been established. Research in our lab demonstrates that the known-word facilitation effect holds for both English monolinguals and Spanish-English bilinguals when the known word is in English. In the current study, we aim to explore whether Spanish-English bilinguals experience a facilitation effect when the known word is from the Spanish language. If so, the advantage should manifest for Spanish-English bilinguals and not for English monolinguals. We hypothesize that English monolinguals will not recognize the Spanish word as a known-word in their lexicon, and thus not experience a facilitation effect in their ability to segment the artificial speech carrier stimuli. Findings from the current study will further elucidate the interaction between prior knowledge (top-down information) and incoming speech information (bottom-up information) in speakers with different lexical knowledge available to them.

Pixie Rose

Cognitive and Behavioral Neuroscience, UC San Diego
Gremel Lab
Mentored by Dr. Christina Gremel, Department of Psychology

Measuring Activity of Mediodorsal Thalamic Inputs into Dorsomedial Striatum During Decision-Making

The ability to learn an action sequence to produce a reward relies on the ability to use consequences to inform behavior. Prior studies have shown that mediodorsal thalamus (MD) plays a role in goal-directed behavior and identifying cues. Most of the focus has been on MD interactions with various cortical structures; however, MD also has projections to dorsal striatum (DS). The role of this MD-DS communication has been largely unexamined. We aim to examine the neural activity of MD terminals in DS in the context of an incentive learning task. To this end, we trained food restricted mice and had them execute a chained sequence task that involved two levers for a sucrose reward. First, mice must press a left lever a specific amount of times in order to meet criteria for the right lever to appear. Mice then press the right lever once in order to produce a sucrose reward. To examine neural activity of MD inputs into DS, we used

fiber photometry and a genetically encoded calcium indicator. We injected hSyn1-Flex-axon-GCaMP6s into MD neurons in VGlut2-Cre mice and implanted the fiber over DS. We will examine the relationship between neural activity of this projection and behavior, including right and left lever-presses and licks. We hypothesize that MD axon terminals will show activity changes during reward cue and consumption. Behavioral, fiber photometry, and histological data will be discussed. Our findings will provide insight into what information MD is providing to DS during decision-making.

Antonia Esmeralda Sajche Sapon

Neurobiology & Molecular and Cell Biology, UC San Diego
Creating Scientists to Address Cancer Disparities Program
Mentored by Dr. Georgia Sadler, Surgery

Exploring Liver Cancer Disparity Within the Latinx Community

Liver Cancer rates for the Latinx community are disproportionately higher compared to rates of other Non-Hispanic White communities. To better understand the factors that may be contributing to this disparity, a narrative review of the peer-reviewed scientific literature was undertaken. PubMed, CINAHL, and PsychInfo databases were searched from 2015 to the present, using such key words as: Latinx/ Hispanic, men/women, birthplace, work, socioeconomic status, liver cancer, liver disease, Hepatitis, immigration, screening, religion/spiritual, and education. Articles available in English and Spanish were included. Findings indicated that there is a lack of screening and a higher risk of chronic hepatitis C infection, which puts patients at risk for liver cancer. Furthermore, low socioeconomic minority communities compared to Non-Hispanic White face barriers to accessing preventative care and health monitoring. Closing these disparities will improve clinical care and survival rates, and provide insights for future cancer research.

Esmeralda Salas

Psychology with a Specialization in Clinical Psychology, UC San Diego
McNair Scholars Program
Mentored by Dr. Amy Bintliff, Education Studies

Impacts of Social and Emotional Learning at Akanksha Foundation

The University of California, San Diego's [UCSD's] Partners At Learning [PAL] Program co-designed a research project with the Akanksha Foundation about the impact of social and emotional learning (SEL) on students, teachers, and their families. The Akanksha Foundation is a nonprofit organization located in India dedicated to providing K-12 students from impoverished communities around Mumbai and Pune an opportunity to

access a high-quality education. SEL is defined, by CASEL, as including five core competencies: self-management, self-awareness, social awareness, responsible decision making, and relationship skills. These competencies revolve around teaching students other subcomponents such as identifying emotions, learning about empathy, understanding self-motivation and the role of reflecting, and the importance of teamwork. Data gathered in this study has been analyzed using the theoretical framework of Positive Youth Development (PYD). Lerner's PYD, characterized by the "Five Cs"-- Competence, Confidence, Connection, Character, and Caring, is based on positive youth development and strengths. PYD builds upon existing family and community assets by promoting social support, positive identity and values, social competency, and empowering youth. This study evaluated Akanksha's SEL curriculum using the PYD framework. This study also fills in the gaps of PYD across cross-cultural and international contexts, since a majority of PYD literature conducted has been in white, affluent communities in the United States. Findings indicate that parent engagement helped promote both student and parent wellbeing. Also, facilitating youth leadership increased student engagement, feelings of purpose and belonging, and autonomy over learning.

Anahi Salazar

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

Effects of Medial Prefrontal Cortex Lesions in Rats on the Traveling Salesperson Problem

The Traveling Salesperson Problem (TSP) is an optimization task that requires subjects to identify the shortest route to travel from a starting to ending point, while visiting a certain number of targets. This task has been used to examine spatial memory and decision making in animal models, such as rats, while they perform naturalistic foraging behaviors. Previous studies from our lab have found that rats with hippocampal lesions and medial entorhinal cortex lesions are impaired across many different measures and spatial configurations in the TSP task, specifically on measures of spatial memory. Given the various cognitive demands of this task, our lab was interested in examining the role of the medial prefrontal cortex (mPFC) in the TSP task. After rats were trained on the task, they received medial prefrontal cortex lesions or sham lesions and were retested on the TSP task using eight spatial configurations. Following testing, rats were perfused and their brain tissue was analyzed for lesion quantification. Results will be discussed in terms of medial prefrontal cortex involvement in rat performance in the TSP task.

Celeste Salinas

Psychology, CSU Fullerton

McNair Scholars Program

Mentored by Dr. Leslie J. Carver, Psychology and Human Developmental Sciences

The Early Development of Joint Attention in Autism Spectrum Disorder

Joint attention involves two people sharing attention on an object. Joint attention is typically initiated by one social partner through gesture or direction of gaze and is responded to by the other social partner. The behavior that is typically associated with joint attention is making eye contact with the other individual or gesturing through eye gaze. However, researchers in previous studies have shown that the early development of joint attention behavior in infants is related to sensorimotor skills. This includes grasping, reaching, and manipulating an object that is present. These alternatives provide the foundation for infants to learn to follow joint attention bids. At 12 months, infants learn how to shift their gaze to the object in either their hands or the caregiver's hands and the caregiver's face. This study focuses on observing joint attention behaviors in infants that are at risk for developing autism spectrum disorder. Our study observed the interaction between infants ages 2-13 months who are at low and high risk for autism and their caregiver. This occurred through a virtual setting where the interactions were recorded. The video recordings will be used to code joint attention behaviors. This study will look at any difference in sensorimotor behaviors during joint attention interactions in low and high-risk infants compared to typical development. Our study can contribute to improving interventions and diagnosis of low and high-risk infants.

Negin Samandari

Human Biology, UC San Diego

199 or other independent study for credit

Mentored by Dr. Mark Hepokoski, Pulmonology

Characterization of Circulating, Cell-Free Mitochondrial DNA in ARDS due to Sepsis

Acute respiratory distress syndrome (ARDS) develops in 10% of critically ill patients, and sepsis is the leading inciting etiology. The long-term goal of this project is to characterize mitochondrial DNA (mtDNA) as a novel mediator that contributes to the pathogenesis of ARDS due to sepsis. Current investigations into the clinical utility of mtDNA have been limited by a lack of characterization of key features of extracellular mtDNA fragments. The kidney is a likely tissue source of extracellular mtDNA in sepsis as acute kidney injury (AKI) occurs in 40-50% of patients with sepsis. These data suggest that AKI may be an important source of the extracellular mtDNA fragments that are associated with

mortality during sepsis. The objective of this study is to determine the size, genome location, and tissue origin of circulating, cell-free mtDNA in the cecal ligation and puncture (CLP) model of sepsis in mice. C57BL/6 are randomized to CLP vs sham operation and lung, kidney, liver, heart, plasma, urine, and bronchoalveolar lavage fluid (BALF) samples are collected. MtDNA is isolated from all tissues and extracellular fluids and next-generation sequencing (NGS) is performed to determine the size, sequence, and concentration of circulating mtDNA fragments. Tissue-specific mutations (heteroplasmies) are evaluated and compared to plasma to determine potential tissue origin of mtDNA. Successful completion of these aims will provide insights into the size, sequence, and tissue origin of extracellular mtDNA in sepsis. These data will lay the groundwork for future investigations into mtDNA as a biomarker in ARDS due to sepsis.

Lindsey Sanchez

Political Science, UC Merced

UROC

Mentored by Professor Jessica Trounstein, Political Science

Housing Inequity: An Overview of How Land Use Policies Contribute to Political Inequality and Housing Segregation in the Bay Area

Since the early 19th century, local governments in the Bay Area have used their power to sustain and perpetuate inequality by constructing land policies that have disproportionately benefited white property owners at the expense of people of color. These policy decisions excluded people of color from various resources and neighborhood amenities, ultimately contributing to massive racial and socioeconomic inequalities present in housing patterns today. This study aims to analyze present land-use regulations in Bay Area cities that contribute to the disparity in housing quality. To test this, we collected data on land use regulations in Bay Area cities and coded for variables that include, but are not limited to, restrictions on building townhouses, the presence of density bonus overlays, and senior housing restrictions. For example, we coded for mentions of age restrictions and incentives for senior housing of the variable “senior housing.” The results attained in this study will aid local governments in recognizing the racial inequalities entrenched in their land-use policies and will outline suggestions for moving towards intentional and fair housing practices in the Bay Area.

Daisy Santana

Criminology and Justice Studies, CSU San Marcos
STARS
Mentored by Dalia Garcia, Psychology

Who Converts: Examining Speech Patterns in Older Adults that predict the Development of Alzheimer's Disease.

As people age, the incidence of Alzheimer's disease (AD) becomes more prevalent. In monolinguals linguistic analysis of spontaneous speech revealed subtle changes that seemed to predict who would eventually develop AD - these signs included grammatical complexity, use of fillers and non-specific nouns, number of unique words used, and lexical frequency (Berisha et al., 2015; Ostrand & Gunstad, 2020; Snowdon et al., 1996), though these changes may not always be systematic (Ahmed et al., 2013). However, little is known about these linguistic changes in bilinguals and whether both languages show the same linguistic characteristics. The present study examines the speech patterns of eight Spanish-English bilinguals. All bilinguals were considered healthy at the time of testing, but four of them later developed Alzheimer's disease. The present study examines the speech patterns of eight Spanish-English bilinguals. All bilinguals were considered healthy at the time of testing, but four of them later developed Alzheimer's disease. Speech samples were collected by administering Oral Proficiency Interviews (OPIs) developed by the American Council on Teaching Foreign Languages. The OPIs were transcribed and analyzed using the Systematic Analysis of Language Transcripts Software (Miller & Iglesias, 2020). Consistent with previous findings, people that developed Alzheimer's Disease exhibited more perseverations in their speech ($t(6)=2.02$, $p<.05$) and made more errors ($t(6)=3.54$, $p<.01$) when using their non-dominant language. In the dominant language, there was a significant difference in the number of different words, with converters using less unique words ($t(6)=-2.05$, $p<.05$).

Alfredo Santiago

Psychology, CSU Northridge
STARS
Mentored by Dr. Lane Kenworthy, Sociology

Law and Order: The Impact of Policing on Crime

Due to constant videos and media clips that focus on daily crimes, it feels as though crime is worse than it has ever been. However, crime has actually been steadily decreasing over time. The size of law enforcement agencies and their procedures have changed over time. Community Patrol Officer Programs (CPOP's) are being implemented by law enforcement agencies throughout the United States and new recruits are trained

in the academy on how to properly engage in community policing. Cities where the CPOP approach was used reported lower crime rates in specific areas where community policing was used. This approach allows officers to communicate and get to know individuals in neighborhoods, which makes it difficult for both criminals and police to break the law. Unfortunately, some sources claim that the CPOP approach isn't a solution because it relocates the problem. Overall, it's still unknown whether community policing helped reduce crime in the United States. This study looked at and reviewed a variety of articles from different disciplines and fields examining law enforcement agencies' growth, size, and procedures to better understand the cause of crime rate decline. The results of this study can be used for the betterment of communities that are struggling with high crime rates.

Sara Santibanez

Visual Arts- Studio, UC San Diego

Triton Research & Experiential Learning Scholars (TRELS)

Mentored by Leslie Carver, Provost Thurgood Marshall College/Psychology and Human Developmental Sciences

Access Art San Diego

Having access to all kinds of art at any income level humanizes our environments and helps with our: mental, physical, visual, and sensational well being. Access Art San Diego is a public service project relating to the topic of art, conducted in San Diego County. The mission of the project is to collect art (artwork, media, texts, materials/ supplies, and art related: books, journals, magazines) from willing donors made of: artists, art collectors, libraries, non-profit, small & corporate businesses, general public individuals, friends and family members within San Diego County. The goal is to acquire a collection of art that will be donated to those who do not have access to art (artworks/materials) and/or who are of lower income in San Diego County. The methods involve the coordination of several tasks to achieve the goal. Task one, involves the participation of San Diego County residents in a survey; where the data helps determine and reveal potential donors and recipients for art/artwork in San Diego County. Task two, involves the creation of interest lists based on the survey data results for potential donors and recipients. Receiving and distribution of art will be coordinated conveniently for the donors and recipients. With the use of a website, several public media platforms, distribution of paper flyers, and face to face interactions with San Diego Residents, outreach will be conducted to make this public service project successful.

Angie Santos

Biochemistry, UC San Diego
Genentech Scholars Program
Mentored by Dr. Olivier George & Dr. Lieselot Carrette, Psychiatry

Alcohol Dependence and Withdrawal: Effects on Whole-Brain Functional Connectivity

Alcohol use disorder (AUD) was estimated to affect almost 15 million people in the USA in 2019, significantly impacting their physiology and psychology. Developing effective treatments requires not only an understanding of how alcohol affects the whole brain but also the changes that occur during the transition to dependency. While traditional preclinical research investigating AUD has typically focused on changes in single brain regions, recent developments in whole-brain clearing and lightsheet microscopy now enable visualization of the entire brain simultaneously. Our lab uses the iDisco+ brain clearing and immunolabeling method to detect the immediate early gene c-fos and map neuronal activity throughout the brain at single-cell resolution during alcohol withdrawal. Additionally, the technique allows for the mapping of whole-brain functional connectivity between all brain regions calculated through correlation analysis and graph theory. Using such methodologies, the George lab recently found that alcohol withdrawal in dependent animals increased co-activation between brain regions and reduced network modularity, similar to functional changes in an aging brain. Building on the George Lab's research, this project seeks to further dissect the network changes in the transition to alcohol dependency and evaluate the effectiveness of FDA-approved (naltrexone) and experimental (R121919) treatments for AUD. Our findings will provide a better understanding of the impact of alcohol use on the whole brain network, functional alterations underlying the development of alcohol dependence, and the mechanisms responsible for the therapeutic effects of AUD treatments. Moreover, whole-brain imaging has the potential to reveal previously understudied regions and connectivity.

Angel Sarabia

Molecular and Cellular Biology, UC San Diego
STARS
Mentored by Dr. Rachel Dutton, Biological Sciences

Characterization of Host-Phage Interactions in Cheese Microbial Communities

Historically, studying bacteria-phage interactions within a community context has been challenging to study due to the lack of a tractable system that is able to model their complexity. Cheese biofilm communities have been established as model systems for these investigations because they follow reproducible growth patterns, contain few

species, and are experimentally manipulatable under laboratory conditions. Preliminary efforts in the lab have established Hafnia strains and their phages as model virus-host pairs (unpublished). Our work has identified 21 lytic phages that infect one of two Hafnia species (H1 and H2). To continue the characterization of virus-host interactions, we will expand the library of Hafnia phage through isolating phage from different cheeses, determining the efficiency of plating (EOP) for these phages, and use comparative genomics to determine the genetic basis of EOP differences among these phages. Next, we will use an RB-TnSeq-based high-throughput genetic screening method to identify the genetic basis of phage infection success in a model Brie community (Morin et al. 2018; Pierce et al. 2020). Mutants that are resistant to the phage should show positive fitness by growing to higher levels than those that are more susceptible to the phage and show negative fitness. These steps being taken to unearth the molecular mechanisms of virus-host interactions within a community will prove to be useful in assessing safety risks involved in phage therapy.

Barbara Saucedo

Marine Biology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Douglas Bartlett, Marine Biology

Optimizing fluorescent tagging of active microbial cells in deep-sea seafloor sediments

The activity of subsurface microbial communities in deep-sea environments is poorly understood, particularly with regard to in situ temperature and pressure conditions. In the winter of 2022, on a major expedition I will work with an international team to examine the activities of sediment microbes present in the Puerto Rico Trench (PRT). This location is convenient because it is located less than one hundred miles off the north coast of Puerto Rico, extending from bathyal to abyssal and hadal depth zones down to ~8,400 meters below the sea surface. Sediment cores will be collected at various depths, and subdivided into various sediment core fractions extending into anaerobic zones occupied by sulfate-reducing and methane-producing microbes. Microbes will be separated from sediment grains and their levels of protein synthesis activity assessed using bioorthogonal non-canonical amino acid tagging (BONCAT). This method involves incubating cells with an amino acid analog which is incorporated into newly made proteins, fluorescently tagging the proteins containing modified amino acids, then measuring the degree of fluorescence within the cell populations using flow cytometry. To maintain in situ trench sediment conditions, samples will be processed and incubated under strictly anaerobic low temperature/high pressure conditions using custom-designed pressure vessels. Activity measurements of sediment microbial communities will significantly improve our understanding of active and carbon cycling in one of earth's largest marine ecosystems, seafloor habitats. I will prepare for the PRT

expedition by learning how to process sediments for anaerobic microbes and set up incubations under different temperature pressure conditions.

Justin Savage

Theatre, UC San Diego

Triton Research & Experiential Learning Scholars (TRELS)

Mentored by Professor Todd Salovey, Theatre

Le Théâtre du Grand-Guignol: Its Practice, Themes, and Importance to a Modern World

The phrase “Grand-Guignol’ has entered the English lexicon to describe a grotesque style of horror media infamous within any culture and/or era’s zeitgeist. From the late twentieth century’s Giallo slashers, to the West-End’s ongoing fascination with “ghost plays”, to even the modern thrillers of Steven King, a strong history and direct connection to Paris’ premiere horror theatre: Le Théâtre du Grand-Guignol (1897-1962) can be seen and felt today. Translated as The Great Puppet Theatre, these performances were legendary in their gruesome and shocking nature, forming the basis for horror as we understand it today. And now, through extensive research into the translated performance texts and consolidation of the existing academic literature, this project charts an accessible overview of the theatre and its practices. From laying bare its visual, structural, and thematic constructions to updating the popular view in regards to the theatre’s downfall in the mid-twentieth century- this project will also hopefully serve as a resource for future scholars and dramaturgs interested in the Grand-Guignol. Further, to illustrate the applicable nature of the research and to prove several theories regarding the theatre’s success and appeal to audiences today, a small staged reading of these works has been performed and reflected upon within the larger context of Grand-Guignol performance.

Emmanuelle Scott

Sociology/Culture & Communication and Political Science/Data Analytics, UC San Diego

Triton Research & Experiential Learning Scholars (TRELS)

Mentored by Dr. Margaret Roberts, Political Science

Memes and Misinformation on Twitter during the 2020 US Presidential Election

Over the last decade, social media has become more than a form of social expression; it is a major public venue for information and misinformation sharing. This study collects tweets related to the Nevada ballot count posted between November 4 and November 7; from the day after the 2020 election to the day Joe Biden was declared the president-elect. In this time frame, many people used Twitter to vent their anxieties and frustrations while waiting for the election results, often in the form of memes. While

many expressed exaggerated frustration about the speed of Nevada ballot counting, others shared misinformation about election fraud. On the surface, these posts seem similar—humorous posts often share factually inaccurate information in jest. But a claim that the sloth from Zootopia is counting ballots is much less dangerous than a claim that a van full of ballots for Biden was dropped off at a vote counting center at 3 AM, the latter of which can undermine trust in the democratic process. I develop a supervised learning algorithm to categorize tweets as memes, misinformation, formal news, and informal political conversation. By studying the accuracy of the classifier -- and where it fails -- I hope to inform efforts to prevent the spread of dangerous misinformation while preserving political memes that have an important positive effect on modern political participation.

Rahul Sehgal

Biochemistry, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Professor Michael Burkart, Biochemistry

Science vs. the World: Breaking Down the Knowledge Barrier between Science Researchers and the General Public

As our understanding of science deepens through new research findings, the knowledge divide between the scientific community and the general public appears to grow. Of course, the audience for published scientific literature is fellow researchers, so research papers tend to assume familiarity with relevant prior work and are chock-full of scientific jargon. Reading and understanding these esoteric research findings can be challenging for lay audiences, creating barriers to the diffusion of this knowledge and its implications to the general public.

In an effort to bridge the knowledge gap between scientists and lay audiences, this project focuses on developing lay summaries for a curated set of research papers in biochemistry/biotechnology that highlight environment impact and climate change. These non-technical summaries will assume familiarity with high school-level science and will include not only the content of the paper, but also the context and significance of the work itself. I plan to include recently published research with broad implications for which no lay summary exists, using impact factor as a selection criterion. With this project, I have three goals: (1) to promote trust and transparency in science by breaking down the barriers to understanding new research, (2) to raise public awareness of recent research on the global environment so that public attitudes and behaviors can align to conform with what the science is telling us, and (3) to stimulate curiosity among young students to potentially pursue a career in scientific research.

Shantelle Megan Serafin

Cognitive Science ML/NC, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Shannon Ellis, Cognitive Science

GEM - Mobile Application Game for Female Self-Development

While significant progress has been made in pursuit of the political, economic, and social equality of the sexes, there is still much work to do. My area of focus is particularly concerned with female confidence and self-development. This project is founded on the idea that the feminist movement begins within oneself and one's mindset. Inspired by Carol Dweck, this study aims to determine which actionable items best help women develop a growth mindset. The outcomes of this study will inform the design of the challenges in my mobile application self-help game for females by females, GEM. GEM is a scalable technology solution that teaches women invaluable life skills, such as a growth mindset, through gamification.

Alessandra Serrano

Biology, California State University, Northridge
STARS
Mentored by Dr. Hemal Patel, Department of Anesthesiology

Impact of Meditation and Vacation Effects on Blood Plasma Physiology

The effects of meditation are an area of interest due to their potential benefits to human health. This study aims to understand the physiological effects of attending a meditation conference by analyzing the blood plasma of control, novice, and expert groups. The control group consisted of individuals who attended the event but did not participate in meditation. The novice group consisted of individuals who were new to the meditation process, whereas the expert group were individuals who meditated regularly. Blood samples were collected from all groups before and after the meditation event. Metabolomics, lipidomics and proteomics analysis was performed on the collected plasma. Current analysis includes the use of Python and Jupyter Notebook for data visualization and analysis. Hierarchical clustering analysis was performed on the metabolomics dataset pre and post meditation. Results suggest significant changes associated with meditation effects. Further visualization and analysis of these groups will allow us to determine whether meditation is directly correlated with metabolic changes in blood physiology. Future studies will also aim to see how these changes relate to different disease and immune response pathways.

Alina Shahin

Cell and Molecular Biology, California State University, Northridge

STARS

Mentored by Dr. Diana Rennison, Biological Sciences

Associations Between Morphology and the Gut Microbiome in Threespine Stickleback Fish

The gut microbiota, the microbial community inhabiting an organism's gut, is crucial for survival and health of their host organism, with functions such as nutrient and mineral absorption or immune system regulation. The importance of the gut microbiota is increasingly recognized, and numerous studies focus on the gut microbiota of different hosts. Threespine stickleback fish, (*Gasterosteus aculeatus*), are becoming a model for gut microbiota research, as they show certain interesting characteristics. Threespine sticklebacks are widespread across the Northern hemisphere and repeated cases of parallel evolution allow for studying whether the gut microbiota display parallel changes when their hosts adapt to similar ecological niches. There are two threespine stickleback ecotypes, benthic and limnetic, which differ in their diet and morphology. In small lakes, populations are more benthic, in larger lakes more limnetic; fish in medium-sized lakes are intermediate. Ecological variation along this benthic-limnetic axis allows for studying the effects of host-associated environments on the gut microbiota. Here, we tested for associations between morphological traits and the composition of the gut microbiota across stickleback populations from different sized lakes. The morphological traits are either trophic, relating to feeding, or defensive, relating to protection against predators. We hypothesize that trophic traits show a stronger association with the gut microbiota compared to defensive traits. This research will help with understanding the interaction between microbial communities and their host during adaptation to different ecological niches.

Ju Ying Shang and Hannah Chen

Materials Science and Engineering, UC San Diego

MRSEC REU or RIMSE

Mentored by Prof. Michael Sailor, Chemistry & Biochemistry

Investigating ambient stability and sensitivity of chemical sensors based on photoluminescent, quantum-confined porous silicon nanoparticles

Photoluminescence (PL) is light emission due to absorption of photons. It is a widely studied phenomenon because it has both practical and fundamental applications. PL from quantum-confined silicon nanoparticles embedded in a porous silicon framework is quenched when in contact with certain molecules, and this phenomenon provides a

means to construct sensitive chemical sensors. However, oxidation of silicon in ambient air leads to a substantial reduction in sensitivity of the sensor. Here, we explore techniques to stabilize silicon nanoparticles for an application in sensing of volatile organic compounds (VOCs). The ability of a native oxide to protect the Si core while maintaining strong quenching in response to ethanol vapor exposure is studied. Grafting of hydrocarbons to the surface is explored as an alternate means to enhance stability while preserving analyte sensitivity. The steady-state and time-resolved PL response of silicon nanoparticles containing native oxide or other coatings is explored as a function of analyte exposure.

Imani Shell

Sociology, Howard University

STARS

Mentored by Dr. Richard Pitt, Sociology

Race Differences in College Major Perceptions

Persistent disparities in post-baccalaureate outcomes exist for Black and Latinx students relative to their White and Asian peers, disparities which are related to their choices of college major. While we know race differences exist in student choices of college major, it remains unclear what differences between students might factor into these diverging choices. In this study, we examine the relationship between students' races and their evaluations of college major prestige, a characteristic proven to be related to important post-baccalaureate outcomes like early-career income. We argue that the differences between Black/Latinx and White/Asian students' choices of majors might be reflected in differences in their evaluations of the value or status of the majors themselves. Our results, based on a survey of more than 1800 undergraduate seniors, reveal that Black and Latinx students give low-paying communications, education, and social science majors higher prestige ratings than their White and Asian counterparts.

Romina Shirazi

Biomedical Engineering, UC San Diego

STARS

Mentored by Dr. Shamim Nemati, Dr. Joseph Osorio, Department of Biomedical Informatics

Predicting the Outcome of Spine Surgeries using Image Processing and Machine Learning

Adult Spine Deformity (ASD) is a complex disease, referring to a group of conditions in which the spinal column bends abnormally in the S-curve or C-curve shape which encapsulates from the cervical, lumbar, and thoracic vertebrae. The population affected

by ASD are unable to maintain a proper posture required for functional and pain-free daily activities, thus this misalignment needs to be corrected to provide the patient a better quality of life. The purpose of this study is to develop a quantitative machine learning-based score to determine if the spine at each segment is rigid, semi-rigid, or flexible by comparing imaging data (e.g., spine X-Rays, and MRI, CAT scans) in standing and supine positions where the effect of gravity is minimized. We hypothesize that such risk score will augment the ability of spine surgeons to optimize their surgical plans. Image processing will be performed to automatically segment images, and 'edit distance' and 'Procrustes analysis' will be performed to compare and quantify spine deformity in various positions. To better predict surgical outcomes, we aim to further enrich our imaging data with additional covariates from electronic health records (EHR), including age, weight, height, gender, and current health condition. Successful completion of this project will enable the next generation of precision spine surgery (PSS) and may lead to more optimal surgical planning, improvements in mobility and function, and ultimately better quality of life for ASD patients.

Sukham Sidhu

Economics, UC San Diego

Triton Research & Experiential Learning Scholars (TRELS)

Mentored by Dr. Kwai Ng, Sociology

California Punitive Damages Appeals: Award Reduction and Wealth

There has been continual debate in legal research about the validity of punitive damages – the purpose they serve and the consistency with which they are awarded. Often, defendants appeal punitive damages, and the general perception is that most of these appeals are granted. With my project I intend to explore the factors that influence the verdict of punitive damage appeals and the amount of damages awarded. Compensatory damages are those that are paid to directly remedy the harm caused by the defendant. Punitive damages are awarded above and beyond compensatory damages with the purpose of deterring similar future conduct. This project uses the Westlaw database to create a dataset of reported civil cases after 2009 from California courts of appeal dealing with punitive damages. A sample of cases from each court district will be reviewed. Variables such as the plaintiff and defendant characteristics, the amount of punitive and compensatory damages, the case area, and whether the case mentions the defendant's wealth (a "deep pocket" case) will be created. The plaintiffs and defendants will be categorized as individuals, small businesses, large businesses, or corporations. This dataset will then be used to test the hypotheses that punitive damages are lowered in the majority of appeals, corporations pay higher punitive damages than individuals, and punitive damages are even higher in "deep pocket" cases.

Elanor Sievers

Biochemistry/Chemistry, UC San Diego

Undergraduate Research Scholarships

Mentored by Professor Debelouchina, CHEMISTRY/BIOCHEMISTRY

Determining the structure of a cysteine-less intein and improving its splicing efficiency using NMR spectroscopy and splicing assays.

Inteins are a unique class of proteins, that are capable of stitching other proteins together in a process known as protein splicing. They are valuable tools for protein chemists as they allow for selective labelling and assembly of proteins. One caveat for using inteins is that they typically need the amino acid cysteine in order to stitch together the proteins. This cysteine is inserted into the newly assembled protein and results in an undesirable “cysteine” scar. This limits protein chemists, as not all assembled proteins function well with a new cysteine in their structure. In 2019, a cysteineless intein was discovered, which uses a serine instead of a cysteine to catalyze the protein splicing reaction. However, not much is known about this intein, including its structure, and by extent its splicing mechanism. My research goal is to determine the structure of this intein, and then improve upon its splicing efficiency. Using NMR spectroscopy, we have begun determining the structure of the intein via backbone assignments. In addition, I have used molecular dynamics simulations to predict the effect of mutations on the splicing efficiency of the intein. I am currently testing those predictions with splicing assays in vitro and in bacterial cells. With this research, I hope to contribute to the development of a new intein tool for protein chemistry applications.

Kyle Skelil

NanoEngineering, UC San Diego

McNair Scholars Program

Mentored by Dr. Darren Lipomi, NanoEngineering

A Synthetic Microrobot to Regrow Severed Neurons

Neuropathy is defined as damage or dysfunction of one or more nerves in the body, and can range from mild tingling and numbness to complete paralysis. It is estimated that approximately 25% to 30% of Americans will suffer from Neuropathy in their lifetimes, with odds increasing drastically for those affected by diabetes, cancer, physical trauma, and more. Researchers have found that although the axon (the body of the neuron) may be damaged or cut, the remaining head stays alive but lacks the ability to communicate with the spine and relay sensations to the brain. They also found that if the neuron head is stretched at a slow enough rate, it can regrow to its original length. While this shows

great promise, a surgery to reattach a nerve from an extremity to the spine is a high-risk procedure and may not be feasible. Instead, scientists have looked to microrobots as vehicles that might be able to regrow the nerves. By fabricating robots to the correct size and programming them to move at the correct speed, they can instead be the “surgeon” and perform this procedure in vivo. Three classes of microrobots have emerged for such applications: biological, synthetic, and hybrid. While their structures are dissimilar, they share common functions within the body, including sensing, gripping, and carrying cargo. In this presentation, I will review the various types of microrobots with their strengths and weaknesses, and dive into the mechanisms required to regrow a broken nerve inside of a person.

Michael Skipworth

Cognitive Psychology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities Program
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

Released from smoking: Can a tailored smoking cessation program encourage smoking abstinence before and after release?

The United States currently stands as the world leader in incarceration rates, with Black and Hispanic/Latinx men more likely to be incarcerated than their White counterparts. Although smoke-free policies have been implemented in many federal prisons and correctional facilities across the country, the incarcerated community has greater smoking prevalence than the general population and higher reports of relapse following release. This literature review investigates smoking cessation and behavioral therapy programs that focus on incarcerated members; furthermore, this review will discuss methods to encourage intention to quit smoking and maintain smoking abstinence during incarceration and after release. A review of the literature was conducted relating to smoking cessation and substance abuse programs designed for persons during and after incarceration. Databases including PubMed, PsycINFO, CINAHL, and EBSCOhost, were searched using the following major search terms: incarceration, smoking cessation, behavioral therapy, tobacco, incarcerated members, federal prisons, and correctional facilities. Reference lists of articles were reviewed to identify additional articles. Articles were discovered regarding current smoking cessation programs and behavioral therapies aimed towards persistent smoking abstinence during incarceration into release. Studies identified that increased social support following release alongside the smoking cessation treatment facilitated greater smoking abstinence. Further research concerning potential cessation programs and policies that may encourage smoking abstinence and provide effective resources toward maintenance and support following release will be discussed at the conference.

Emma Smith

Marine Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Melissa Carter, IOD

Differences between biofouling communities underneath Southern California piers

Multiple settlement plates were deployed underneath a series of piers in Southern California: Scripps Pier, Newport Beach Pier, and Santa Monica Pier. These plates were then left in the water to accumulate the natural growth of biofouling species for approximately one month. Settlement plates provide an area for natural recruitment within an organism's natural environment so that the contents on the plate can be later removed for further investigation and analysis. This allows for the most accurate observation of community components as well as an efficient method of monitoring for any nonnative or invasive species that could potentially threaten the local ecosystem. A survey of the pier pilings at different depths similar to the depths of the settlement plates will also be performed as to attain prior understanding of the natural growth at each site. Along with visual analysis and identification of the species growing on the settling plates, statistical analyses must be made to determine the quantitative differences between sites. This is to be done by calculating percent cover and community composition of the settlement plates at each site, as well as a comparative analysis between all three sites.

Harriet Song

Molecular and Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Elizabeth Komives, Chemistry and Biochemistry

The inhibition of the urokinase-type plasminogen activator (uPA) with and without the amino-terminal fragment (ATF)

The urokinase-type plasminogen activator (uPA) is a trypsin-like serine protease that activates the inactive plasminogen to plasmin. The uPA-plasmin system is normally involved in regulating the degradation of the extracellular matrix (ECM) and fibrin blood clots. However, the uPA-plasmin system, when unregulated, can contribute to tumor angiogenesis/progression. My project focuses on the uPA activation of plasminogen to plasmin by uPA which serves as the rate-limiting step in the uPA-plasmin system.

The uPA has four domains; an N-terminal Epidermal Growth Factor (EGF)-like domain and a Kringle domain which collectively constitute the Amino-Terminal Fragment (ATF). A linker sequence connects the ATF domain to the C-terminal protease domain of the

uPA. Plasmin activates single-chain uPA by cleaving it at the linker-protease region, creating a two-chain uPA. The two chains, the ATF-linker and the protease, are attached via a cysteine disulfide bond between the linker and the protease. Our lab has previously shown that the ATF-linker interacts with the protease and increases the k_{cat} for chromogenic substrate cleavage. My main research objective is to analyze how ATF-linker alters the inhibitory capacity of various inhibitors on the uPA. So far, I have shown that benzamidine, an inhibitor of uPA, inhibits the uPA protease (without ATF) activity with an IC_{50} of 150 μ M. Next, I will measure the IC_{50} of benzamidine for Full-length uPA. This will reveal whether the ATF-linker affects benzamidine inhibitory potency. I also plan to test a second inhibitor that has higher specificity for uPA and is currently in clinical use.

Dafina Sopi

Bioengineering, UC San Diego
Genentech Scholars Program
Mentored by Dr. Oscar Vazquez Mena, NanoEngineering

Designing of Acoustic Metamaterial for Enhanced Ultrasound Transmission Through the Skull for Non-Invasive Brain Stimulation.

The plan is to use the finite element analysis code developed under Dr. Vazquez Mena's lab to simulate an acoustic metamaterial with effective negative density and modulus as close as possible in magnitude to the bone parameters. This is being done in order to fully develop a biomaterial that can enhance the transmission of ultrasound through the skull with minimal aberrations. If the values and parameters are close enough to bone, we can then start manufacturing the material in-lab and testing it.

Kristina Stahl

Art History, Studio Art, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Professor Grant Kester, Art History

Museums & Justice: An Exploration of Power, Privilege, & Protest

The complex relationship between museums and justice has been brought to the fore by recent discourse, protest, and scandal. Guided by recent literature and critical theory, this research considers how museums are monuments of colonialism that claim authority, universalize white experience, receive funding from private interests, and retain stolen artifacts while continuously excluding Black and Indigenous narratives. Movements like #MuseumsAreNotNeutral and the Instagram account @ChangeTheMuseum increasingly call on these institutions to recognize their

inextricable ties to white supremacy and commit to the repatriation of stolen artifacts and ancestral remains. But despite extensive discussion of “DEI” initiatives within the field, the majority of museums fall short in key areas, maintaining curatorial practices that prioritize commerciality over community care. Highlighting the work of the Museum of Us in Balboa Park, the goal of this research is to investigate and dismantle the facade of neutrality upheld by many art museums in order to create space for a vivid reimagining of these institutions’ futures.

Gabriella Stark and Helen Zhang

Inorganic Chemistry / Materials Science and Engineering, UC San Diego
MRSEC REU or RIMSE

Mentored by Dr. Michael Sailor, Department of Chemistry and Biochemistry

Toward the Targeted Delivery of Imatinib to Gastrointestinal Stromal Tumors Using Aptamer-Conjugated Porous Silicon Nanoparticles

Gastrointestinal stromal tumor (GIST) is the most common sarcoma of the gastrointestinal tract. GISTs are immunohistochemically positive for the receptor tyrosine kinase KIT, which makes KIT an essential means to detect and target GISTs. Imatinib is a KIT inhibitor drug which possesses anti-cancer properties and is a first-line therapy for patients with GIST. This presentation will describe the use of porous silicon nanoparticles (pSiNPs) conjugated with anti-KIT DNA aptamers to specifically target GIST. Aptamers are short, single-stranded oligonucleotides that bind to specific proteins with high affinity and specificity, analogous to peptides or antibodies. Our work aims to synthesize pSiNPs, load Imatinib at clinically relevant concentrations utilizing various loading and trapping chemistries, and attach an anti-KIT aptamer highly specific to GIST in order to promote non-specific uptake. We aim to test pSiNP candidate formulations in in vitro tests to compare the efficacy for targeting of HMC-1 and GIST-T1 cells. This presentation will present the latest progress toward these goals. Nanoparticles will be characterized by Fourier Transform Infrared Spectroscopy (FTIR), High Performance Liquid Chromatography (HPLC), and Thermogravimetric Analysis (TGA). If successful, this work could lead to more effective treatment of cancer types that overexpress KIT.

Bettina Suarez Davila

Biology, UC San Diego
Creating Scientists To Address Cancer Disparities Program
Mentored by Dr. Sadler, Surgery

Factors Explaining Higher Rates of Breast Cancer in Hispanic Women in the United States than Hispanic Women in Mexico

Hispanic women born and living in the United States are more likely to develop breast cancer than Hispanic women born and living in Mexico. Different factors such as lifestyle, education, lack of health care, religion, and language barriers have been proposed. However, certain factors may contribute more than others to the higher rates of breast cancer in Hispanic women in the United States. This literature review was conducted using articles from PubMed, Very Well Health, American Association for Cancer Research, and data from the U.S. Department of Health and Human Services. Keywords included: Hispanic women, breast cancer, Mexico, Hispanic, acculturation, lifestyle, health care, religion, language barrier, and education. This presentation will review the nature of these specific factors' contributions to the breast cancer disparities between Hispanic women in the U.S. versus Mexico. Proposals for future research will also be provided.

Shengmin Sun

International Business, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor.Luz Chung, Educational Studies

Why Tax Me?

Have you ever wondered where your income tax goes? Every paycheck a person receives from his/her job must pay a certain percentage of that income to the IRS or the state. Many people think they know where their tax money goes, but do they really know in detail? The overview of this project is knowing everything there is about Income Tax in California and how it came to be from history till now. The focus will be researching heavily on how Income Tax work around the public people. The issue is people not knowing enough. Not just this, making minimum wage and paying a certain percentage of that gain is extremely hard for low-income families. When you're not keeping all the gains but must share it with the state, it's hard to survive, thus they question. Many people know where their tax goes but they do not know the specifics. They're simply following the rules and regulations which applies to their livelihood within this society. They question but doesn't get the right answer. Therefore, I am here to research deeply towards this matter so that I can answer it towards citizens that want

to know where their hard-worked money is distributed throughout our communities and this state of California. Hence, I am here to seek out specific history, stats, numbers, laws, rules and regulations which apply towards income tax, so that people can have a better understanding of this matter and get their questions answered.

Steven Swee

Chemical Engineering, UC San Diego
UCSD DBMI
Mentored by Dr. Jejo Koola, UCSD DBMI

Evaluating the Elevated Accuracy of Time Series vs. Standard Bootstrap Analysis on Implantable Medical Device Adverse Outcomes

Implantable medical devices have made significant contributions to improving patient care and advancements in such devices continue to be made. However, complications associated with medical devices are poorly reported and are primarily known by their aggregate failure rates. The contributions from sources such as patient comorbidity, intrinsic device issues, and physician/operator error to the aggregate failure rate is not well studied. Retrospective and simulated datasets from Medical Information Mart for Intensive Care (MIMIC-III) and from device usage describe patient feature distributions and success and failure rates respectively. We utilize various parametric and nonparametric models to estimate the errors inherent in the use of the device along with the reduction of error caused by learning effects (i.e., the device is used by a larger population of physicians for a longer period of time). We develop a potential pipeline for statistical analysis along with highlighting potential challenges in real-time analysis.

Luke Sztajnkrzyer

Cognitive Science - Machine Learning, Joint Math/Economics, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Angela Yu, Cognitive Science

Exploration of the Effects of Individuation Training on Explicit Face Perception-based Bias

In previous studies, it has been found that a contributing factor to implicit racial bias may be race-sensitive social processing of faces. It has been shown that the general population, and certain service sectors, are implicitly biased towards minorities in this manner. In a similar area of study, a style of face recognition practice known as Individuation Training was used to reduce implicit bias in preschool children. This study aims to test whether individuation training offers a means of reducing bias in a population of adults, rather than children. It also places an emphasis on determining whether individuation training affects explicit bias, although it still includes some tests

for implicit bias. We hope to explore possible relationships between facial features and explicit bias in different scenarios, and we hope to find that individuation training reduces the magnitude of one's bias against their "less-preferred" race. Additionally, this study may provide insight into why and how individuation training reduces explicit racial biases in adults or why it does not; this discernment is key in future studies and potential optimization of individuation training (or a similar bias-reducing method) for more general use.

Michael Tang

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Cheolhong An, Electrical and Computer Engineering

OCT-Angiography processing for disease detection and classification

The relationship between the retina and the central nervous system enables us to study features of the brain that may be indicative of systemic, metabolic and hematologic disease. More specifically, microvascular information such as blood flow and vessel density gives us valuable insight into the blood vessel patterns, which can be telling of the levels of damage in the brain. Optical Coherence Tomography Angiography (OCTA) is a newly developed non-invasive imaging technique that has been often utilized for its ability to capture high quality 3-D representations of retinal vasculature. While vessel segmentation of OCTA images would greatly further our ability to detect various diseases and understand their developments, it remains a minimally explored task due to the challenges posed by low visibility, image noise, and increased vessel complexity. In this project, we develop and implement a deep learning algorithm that overcomes these barriers and effectively segment vessels in OCTA images. Since our model is designed specifically to overcome the challenges posed above, across our dataset of OCTA images it is able to outperform other traditional state-of-the-art segmentation techniques built for varied usage. We verify our model's superiority by measuring a variety of parameters at different depth layers of the retina, such as accuracy, area under ROC curve, false discovery rate, etc. and comparing the parameters generated by our model with those generated by the other models. This leads to promising medical implications in the detection, study, and treatment of neurodegenerative diseases.

Dawei Tang

Neurobiology, UC San Diego
UC Scholars
Mentored by Dr. Edward Callaway, Neuroscience

Explore the spatial relationships between functional maps and neuronal clustering in macaque primary visual cortex

For trichromatic color vision, light signals are sampled by L-, M-, S-wavelength sensitive cones on the retina. Then, signals from cones are encoded by parasol, midget, and bistratified retina ganglion cells, and delivered to primary visual cortex (V1) through M, P, and K layers of the lateral geniculate nucleus. Recently, Li et al. found cone opponent functional domains (COFDs) in V1 using intrinsic signal optical imaging. This COFD functional map shows how cone-opponent signals (L/M and S/(L+M)) are organized and mixed in V1 to generate tuning for all hues. Together with ocular dominance, orientation, spatial frequency and color maps, COFD map demonstrates again that macaque V1 is highly organized. Previous studies have shown the orthogonal relationship between orientation and spatial frequency maps, and between ocular dominance and orientation maps, it is interesting to investigate the relationship between the new COFD map and other functional maps. Besides, Li et al. also found direction-selective neuron clustering based on two-photon calcium imaging (unpublished). So, it is also interesting to analyze the clustering properties of those neurons, and study their spatial relationship with other functional maps.

To quantitatively analyze the relationship between different functional maps, and characterize the spatial distribution of direction-selective neurons, I developed Julia programs based on published and new methods. Preliminary autocorrelation analysis shows that neighboring direction-selective neurons in superficial V1 share similar tuning preference. This research will help us better understand how different functional maps are organized in V1.

Isabel Tate

Sociology/Cognitive Science, UC San Diego
McNair Scholars Program
Mentored by Professor John H. Evans, Sociology

Examining the Factors Behind the Facilitation of Social Cohesion Through Online Interactions During the Covid-19 Pandemic

As users of platforms like Zoom are experiencing negative effects from being on their computers more often during the pandemic, like fatigue and increased social anxiety, there is a need to understand why certain aspects of online

communication and communication technology cannot replicate our in-person interactions. The sense of social presence and cohesion online can be influenced by the interactions within communication technology, for example turning your camera on or off on Zoom. It is increasingly more significant to consider how the sense of social cohesion and social presence is created online. In this project, I introduce an analysis of social cohesion in a university setting where students are attending courses virtually in order to understand the requirements for social cohesion to occur in communities of different social norms and dynamics as in this situation and many others during Covid-19.

Luisa Taverna

Biology, Emory University

STARS

Mentored by Dr. Lucila Ohno-Machado, Bioinformatics

Genetic Diversity and Association Studies in LatinX populations using All of Us Research Cohort

The background of LatinX/Hispanic individuals in the US includes ancestrally diverse source populations. Characterizing the genetic variation present in Latino-specific genome wide association studies (GWASs) reveals pathways for understanding population structure and familial relatedness. Previous studies conducted GWASs for the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) of 22 electronic health record (EHR)-based traits and genetic-based clustering among six self-identified background groups (Cuban, Dominican, Puerto Rican, Mexican, and Central and South American) [Conomos et al. AJHG2 2016; PMID: 26748518]. Our study aims to extend these results to a more robust sample size using the All of Us (AoU) Research Program Cohort. AoU is an NIH- funded initiative that aims to generate a large-scale health record database incorporating demographic groups typically underrepresented in biomedical research. Our study will check reproducibility of previous documentation of genetic diversity in LatinX populations. The analyses will primarily utilize principal components estimated from single nucleotide polymorphisms derived from whole genomes. We expect to develop a sizable genetic map of the ancestral origins of LatinX populations and also highlight the effect of admixture in characterizing genetic signatures.

Mary Taylor

Chemistry, North Carolina A&T State University

UC-HBCU Pharmacy

Mentored by Connor Caffery, Skagg School of Pharmacy and Pharmaceutical Sciences

Congeners derived from microtubule-active phenylpyrimidines as a basis for a novel treatment of the neglected disease, Schistosomiasis

Mary Taylor*, Ludovica Monti, Karol Francisco, Thibault Alle, Nelly El-Sakkary, Lawrence Liu, Carlo Ballatore, Conor Caffrey

Skaggs School of Pharmacy and Pharmaceutical Sciences, UC San Diego

Schistosomiasis is a parasitic disease that affects approximately 200 million people in developing countries. Treatment relies on just one partially effective drug, and new drugs are needed. Tubulin and microtubules are essential components of the cytoskeleton cells and considered potential drug targets to treat parasitic infections. Based on recently published work (PMID: 33135408), we are pursuing a series of thiophen-2-yl-pyrimidines derived from molecules originally designed to target tubulin in the treatment of neurodegenerative diseases. Approximately 35 different analogs are currently being screened in vitro against the adult *S. mansoni* parasite. Assay readouts include both motility-based and observational-based assays. The molecules induce a potent and long-lasting paralysis of the parasite and the preliminary structure activity relationship will be described. Because these are relatively simple drug-like structures, and are relatively non-toxic to mammalian cells, these molecules hold promise as candidates for the development of new treatments for schistosomiasis.

Allyson Teague

International Relations, University of San Diego

McNair Scholars Program

Mentored by Dr. David A. Shirk, Political Science and International Relations

The COVID-19 Crisis in the San Diego-Tijuana Region: Public Health, Economic, and Social Impacts

This study examines the impact of the COVID-19 pandemic in the Cali-baja and San Diego-Tijuana region, with regard to the diverse public health, economic, and social consequences of the pandemic for people, businesses, and communities on both sides of the border. While there have been many studies of the impacts of COVID19 in the United States and in Mexico, there are comparatively fewer studies that have examined the impact of the pandemic in cross-border communities. The research methodology employed in this study includes analysis of available descriptive data on public health and economic impacts, as well as personal interviews with local stakeholders in both San Diego and Tijuana. Overall, the research provides a basis for understanding how trans-border communities have been specially impacted by (and how they have adapted) to the realities of the pandemic. The findings of this study also shed light on the lessons for policy makers on how to manage the complexities of a global pandemic in a highly integrated cross-border region. In this sense, this report provides a unique

perspective that will prove useful in improving regional emergency responses to crises affecting the San Diego-Tijuana region and other cross-border regions.

Ananya Thridandam

Mechanical Engineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Michael Davidson, Mechanical and Aerospace Engineering and
The School of Global Policy and Strategy

Renewable Energy Resource Assessments in the Western United States

Greater integration of energy planning and markets have the potential to lower costs, and facilitate the transition from fossil fuels to renewable energy as the western United States' primary source of energy. Currently, there are proposals to expand the California Independent System Operator into a western regional Independent System Operator (ISO) in order to reach California's ambitious renewable portfolio standard of 100% renewable energy by 2045. However, reaching this goal by means of a regionalized energy grid faces unique geographic, technical and political constraints. The goal of this study is to use these constraints to assess the availability of renewable resources required to meet California, and other western states' clean energy goals. Preliminary work for this study involved classifying energy stakeholder positions regarding policies related to regional coordination of the western energy grid to develop assumptions about how various states in the western US will interact with each other to achieve their energy goals. These political assumptions will be used in addition to existing geospatial data to assess the availability of renewable resources in the western United States. The goal of this resource assessment will be to determine which areas of land in the western United States are most suitable for the development of renewable energy infrastructure required to meet each western states climate and energy targets.

Serly Tomas

Molecular and Cellular Biology, CSU Northridge
STARS
Mentored by Hemal Patel, PhD, Anesthesiology

Impact of Meditation and Vacation Effects on Blood Plasma Metabolites

The effects of meditation are an area of interest due to their potential benefits to human health. This study aims to understand the physiological effects of attending a meditation conference by analyzing the blood plasma of control, novice, and expert groups. The control group consisted of individuals who attended the event but

did not participate in meditation. The novice group consisted of individuals who were new to the meditation process, whereas the expert group were individuals who meditated regularly. Blood samples were collected from all groups before and after the meditation event. Metabolomics, lipidomics and proteomics analysis was performed on the collected plasma. Current analysis includes the use of Python and Jupyter Notebook for data visualization and analysis. Hierarchical clustering analysis was performed on the metabolomics dataset pre and post meditation. Results suggest significant changes associated with meditation effects. Further visualization and analysis of these groups will allow us to determine whether meditation is directly correlated with metabolic changes in blood physiology. Future studies will also aim to see how these changes relate to different disease and immune response pathways.

Alan Tram

Cognitive Science HCI, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Professor Elizabeth Eikey, Public Health and Design Lab

Using a Digital Mental Health Intervention to Improve Student Social Endeavors

Been-Awhile is a mobile application that seeks to assist it's users as a new digital intervention tool that supports college students in their social endeavors. The application prompts the user with set up options where they construct their own profile, add contacts, create messaging routines, and track their improvement. Following an industry standard design process, the development will progress from collecting helpful data on the target audience, wireframing, low to high level prototyping, app development, with user testing and interviews conducted throughout. Been-Awhile will be an application that is tested and tailored for student users. Following the idea of Gamification, the use of game-related principles in non-game contexts to promote self efficacy, Been-Awhile intends to incorporate a work-reward mentality to a student's everyday social interactions. To instill such positive reinforcement, the design will utilize progression bars, achievement notifications, and the users themselves will see an improved state of life from such social engagements. I believe that the pandemic has caused a lot of harm to college students, especially to their social engagement among peers. Said students are also related to heavy smartphone usage; and with these aspects in mind I believe that they'll see the most benefit using Been-Awhile. Been-Awhile will serve as an example that digital intervention technologies can be valid options to better various facets of people's lives.

Pauline Tran

Human Biology, UC San Diego

Biorepository Student Assistant

Mentored by Dr. Sharmeela Kaushal, Moores Cancer Center Biorepository

Assessment of DNA and RNA Quality of Human Autopsy Tissue for Genomic Analysis

Autopsy, compared to surgical biopsy, allows for extensive collection of matched tissue that is not available pre-mortem, including normal tissue, primary tumors, and especially metastatic sites. Metastasis is responsible for 90% of cancer-related deaths, however the only way to collect and study metastatic sites is through autopsies (Kaushal, 2017). Preliminary studies have established that after death, RNA degrades if tissues are not fixed (Bauer et al., 2003). While collecting tissue via rapid autopsy is ideal, it is not economically possible due to hospital regulations and family desires. The goal of this study is to validate that normal autopsy (2-3 days postmortem) is a sufficient alternative to collecting human tissue, specifically metastatic sites, for genomic analysis.

In collaboration with UC San Diego School of Medicine's Division of Anatomic Pathology, human specimens were collected during clinical autopsies under Moores Cancer Center Biorepository IRB-approved protocol #181755. All specimens were fresh-frozen (FF) and formalin-fixed, paraffin-embedded (FFPE). The Qiagen QIAcube will be used to isolate DNA and RNA, and the Thermo Fisher Nanodrop 2000 and Agilent TapeStation 4200 will be used to assess nucleic acid quality and quantity.

Tissue from ten autopsies have been procured and are actively being procured. Samples have been collected from eight different organs and have been processed as both FF and FFPE. In the future, we plan to extract DNA and RNA and assess their quality and quantity, which will validate if normal autopsy is a reliable source of normal, cancer, and metastatic human tissue for downstream genomic analysis.

Diane Tran

Human Biology, UC San Diego

Creating Scientists To Address Cancer Disparities Program

Mentored by Veronica Cardenas, psychology

Disparities in End-of-Life (EOL) Care for Asian American Cancer Patients

End-of-life (EOL) care (a type of palliative care) in conjunction with oncology care for patients with advanced cancer can enhance quality of remaining life. Asian American patients diagnosed with cancer are more likely than Non-Hispanic White patients to

receive aggressive care and die in an ICU, and have the lowest utilization of palliative/hospice care at the end of their lives. Cultural differences between different ethnic groups, communication difficulties, poorer physician-patient relations, less awareness of palliative care, different levels of acculturation, and EOL care costs can play a role in these disparities. This literature review identified articles from PubMed and PsycINFO databases using the following keywords: asian american/asian immigrants/vietnamese/chinese/hmong/japanese/korean/east asian americans/south asian americans/southeast asian americans, palliative care, terminal care, patient-physician relations, end of life/EOL, and cancer. To date, there has been little research done on interventions focusing on improvement of the delivery of and access to EOL care for Asian American patients diagnosed with cancer. Suggestions for improvement in EOL care will be presented.

Joshua Tran

Human Biology, UC San Diego
Creating Scientists To Address Cancer Disparities Program
Mentored by Dr. Georgia Sadler, UCSD Moores Cancer Center

Could the cumulative effect of environmental exposures negatively impact the gut microbiome of African American women with breast cancer? A narrative literature review.

Past research has demonstrated that environmental exposures can trigger alterations in the gut microbiome and may be risk factors for breast cancer. African American women have the second-highest breast cancer morbidity rate and the highest mortality rate compared to other racial and ethnic groups in the US. A potential cause of this disparity could be that African American women are at an increased risk of environmental exposures to harmful pollutants that may cause genetic alterations to the gut microbiome. This narrative literature review identified articles using PubMed, Nature, CINAHL, and Google Scholar databases, using key search terms such as: African American/Black, women, gut microbiome, breast cancer, and mortality. Reference lists of key articles were reviewed. This presentation will summarize the findings on how the gut microbiome may contribute to the disparities in breast cancer morbidity and mortality among African American women and highlight implications. This presentation will also explore how the altered gut microbiota might circulate through the body to affect breast tissue and possibly trigger genetic mutations in the breast tissue that increase the risk of cancer. Recommendations for future research and policy changes will be given.

Cindy Tran

General Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Jonathan Shurin, Biological Sciences

Behavioral Syndromes in Tui Chub and Its Ecological Impacts

Several studies have demonstrated that species within populations can exhibit individual “behavioral syndromes,” or correlated behaviors that remain consistent across different contexts (e.g. mating, feeding, antipredator behaviors). However, the ecological causes and consequences of individual behavioral syndromes are not well understood. In many animals, the bold-shy axis is a robust classification of behavioral syndromes. We will compare the distribution of bold/shyness in natural populations of the minnow tui chub and determine whether environmental factors can explain any variations. If it is established that there is a difference in the distribution of behavioral types between separate populations, we will be interested in comparing how these distinct behavioral types impact food web and ecosystem dynamics using a mesocosm experiment. Understanding this would provide insight into the relationship between animal behavior and ecology, as well as help inform conservation of the Owens tui chubs.

Sally Trinh

Biochemistry and cell biology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities Program
Mentored by Dr. Georgia Sadler, Surgery

The Key Determinants of a Cancer Survivorship Needs Model

Advanced cancer therapeutics have contributed to the increasing number of cancer survivors, however they are left with financial, economical, physical, and psychological burdens after cancer treatment. Thus, cancer survivors continue to suffer from the side effects of cancer. Multiple models have been proposed to address cancer survivorship needs, but a standardized model has not been established. Since a standardized model does not exist, many struggling cancer survivors are left without support. Although some hospitals may provide additional support for their cancer patients, support beyond treatment is limited. A narrative literature review was synthesized using the PubMed database. The keywords financial, economic, financial toxicity, burden, cancer survivor, survivorship, cancer, outcome, health, and quality of life were used. This presentation will highlight key determinants towards creating a standardized model by identifying overlapping aspects of the available models.

Andrew Truong

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Tanya Nguyen, Psychiatry

The Microbiome and Mental Health Disorders

An emerging element in psychiatry is the gut-brain-axis, the bi-directional communication pathways between the gut microbiome and the brain. A prominent hypothesis, mostly based on preclinical studies, is that individual differences in the gut microbiome composition and drug induced dysbiosis may be associated with vulnerability to psychiatric disorders including schizophrenia. Schizophrenia is a chronic and severe mental disorder that is characterized by distortions in thinking, perception, emotions, language, sense of self and behaviour. Treatment for schizophrenia is currently limited to psychotherapy and antipsychotic drugs that have significant side effects. A better understanding of the link between the microbiome and central nervous system will be critical in developing novel therapeutic strategies. We leveraged pipelines for microbiome data analysis such as linear discriminant analysis and PICRUSt to analyze open-source datasets to identify microbiome constituents as well as metabolic pathways that are associated with schizophrenia. Identification of microbes and tangential metabolic pathways involved in schizophrenia may represent an innovative strategy for the development of novel biomarkers and medications for the treatment of schizophrenia. We found there were differences in the microbiome that subdivided the schizophrenia patients from the control group. This provides evidence of altered gut microbial composition in persons with schizophrenia, and suggests a need for further studies into the relationship between the microbiome and mental health disorders.

Joseph Tsai

Molecular and Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Weg Ongkeko, Surgery

Tobacco smoke and electronic cigarette vapor alter enhancer RNA expression that can regulate the pathogenesis of lung squamous cell carcinoma

Tobacco is the primary etiologic agent in worsened lung squamous cell carcinoma (LUSC) outcomes. Meanwhile, it has been shown that etiologic agents alter enhancer RNAs (eRNAs) expression. Therefore, we aimed to identify the effects of tobacco and electronic cigarette (e-cigarette) use on eRNA expression in relation to LUSC outcomes. We extracted eRNA counts from RNA-sequencing data of tumor/adjacent normal tissue and before/after e-cigarette tissue from TCGA and GEO, respectively. Tobacco-mediated

LUSC eRNAs were correlated to patient survival, clinical variables, and immune-associated elements. eRNA expression was also correlated to mutation rates through the REVEALER algorithm, and methylated sites through methylation Array Analysis. Differential expression analysis was then completed for the e-cigarette data to compare with key tobacco-mediated eRNAs. We identified 684 downregulated eRNAs and 819 upregulated eRNAs associated with tobacco-associated LUSC, specifically, with cancer pathological stage. We also observed a decrease in immune cell abundance in tobacco-mediated LUSC. Yet, we found an increased association of eRNA expression with immune cell abundance in tobacco-mediated LUSC. We identified 16 key eRNAs with significant correlations to 9 clinical variables, implicating these eRNAs in LUSC malignancy. Furthermore, we observed that these 16 eRNAs were highly associated with chromosomal alterations and reduced CpG site methylation. Finally, we observed large eRNA expression upregulation with e-cigarette use, which corresponded with the upregulation of the 16 key eRNAs. Our findings provide a novel mechanism by which tobacco and e-cigarette influence eRNA interactions to promote LUSC pathogenesis, and provide insight regarding disease progression at a molecular level.

Rowan Ustoy

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

Examining diet change as a contributing factor of higher cancer rates in Puerto Rican U.S Immigrants

Studies have examined immigrant Puerto Rican populations in the United States (US) and compared the rates of cancer to those in Puerto Rico (PR) and non-Hispanic whites in the US. Puerto Ricans who have immigrated from PR match or surpass cancer rates of non-Hispanic whites in the US. However, Puerto Ricans in PR have relatively low cancer rates compared to non-Hispanic whites in the US. Various lifestyle changes were hypothesized to be contributing factors to the increased cancer rates, such as changes in the environment, diet, activity level, and social-economic status, but not deeply examined. This study further explored the difference in diet among the two populations and its potential as a contributing factor to the increased rates of cancer. A literature review was conducted using PubMed, CINAHL, and Google Scholar databases with keywords: Puerto Rican, Immigrant, Diet Change, United States, and Cancer Rates.

Matthew Uzelac

Neurobiology (B.S.) & Biochemistry (B.S.), UC San Diego
Undergraduate Research Scholarships
Mentored by Weg Ongkeko, Department of Surgery

ER stress associated gene expression among COVID-19-infected adipose tissue

The Coronavirus disease 2019 (COVID-19) outbreak is responsible for over 450,000 deaths in the United States to date. A great proportion of these deaths are in individuals with pre-existing medical conditions, called comorbidities. One of these comorbidities, obesity, is of particular concern; obese individuals infected with SARS-CoV-2 have greater severity of illness and are far more likely to die than their non-obese counterparts. The mechanisms by which obesity increases this death rate, however, remain unclear. Obesity has been correlated with endoplasmic reticulum (ER) stress in adipose tissue, leading to cell apoptosis. Infection of such a host cell by COVID-19, however, could prove more threatening; preliminary data have indicated a link between COVID-19 infection and increased ER stress. As such, we hypothesize that COVID-19 correlated ER stress might exacerbate the existent ER stress issues within adipose tissue, potentially explaining the increased mortality rate among obese populations. Thus, the purpose of this project is to analyze this effect of COVID-19 infection on adipose tissue ER stress. Initial analysis of ER stress-associated gene expression will be conducted using COVID-19 infected patient data, sourced from the NCBI's Gene Expression Omnibus (GEO). RNA sequencing will then be performed in vitro on COVID-19 infected adipocytes to analyze similar ER stress-related gene expression; computational analysis methods will reveal common expression variations among these initial data sources. Further experimentation will confirm these variations using PCR and ELISA on genetically-altered COVID-19 infected adipose tissue.

Vianey Valdez

Human Developmental Sciences & Global Health, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Professor Megumi Naoi, Political Science

Identifying the Barriers UCSD Undergraduate Students Face in Obtaining Basic Needs Support

Facing food insecurity is a situation which many college students across the nation find themselves in as the cost of attendance and cost of living exponentially rises. Unfortunately, UCSD's students are not an exception to this issue. My project focuses on identifying and better understanding the barriers which prevent undergraduate students facing food insecurity from accessing campus resources designed to combat

hunger. I will be collecting both qualitative and quantitative data from students who have accessed two of the Basic Needs resources on campus: the Triton Food Pantry and The HUB Basic Needs Center. I will also be collecting data from students who have not accessed these resources, in an attempt to understand why there is a disconnect between the student body and the services that are there specifically for them. Given my work experience in the field of Basic Needs, I hypothesize that the main barriers which students face when trying to access Basic Needs services on UCSD's campus, are: 1. Misinformation on what exactly the Basic Needs service is, how it operates, and thinking that they are ineligible to use the service, 2. Not knowing that these services exist, and that some of them are funded in part by their student fees, as well as 3. A sense of guilt from students, thinking that other students may find themselves in greater need than them, and in utilizing the service, they are taking away from someone who needs the support "more" than them.

Lauren Valdez

Neurobiology, UC San Diego
Colors of the Brain
Mentored by Brenda Bloodgood, Biology

Gene Regulation Through NPAS4 Induced by an Enriched Environment

The brain contains millions of neurons that organize into synaptically connected circuits which form a dynamic structure. Alterations to this circuit allows us to initiate specific behavioral responses as a way to interact with our environments and experiences. Neurons have the ability to interpret spatial and temporal electrical signals traveling through synapses to trigger the appropriate cascade of downstream molecular pathways that ultimately alter the neuronal circuit. One inducible transcription factor expressed within neurons in the hippocampus as a result of a molecular cascade is NPAS4. The hippocampus is where learning occurs and memory is stored. It is essential for the circuitry in this structure to preserve plasticity in order to function in unison with the rest of the brain. Interestingly, NPAS4 is thought to contribute to the conservation of plasticity in the hippocampus by promoting a morphological shift of inhibitory synapses from apical dendrites to the soma of pyramidal neurons. However, the regulatory role of NPAS4 on gene expression is still rather unknown. I will be conducting an experiment where I take a mouse from its unstimulating home cage, place it in an enriched environment for 15 minutes, and return it to its home cage. From there, I will then dissect the hippocampus and perform immunohistochemistry to fluorescently label NPAS4. Previous data has suggested that the fluorescence should appear in the dendrites and soma of the pyramidal neurons. I am aiming to confirm the purpose of NPAS4 and help expand our knowledge of the direct molecular effects of NPAS4.

Smriti Variyar

Molecular and Cell Biology; Chemistry, UC San Diego
UC Scholars
Mentored by Arshad Desai, Cellular and Molecular Medicine

MAD-1 recruitment in the spindle assembly checkpoint

During mitosis, cells use a mechanism known as the spindle assembly checkpoint to protect against aneuploidy by ensuring that chromosomes are equally segregated into the two daughter cells. Specifically, the checkpoint monitors the interaction between chromosomes and spindle microtubules that is mediated by kinetochores, which are large protein structures that assemble onto the centromere region of chromosomes. When kinetochores are not bound by microtubules, they recruit a protein called MAD-1, which produces a cascade of downstream signaling that delays anaphase onset to allow all the chromosomes enough time to associate with spindle microtubules. However, the mechanism through which MAD-1 is recruited to kinetochores is still unknown. Prior work suggested that a protein complex within the kinetochore, called the RZZ complex, participates in MAD-1 recruitment, but the extent to which the RZZ complex contributes to MAD-1 recruitment is unclear. To test the role of the RZZ complex in MAD-1 recruitment, I will use *C. elegans*, a robust system for cell division studies. For this, I will use RNA interference (RNAi) against the protein ROD-1, a component of the RZZ complex, to deplete ROD-1 and thus the RZZ complex from embryos. I will first validate the use of ROD-1 RNAi and then I will test the effect of ROD-1 depletion in MAD-1 recruitment to unattached kinetochores by imaging fluorescently-labelled MAD-1 through quantitative time-lapse microscopy. My work will help clarify the mechanism of checkpoint activation at kinetochores, which may impact our understanding of the origin of aneuploidy in diseases like cancer.

Romain Vergniault

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

Baboon Tracking

The behavior of baboon troops requires a variety of nuanced interactions between individual baboons for the collective to make a decision. Our principal collaborator has sought out methods to identify the key interactions that precede a group decision, but the size of the troops (20 to 150 individuals) renders manual observation of individual baboons prohibitively difficult. To solve this problem, our engineers at Engineers For Exploration have developed a method to track individual baboons. By hovering a

camera-mounted drone above the entire troop and processing the footage, each baboon can be easily identified. We developed a modified background subtraction algorithm which, by comparing frames, finds pixels that have changed due to baboon movement, and labels the residual pixel blob a baboon. Our algorithm currently lacks the ability to track stationary baboons, so we've been working on adding a statistical heat map for each of our baboon blobs.

Matthew Vigil

Nanoengineering, UC San Diego

UC Scholars

Mentored by Dr. George Tynan, Mechanical and Aerospace Engineering

Testing Steady-State Operations of The Water Cooled Plasma Source in PISCES-RF

PISCES-RF, a helicon plasma device, is able to produce high density plasma using high powered radio frequencies (RF). It is capable of achieving up to 20 kW input power steady state operation, allowing for operation of many hours, as opposed to pulse plasma operation of several seconds. This steady state operation is achieved with a novel watercooled plasma source.

Deionized (DI) water has been implemented as a coolant for the RF transparent ceramic window. The window is subject to a nonhomogeneous heat load on the plasma facing inner surface and coolant on the outer surface. A fracture failure of the ceramic could lead to coolant leakage into the vacuum chamber, or total vacuum failure. This project focuses on finding the cause of a previous ceramic failure.

An increase in the conductivity of the coolant was observed before and during a fracture failure. Increases in coolant conductivity may be an indicator of impending failure due to dissolution of alumina in the DI water. Using an infrared (IR) camera, thermal images of the ceramic surface are collected which will illuminate possible causes of ceramic fracture. This analyzed data can quantify the heat load on the ceramic window as a function of varied parameters (e.g. changing the magnetic field or RF power).

The information gathered on the failure mechanics and behavior of the ceramic window will be used in the design of the next generation iteration of this device, the Materials Plasma Exposure eXperiment at Oak Ridge National Laboratory (ORNL).

Marinelle Villanueva

B.S. Environmental Systems & B.S. Global Health, UC San Diego

McNair Scholars Program

Mentored by Dr. Tarik Benmarhnia, Scripps Institution of Oceanography & Hebert Wertheim School of Public Health and Human Longevity Science

The Impact of Climate Shocks & Women's Empowerment on Child Undernutrition in Mozambique

Countries in Sub-Saharan Africa, particularly Mozambique, are experiencing changing environmental conditions which may threaten food systems by reducing agricultural yields and exacerbating the burden of undernutrition. Child growth is internationally recognized as an important indicator of nutritional status and health in populations by which low food availability can impair child development and long-term productivity. Women's autonomy is strongly associated with children's nutritional status, such that disparities in maternal autonomy may explain variations in climate-related vulnerabilities in this regional context. Climate change scenarios for Mozambique indicate that climate shocks in the form of increasing frequency and magnitude and droughts and floods are projected to increase, necessitating efforts to understand and protect children's health. By focusing on climate shocks during the main growing season, the purpose of this research is to determine the extent climate shocks are associated with child undernutrition among distinct populations. In addition, this research investigates the potential of women's education and empowerment for mitigating climate-related vulnerabilities of children. A Demographic Health Survey (DHS) is linked with regional gridded climate data (SPEI) using a stratified regression analysis to provide information on the impact of climate shocks on child stunting and wasting. Identifying population groups most vulnerable to the impacts of climate change will be important for reducing social inequities and ensuring the continued economic progress of Mozambique. This study contributes to information for early warning systems to manage food systems threatened by climate anomalies, and recommends investments in infrastructure for education and gender equity.

Laura Vlahakis

Computer Engineering, UC San Diego

Electrical and Computer Engineering SRIP

Mentored by Professor Karcher Morris, Electrical and Computer Engineering

Developing Educational Tools to Integrate Circuits and Python

Python is known for its beginner-friendly syntax, profusion of libraries, and multifold engineering applications. For students with an interest in engineering and robotics,

microcontrollers are often their first introduction into coding. This presents an opportunity to introduce students to Python early, and in an engaging, hands-on format.

In this educational research project, we explored a Python-derivative microcontroller language called CircuitPython and developed a website featuring tools and tutorials to introduce students to Python and circuitry through building interactive projects. The first half of tutorials take an integrated approach. Each tutorial consists of a circuit to build, an interactive Python lesson, and a guided mini-project that combines concepts from both previous parts. The remaining tutorials take a more divorced approach with CircuitPython projects and Python lessons hosted separately. These tutorials will be given to students during a summer internship prep program. We will collect data through student feedback surveys to investigate students' engagement, understanding, and confidence with these concepts over time. We hypothesize that this assessment data will give us a better understanding of the students who are using this educational tool and what they like or dislike about it. Ultimately, we aim to improve this educational tool so that both Python and circuit building can reach an even larger audience.

Jovaan Volcy

Economics, Hampton University

STARS

Mentored by Dr. Sally Sadoff, Economics and Strategic Management

A New Dataset: Small Business Owners and Whether They Received The PPP or EIDL Loan

In March of 2020 the US economy began to shut down due to the global COVID-19 pandemic. Many small businesses were forced to limit operation or close completely. In response, the federal government developed multiple financial relief packages for these small businesses. We are focusing on the \$650 billion Paycheck Protection Program (PPP) and the \$220 billion Economic Injury Disaster Loan Program (EIDL). The PPP was designed to prevent small businesses from closing and to keep employees on the payroll while the EIDL would cover loss in sales and revenues. Both programs were administered by the Small Business Administration (SBA) through banks, credit unions, and other financial institutions. One of the goals of these packages was to prioritize socially and economically disadvantaged individuals, who have historically had less access to lending. Our research creates a new dataset from multiple sources that includes the near-universe of small businesses in the U.S. With this dataset we will be able to examine the gender and race/ethnicity of each business owner, whether the PPP and EIDL programs succeeded in their stated goal of reaching minority and women owned businesses, and whether a business received funding from each program along with the amount received. We will also analyze whether lending to women and minority owned businesses varies by wave of the programs, business type, lending institution and

geographic region. With this information economists will be able to discern patterns that may prove useful in improving economic policy for future catastrophes.

Cameron Wang

Earth Sciences, UC San Diego
Undergraduate Research Scholarships
Mentored by Wenyuan Fan, Scripps Institution of Oceanography

Dynamic Triggering at Geothermal Fields in California

Earthquakes can trigger other earthquakes at different faults that may be hundreds or even thousands of kilometers away. Such correlated triggering processes are caused by passing seismic waves and are termed as dynamic triggering. Dynamic triggering has been reported in a variety of geological settings, including subduction zones, continental plate boundaries, and particularly, geothermal fields. Understanding the physical mechanisms of dynamic triggering will provide insight into earthquake nucleation and rupture propagation, and can help with seismic hazard mitigation. However, the underlying physical mechanisms are not yet fully understood. We will use the high-resolution Quake Template Matching earthquakes catalog of Southern California to systematically evaluate dynamic triggering patterns at the Salton Sea Geothermal Field. We will apply a new data-driven statistical approach to the catalog to identify dynamic triggering cases. This method is free from probability density function assumptions of background seismicity rates and can accommodate spatiotemporally evolving seismicity. We aim to systematically identify the triggered earthquakes first, and then investigate possible physical mechanisms by comparatively investigating the triggered earthquakes' ground motions and source attributes, as well as the geothermal production activities at the Salton Sea Geothermal Field.

Garret Wang

Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Eric Zorrilla, Dr. Marisa Roberto, Dr. Bryan Cruz, Dr. Valentina Vozella and Dr. Sarah Wolfe, Neurobiology

PTSD, Alcohol Abuse, and Brain Chemistry in Rats

Trauma and Post-Traumatic Stress Disorder (PTSD) have been consistently linked with increased rates of substance abuse. To find out what role neurochemistry, behavior generalization, and stress play in this connection, we will be investigating a 2-hit PTSD model with lab rats to investigate stress and brain chemistry in response to trauma. Trauma will be induced via two spaced-out foot shocks in an initial controlled

environment (a dark room). Later on, we will test their responses in a similar but not entirely identical environment to test for fear generalizability. We will then provide rats the choice of ethanol in a separate dispenser or extra water in a separate dispenser. They will be subject to memory and anxiety testing, reactions to stimuli, sleep patterns, and brain chemistry analysis. Anxiety and stress will be measured via behavioral changes such as freezing and eating behavior, while cytokine sampling and ribosome/RNA profiling will be used to analyze brain chemistry. After 2 weeks of abstinence, shock-stressed rats will be injected with benzotropine to analyze the drug's effect on fear generalizability, hyperactive reactions to auditory stimuli, sleep interruptions, irritability, and more. It is expected that benzotropine may decrease adverse reactions in stressed and traumatized rats.

Eric Wang

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Tina Ng, Electrical and Computer Engineering

Objective assessment of motor disorder

This project is to quantitatively evaluate spasticity severity levels by developing physical model based on an instrumented glove. In the current clinical settings, clinicians are limited by subjective evaluations based on perception. So quantitative measurements are urgently needed for clinicians and caregivers to better determine patients' muscle conditions. The objective spasticity evaluation uses an instrumented glove system. The glove is designed with inertial motion unit (IMU) sensors on the back side and pressure sensors on the palm and fingers. By performing standard maneuvers on patients' limbs, clinicians and caregivers can measure the patient's muscle torque and other characteristics related to the biomechanical properties of muscles.

My project goal is to process the data with biomechanical model fitting and analysis. The pilot data will be examined in torque- displacement plots and biomechanical model parameters. Changes of applied torques will be visualized on spider plots. The analysis aims to distinguish the level of disease severity in a spasticity patient. In the near future, I am developing database structures for patient data storage. With a large amount of data, we need to develop a program which can automate the data analysis in order to analyze more efficiently. After doing analysis and giving the patients' severity results, clinicians and caregivers can better understand patients' degree of recovery after medications.

Katrina Wanner

International Studies - Anthropology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Professor Nancy Postero, Anthropology

Climate Refugees and Accountability

The adverse effects of climate change are destroying communities. Rising sea levels, extreme weather events, and changing weather patterns are drastically threatening the living conditions and the livelihoods of people globally, forcing them to flee their homes and become “climate refugees.” Although there are many contributors to the perpetuation of climate change, including governments, corporations and individuals, my research focuses on the role of multinational enterprises, some of whom are large carbon emitters. Should they be held accountable for their direct and slow-onset contributions to the displacement of people, and if so, to what extent?

This project analyzes the current accountability mechanisms as outlined in the OECD Guidelines for Multinational Enterprises to determine whether these guidelines are effective, and where they suggest responsibility should fall. I will interview climate activists as well as people who are not climate activists in order to analyze their interpretations of the current guidelines and their views on corporate responsibility. This will allow me to determine what changes should be made to the guidelines, if any, and why accountability for climate related displacement is so contentious. As climate change becomes an increasingly urgent issue with more and more people displaced, public opinion will play a substantial role in protecting the rights of climate refugees and in determining whether the existing guidelines are adequate.

Farsamin Warisha

human biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Heidi Cook-Andersen, Reproductive Sciences

Deciphering Mechanisms of Global Transcriptional Silencing in the Mammalian Oocyte

Oocyte chromatin undergoes massive structural changes as Global Transcriptional Silencing (GTS) is established. One such change that is a hallmark of fully grown oocytes is the transition from the non-surrounded nucleolus (NSN) state into the surrounded nucleolus (SN) state. While this reconfiguration of oocyte chromatin is known to be essential for oocyte developmental competence, the key factors that facilitate this transition are unknown. H1foo is an oocyte-specific H1 linker histone variant that is expressed during the GV stage of the oocyte and diminishes upon the late 2-cell embryo

stage. Failure to express H1foo leads to disruption of development at Meiosis I. In this study, we will investigate H1foo expression and localization in relation to chromatin condensation through imaging and sequencing approaches to understand the role of H1foo in NSN-to-SN transition.

Sophia Warlof

Bioengineering: Biotechnology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Ester Kwon, Bioengineering

Bioresponsive Nanoparticles for the Inhibition of Calpain Activity After Traumatic Brain Injury

Every year, around 3 million individuals are hospitalized due to traumatic brain injury (TBI) related causes. However, there are currently no FDA-approved pharmacological treatments for TBI. After a TBI, there is an inflammatory cascade that occurs as part of the secondary injury that follows the primary insult to the head. Calpain is a protease that has increased activity during this inflammatory cascade, and prolonged activity of calpain propagates injury by mediating neurodegeneration.

Due to the secondary injury that occurs as a result of calpain activity, a potential strategy for the treatment of TBI is the inhibition of calpain activity in the brain, thus preventing additional injury and improving patient outcomes. We propose a bioresponsive nanoparticle that functions via a negative feedback mechanism, where increased activity of calpain after TBI results in the release of a calpain inhibitor.

The proposed nanoparticle mediates this feedback mechanism through the cleavage of the nanoparticle peptide backbone by calpain, leading to the disassembly of the nanoparticle and subsequent release of calpastatin, a calpain inhibitor.

We hypothesize that under normal conditions this nanoparticle will circulate normally in the body and only have therapeutic activity in response to increased calpain activity following TBI. We demonstrate optimization of the assembly of these nanoparticles by varying the concentration of calpastatin, charge ratio of the nanoparticle components, and molecular weight of the peptide backbone. After optimization, the kinetics of calpastatin release will be measured and stability and toxicology studies will be performed in vitro.

Sydney Washington

Psychology, California State University, Fullerton
STARS
Mentored by Dr. Celeste Pilegard, Psychology

Does the testing effect reduce the negative influence of stereotype threat on learning?

Previous research shows that activating relevant stereotypes can reduce performance among individuals identified with stereotyped groups. The current study investigates whether taking a practice test can increase college students' resilience to a stereotype threat message when learning. Stereotype threat and testing condition will be manipulated in a 2x2 between-subjects design. College students will watch a short video lesson on a science topic and take a test on what they learned. Prior to the lesson participants will enter their demographic information and either receive a stereotype threat message or no message. After watching the lesson participants will either answer practice test questions or restudy statements from the lesson. We will analyze the results using a factorial ANOVA with stereotype threat condition and testing condition as between-subject factors and test performance as the outcome variable. We predict a positive overall effect of testing and a negative overall effect of stereotype threat. We also predict an interaction, such that the harmful effect of stereotype threat is reduced among participants who receive the practice test compared to students who restudy. Our results will help develop an understanding of how instructional design can reduce the negative impact of stereotype threat on learning.

Alexia Wasson

Sociology, UC Merced
Undergraduate Research in the Humanities (UROC-H)
Mentored by Professor Tanya Golash-Boza, Sociology

The Impacts of Blockbusting on Neighborhoods in Washington D.C.

Blockbusting was a technique used by real estate agents to integrate African Americans into all white neighborhoods, in hopes to profit off whites' fear. Before 1948, neighborhoods were all-white residents. After 1948, blockbusting became a prevalent tactic. These changes have led to racial disparities, community displacement, and the shaping of the neighborhoods which exist today. This study examines the impacts that blockbusting has had on neighborhoods in Washington D.C. Specifically, finding connections that blockbusting may have to neighborhoods, segregation, city development, and housing policies. The focus is to explore how blockbusting affected African American's socio-economic statuses and the determinants of neighborhood living in Washington D.C. Through collecting historical information on blocks in

Washington D.C., results show that living conditions lessened in neighborhoods with primarily African American residents. The methodology for this study included analyzing public data record sheets and qualitatively coding them to find patterns of blockbusting. The data was concentrated on the neighborhoods of Jefferson St., Kennedy St., Longfellow St., 4th St., Ingraham St., Kansas Avenue, Hamilton St., and several more. The data results indicated that in most instances when a sale happened on the same day it was usually sold more than once. Once these neighborhoods became mainly resided with communities of color, there became a lack of adequate institutions, stores, city development, layout, and even law regulations. Overall, blockbusting built the foundation for the cities of Washington D.C. which now has created segregated neighborhoods based on race and class

Chao-Li Wei

Math-Computer Science, UC San Diego
PATHS Summer Program
Mentored by Professor Vikash Gilja, Electrical Engineering

Unsupervised Channel Compression Methods in Motor Prosthesis Design

In Brain machine interfaces (BMIs), the number of available channels for neural signals recording is large, but the available channels for simultaneous recordings continue to fall behind due to power requirements. To address constraint, this study developed an unsupervised dimensionality reduction technique by combining neural features based on proposed combination criteria. The study used "best-first search" which iteratively combines the set of features that satisfy the combination criteria the most. To expand on the previous channel compression strategy, we propose a beam search approach which has the potential to scale the breadth by considering multiple sets of features at each iteration. by expanding the search options, this can potentially allow us to find better solutions at lower dimensions that would have been inaccessible using the original search algorithm. We will apply these methods to different cortical regions (PMd and M1) and compare the proposed compression methods to the results of the first part of the study.

Benjamin Werb

Oceanic and Atmospheric Sciences, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Daniel Rudnick, Scripps Institution of Oceanography

Climate Variability in the California Current System

Ocean temperature is one of the most crucial metrics used to understand how our climate is changing. Although satellite data and Argo floats have been a huge advancement to the field of oceanography and climate science, the first can only provide a view of the temperature at the sea surface and the latter cannot be piloted once deployed. The Spray glider, an autonomous underwater vehicle, can help fill this gap in data because it can be remotely piloted and make repeated dives to 500 meters, creating detailed maps of the ocean. The glider is able to measure pressure, temperature, salinity, and velocity which can enable researchers to study specific current systems in higher resolution than previously possible. Using data recorded on glider missions off the coast of California we will be able to study local climate change in the California Current System. Understanding the changes in climate can aid in the advancement of climate models, fishery science, and combating the impacts of climate change.

Kaitlin Williams

Psychology, University of San Diego
McNair Scholars Program
Mentored by Dr. Jennifer Zwolinski, Psychological Sciences

Influence of Fears of COVID-19 and Overall Psychological Distress on Willingness to Use Telemental Health

The deep impacts of COVID-19 changed many facets of our lives resulting in increased fears and mental health concerns. One recent study found that college students are reporting remarkable problems with academic, health, and lifestyle-related concerns given the negative impact of COVID-19 (Son et al., 2000). Given the benefit of telehealth, and the clear need for college mental health support during the lockdown and as we transition back into reopening, the current study will investigate the relationship between one's willingness to use telemental health, COVID-19 fears, and mental health functioning. I proposed that higher scores on the COVID-19 Fears scale would be associated with an increase in college students' willingness to use telemental health services. I also proposed that willingness to use telemental health services would be associated with an increase in overall psychological distress across the last year. Participants included 242 undergraduate students attending a liberal arts university in

Southern California enrolled in Psychology 101 in the fall 2020 and spring 2021 semesters. Using Qualtrics, participants completed self-report measures including fear of COVID-19, psychological distress across the last year, and perceptions of telemental health. Participants were grouped into three groups based on one's openness to using telemental health. ANOVAs were used to evaluate my hypotheses. Results indicated that recent overall psychological distress, $F(2, 235) = 12.01, p < .001$, but not COVID-specific distress, was associated with more willingness to use telemental health. Findings from this study can provide insight into future outreach programs concerning mental health on college campuses.

Candy Witter

Business Administration and Management, Bowie State University

STARS

Mentored by Dr. Rachel Gershon, Marketing

Social Media Marketing for Mental Health Interventions and Suicide Prevention

Millions of teens and adults struggle with mental health each year. According to the National Alliance on Mental Illness, 1 in 5 U.S. adults experiences mental illness each year and, suicide is the second leading cause of death for people aged 10-34 years old and, yet there is an unmet need for mental health interventions to prevent suicides. Studies show that many individuals with mental illnesses turn to social media to share their experiences, to seek support and information on mental health treatment options. My research aims to find out what barriers prevent teens and adults from receiving interventions and how these barriers can be overcome by using social media marketing on platforms such as Facebook as a medium for delivering mental health interventions and support. In this study, I will be using preexisting data on mental health barriers and interventions then utilizing experimental methods such as Facebook A/B testing to develop effective ads for increased visibility and interest in mental health resources. Currently, this testing is still underway, and therefore, no results can be confirmed as yet. The goal of this research is to consider the role that social media marketing can play in mental health interventions and suicide prevention.

Katherine Wong

Human Biology, UC San Diego

Undergraduate Research Scholarships

Mentored by Dr. Isaac Alexander Chaim, DEPARTMENT OF CELLULAR AND MOLECULAR MEDICINE

Investigating Cellular and Pathway Composition in Autism Spectrum Disorder (ASD) Cortical Organoid Models using Single-cell RNA-sequencing

Autism spectrum disorder (ASD) encompasses a range of neurodevelopmental disorders characterized by deficits in social communication and repetitive behavioral patterns. The cause of ASD is mostly unknown, but largely attributed to environmental and genetic factors, such as inheritable and de novo gene variations. With hundreds of genes identified to contribute to ASD, the genetic complexity of ASD emphasizes the importance of discovering potential convergent and divergent pathways that contribute to this disorder. The goal of this project is to study and identify changes in the composition and transcriptome of cellular populations in ASD models, using cortical organoids differentiated from isogenic induced human pluripotent stem cell (iPSC) model lines generated for five of the most highly penetrant monogenic syndromic forms of ASD. These cortical organoids were sampled at different timepoints for up to nine months, and analyzed using single-cell RNA-sequencing (scRNA-seq). Differences in compositions of cell types and intracellular pathways are currently being examined using gene marker databases and scientific literature. This project aims to find common molecular convergent pathways in ASD by understanding the role of perturbations in cellular and pathway composition of these ASD cortical organoid models, with the future goal of serving as a platform to develop novel treatments for ASD.

Jerry Wu

Bioengineering: Biotechnology, UC San Diego

UC Scholars

Mentored by Dr. Shaochen Chen, Nanoengineering

3D Bioprinted hiPSC-derived Cardiac Micro-Tissues to Investigate Nanoparticle Cardiotoxicity

Burgeoning industrial usage of nanoparticles has raised particular concern as they are easily aerosolized, enabling high exposure to humans. Given that airborne particulate smaller than 2.50 μm has been strongly correlated to higher rates of cardiovascular disease, studying nanoparticle cardiotoxicity becomes an urgent issue. In particular, titanium dioxide and copper oxide nanoparticles stand out due to their pervasive usage in applications such as vehicle coatings and agricultural biocides, respectively. Current

approaches to modeling the cardiotoxicity of these nanoparticles are limited. For example, 2D cell cultures cannot fully replicate the 3D tissue microenvironment, which may be crucial to the toxicity pathway of the nanoparticles. The current in vivo animal models, primarily conducted on rats and zebrafish, not only are expensive but also have reduced translatability to humans. Recently, researchers have developed various 3D cardiac models to recapitulate an adult cardiac heart more accurately. Here, we employ a microscale 3D bioprinting method to investigate the cytotoxicity of titanium dioxide and copper oxide nanoparticles on human induced pluripotent stem cell-derived cardiomyocytes within a more representative heart model. We will characterize nanoparticle's effect on cell viability, reactive oxygen species production, gene expression with qPCR, tissue beating frequency, and force exertion. The findings of this study may reveal a greater insight into the behavior of these nanoparticles within cardiac tissues, instigating stricter policy regulations surrounding their usage.

Sophia Wynn

Oceanic and Atmospheric Science, UC San Diego
Undergraduate Research Scholarships
Mentored by Professor Amato Evan, CASPO - Scripps Institute of Oceanography

Salton Sea Dust Aerosols

East of San Diego lies the Salton Sea located in the Sonoran Desert. The Salton Sea is projected to shrink over the coming decade exposing more dry lake bed projected to add to the severity of the dust storms and the number of dust aerosols in the atmosphere. Dust particle size measurements have been made in other dusty regions of the planet, but the sizes of these particles in Southern California remain largely unknown. Quantifying the sizes of dust particles is important due to the effects dust aerosols have on the earth's radiative balance. Dust aerosols can scatter, reflect, and/or absorb both short and longwave radiation, additionally, these aerosols can aid in cloud nucleation. The larger a dust particle is, the more radiation can be absorbed into the climate system, warming the planet. It's important to understand the size of these dust aerosols to understand their effects on the climate. A recent study in the Saharan Desert showed that typical dust radii there were around 10 microns, large enough to have a substantial warming effect on the planet. The purpose of my research is to quantify the size of dust aerosols around the Salton Sea. I will measure the radii of dust particles, using a Cloud Droplet Probe and analyze the data to determine the distribution of dust particle sizes. I hypothesize that the average size of these Salton Sea dust particles is greater than 10 microns, and thus contributes to the warming of the regional climate

Brian Xi

Chemical Engineering, UC San Diego

MRSEC REU or RIMSE

Mentored by Professor Jon Pokorski, NanoEngineering

Co-melt extrusion of bacterial spores with poly-caprolactone

The integration of living matter into polymeric materials provides the ability for these materials to respond to certain stimuli. As such, we are interested in integrating bacterial spores into polymers and processing this mixture. As a proof of concept, *Bacillus subtilis* spores will be grown and processed in a mixture with poly-caprolactone (PCL) to produce a melt extruded filament. The mechanical and physical properties of the PCL-spore mixture will be compared against pure PCL through tensile machine testing and TGA/DSC analysis. The cell viability of the spores after melt processing will also be confirmed using colony forming unit assay in order to determine the spores' thermal and shear stabilities during the melt processing. Lastly, the filament will be used with a 3D bioprinter to show potential applications for this spore-polymer mixture. Due to the biocompatibility of PCL polymers, there are many applications for these mixtures in the biomedical field. In the future, these polymer-spore composites could be utilized in mass-producing diagnostic polymer patches using spores or enzymes as biosensors.

Jeffrey Xing

Psychology/ICAM Music, UC San Diego

UC Scholars

Mentored by Dr. Timothy Q. Gentner, Psychology

Songbirds as Composers: Understanding Animal Communication with Music and Auditory Aesthetics

Animal communication signals often evolve in secondary sexual selection contexts to influence behavioral and aesthetic preferences for some signals over others. These signals can be studied in respect to linguistic systems, where communication signals produced by the animal are parsed into meaningful units and examined as a symbolic sequence. In reducing communication signals into symbolic sequences, however, acoustic information in the signal is often overlooked and lost. As an alternative approach, it may be valuable to view animal communication as a musical system, in which theories rooted in human musicology and auditory aesthetics motivate direct acoustic analysis of the communication signal. In this study, we investigate the merits of combining both approaches in describing the birdsongs of a relative understudied songbird, the Australian pied butcherbird. They exhibit complex singing behavior, and balance repetition and novelty in vocal performance similar to human music, which

presents their birdsongs as premier targets for both linguistic analysis as well as musical analysis. We computationally annotated free-living Australian pied butcherbirds, and analyzed the syntax of the resulting symbolic sequences with existing methods. To analyze acoustic information in the signal that potentially informs aesthetic structuring of syntax, we developed novel measures to parameterize acoustic differences between annotated elements, as well as a method for combining said measures with syntactic analyses. This presents a more comprehensive approach to studying animal vocal communication that takes into account acoustic and aesthetic information beyond symbolic syntax.

Yilin Xu

Biochemistry, UC San Diego
Youth Enjoy Science (YES)
Mentored by Dr. Georgia Sadler, Department of Surgery

A review of cultural and survival disparities in end-of-life care among African American breast cancer patients

African American women diagnosed with breast cancer are less likely to access end-of-life care compared to Non-Hispanic White women. This literature review was conducted to elucidate the latest scientific evidence related to identifying correlations of cultural disparities and end-of-life care access for African American women. This literature search focused on End-of-Life care and cultural disparities in African American women diagnosed with breast cancer. PubMed, ScienceDirect, and Google Scholar databases were used to search for related terms such as Black women, African American women, health disparities, Breast Cancer, and End-of-Life care access. All full-text articles meeting search criteria in English published between 2006 and 2020 were examined. African American women have the highest mortality rate compared to other women, despite the national focus to create better breast cancer-related outcomes. African American women are less likely to receive end-of-life care due to mistrust of the health care system, insufficient health insurance, and lack of access to healthcare providers. Lack of access to quality healthcare and clinical biases contributed to the low enrollment rate for end-of-life care among African American patients. African American women with breast cancer have lower survival rates compared to other women. Access to quality end-of-life care can provide physical and emotional comfort for patients during their final stage of life. To break the miscommunication between the patients and the providers, educational programs are essential for African American women to improve their relationship and trust with their providers.

Yasmin Yacoubian

Molecular and Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Shyamanga Borooah, Ophthalmology

Optimizing CRISPR-Cas9 Gene Editing in Retinal Pigment Epithelial Cells Expressing Autosomal Dominant Inherited Retinal Dystrophy

Late-Onset Retinal Degeneration (L-ORD) is a severe, blinding inherited retinal degeneration characterized by the formation of drusen-like deposits below the retinal pigment epithelial (RPE) layer, dark adaptation delay, photoreceptor cell death, early loss of central vision, and in the final stages of disease complete loss of vision. L-ORD results from a single missense mutation (S163R) in the C1QTNF5 gene resulting in autosomal dominant disease. Recent developments in CRISPR-Cas9 gene editing offer an opportunity to target this mutation to treat L-ORD, specifically by disrupting the mutant allele by gene knockout. To evaluate the efficacy of our CRISPR-Cas9 design, peripheral blood mononuclear cells (PBMCs) of patients carrying the C1QTNF5 mutated gene were reprogrammed into human induced pluripotent stem cells (hiPSCs). These case hiPSCs were then used as a disease model for testing CRISPR-Cas9 gene correction strategies. Gene editing efficiency was measured through an algorithm that utilizes Sanger sequencing data to detect formation of indels resulting from CRISPR-Cas9 directed gene editing. The ultimate aim is that we validate a CRISPR-Cas9 strategy targeting mutations in C1QTNF5, in order to develop new treatments to prevent sight loss in L-ORD.

Celine Yang

Human Biology, UC San Diego
PATHS Summer Research Program
Mentored by Dr. Michael Taffe, Psychiatry

Behavioral effects of nicotine and alcohol on crayfish

This study focuses on developing a crayfish (*Procambarus clarkii*) model to assess the effects of nicotine and alcohol on behavior. Nicotine and alcohol use are common addictions in the United States, contributing to increasing rates of nicotine dependence and alcohol use disorder (AUD). The methodology used to develop a crayfish model for nicotine includes submerging crayfish into nicotine for 30 minutes and assessing its ability to right itself and its locomotor behavior in a light-dark arena for 30 minutes. For ethanol, crayfish will be chronically immersed in ethanol (EtOH) and will have its locomotor behavior assessed in an open-field and light-dark arena for 30 minutes. This work aims to create a basis which crayfish behavior can be assessed to study the effects

of nicotine and alcohol from a novel perspective and lead to innovative development of throughput ways to gauge potential medications for nicotine and alcohol addiction.

Xunhao Yang

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Professor Patrick Mercier, Electrical and Computer Engineering

Wearable physiochemical sensor technologies

Multi-used Glove-based Sensor

Existing wearable sensors focus on collecting kinematics and photoelectric data of the human body. There exists a lack of wearable and manufacturable products that collect data on chemical substances. The project focuses on developing a next-generation sensor for physicochemical properties in human tissue in real-time and its industrial application. The team cooperates with the manufacturing company on proposing a human-product interface for mass production and miniaturization of the product scale. Current approaching application of the sensor combines a reusable glove that detects traces of opioids such as fentanyl, morphine, and/or heroine. The ongoing working procedure includes optimization of the sensing layer and operational procedure and characterization of the resulting analytical performance toward the target drug in the presence of potential interferences. Appurtenance IOS App acts as a user-friendly interface between potential users and the sensor system. The App also collects data for lab experiments. The application serves as a next-generation device for drug investigation in various scenarios that reduce property costs and human resources. Designed usage of Future feasible applications also includes modification to agricultural herbicide sensors that detect traces of common herbicides and subsequent optimization to agricultural application scenarios.

Dongmin Yoon

General Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Olivia Osborn, Medicine

*Investigation of the role of *Clic1* in being eating behavior in mice*

In the context of human obesity people become obese for many reasons but binge eating disorder (BED), involving eating large amounts of food in a short period of time, is often a driving force. Animal models of eating disorders can be challenging but a group has developed a protocol that models many aspects of BED in people. This involves

cycles of HFD and normal chow (NC) diet availability and determining how much food the mice eat when given HFD for just a few days a time. This intermittent exposure to highly palatable HFD induces significant 'binge like' behavior in mice. Preliminary data from the Osborn lab determined that chloride intracellular channel 1 (Clic1) plays an important role in food intake and body weight regulation. The goal of this project is to establish this Binge eating protocol in the lab. The further goal is to establish if Clic1 is implicated in binge eating behavior. In this project I will: 1) Establish a binge like behavior model in WT mice using a published protocol. 2) I will then determine if KO mice are less prone to binge like behavior compared with WT. These studies will determine if Clic1 is an important regulator of Binge like behavior that could be developed in the future to treat humans with this disorder.

Qingyuan Zhang and Shunkai Yu

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Nuno Vasconcelos, ECE

An iterative framework for dataset collection

While a wide spectrum of automated tools have been created for building deep learning models in the past decade, dataset collection has remained a largely manual process with little systematic effort to account for bias in raw data or human annotations. We aim to build an iterative framework for dataset collection, annotator teaching and model training. Different from active learning which employs unlabeled data, a closed set of classes, and annotation of multiple classes, our method applies noisy labels, an open set of classes, and binary verification of annotated classes. Under our unified framework, new examples are automatically cleaned for bias and added to the dataset progressively. Neural network models are trained on each iteration of data, and model explanation techniques are used to create teaching examples that reduce the bias of crowd-source annotators. The framework aims to produce datasets that are optimal for machine learning, under multiple objectives, including classification accuracy and fairness. Typically, we aim to test our framework with a dog classifier based on Stanford dog datasets with manually added noise on labels.

Claire Zhang

Bioengineering: Biotechnology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Kevin King, Bioengineering

Longitudinal characterization of periodic breathing in heart failure via a non-contact home health monitor

Periodic breathing (PB) is a pattern of sleep-disordered breathing marked by cyclic modulations in tidal volume. This phenomenon is frequently identified among patients with heart failure, where its presence is thought to be negatively prognostic. Due to the impracticality of existing respiratory monitoring methods, no longitudinal data exist on whether individual patients experience prognostically significant fluctuations in PB. Here, we propose a long-term in-home investigation of PB by leveraging an adherence-independent monitoring tool installed in the homes of 28 patients with and without heart failure. By passively capturing respirations during sleep using mechanical sensors placed under the legs of a bed, the need for patient compliance is circumvented. Regions of PB are identified via computation of an amplitude modulation index, and features including respiratory rate, cycle duration, and hyperpnea duration will be extracted. This work will provide the first look into how periodic breathing evolves over longer timescales and inform future studies of PB and its relationship to chronic diseases such as heart failure.

Alex Zhao

Political Science: Data Analytics, UC San Diego
McNair Scholars Program
Mentored by Dr. Kirk Bansak, Political Science

How a public health crisis reveals how governance is approached?

During the COVID-19 pandemic, there have been several waves of literature investigating how the virus affects politics. However, current work does not fully address how a public health crisis might reveal how governance is approached. I argue that understanding institutional structure is key for developing expectations for policy behavior. More specifically, I examine how stay-at-home orders would be enacted under different theories of governance and empirically test them with longitudinal data on regions/counties in the Navajo Nation and neighboring states. The results indicate that while the Navajo Nation functions as a unitary state, its governance is better reflected through a regionalist political economy approach which is congruent to its neighboring states. This approach develops a theoretical framework for determining how governance is approached based on policy behavior as a function of a public health

crisis. Thus, I continue early investigations of indigenous governance, and demonstrate how the theoretical framework implemented is applicable to future comparative studies.

Qilin Zhao

Biochemistry and Bioinformatics, UC San Diego

UC Scholars

Mentored by Brenda Bloodgood, Department of Biological Science

Experience Dependent Visual Cortex Development

Early works have shown that sensory information plays a necessary role in the wiring of the connectivity of visual cortex during development. However, we are unclear about the molecular mechanism of this wiring process. During this project, I will be looking at a transcription factor Npas4 and its role in the visual cortex development when the mice grow up in a dark environment without any visual input. Npas4 is known to be regulated by neuronal activity, so with little visual input, the expression level of Npas4 is expected to decrease. To test this hypothesis, I will place newborn mice in dark environment over the early stage of visual cortex development (from day 1 to day 24). After that, I will perfuse the mice and stain the visual cortex to see the expression level of Npas4. The result will be compared with mice grow up in regular environment with visual input. If there is a significant difference of Npas4 expression level, we are going to do calcium imaging and see if the visual cortex function is disrupted during this process. This means that we will show mice different visual stimuli with different orientation and see if mice grow up in dark environment has same response to the stimuli as mice grow up in normal environment.

Ziming Zhou

NanoEngineering, UC San Diego

MRSEC REU or RIMSE

Mentored by Dr. Michael Sailor, Chemistry and Biochemistry

Harnessing the Chemistry of Mesoporous Silicon to Prepare “Armor-Clad” Enzymes with Improved Catalytic Performance

Enzymes are useful catalysts for a wide range of industrial processes due to their high specificity and high activity for their target substrate. However, enzymes are limited by their susceptibility to degradation at extremes of pH, at high temperatures, or upon exposure to organic solvents. To overcome these obstacles, much research effort has focused on immobilizing enzymes in nanomaterials. As a class of highly porous materials, porous silicon nanoparticles (pSiNPs) provide a promising platform for

enzyme immobilization. This project focuses on two chemical reactions that can be used to encapsulate an enzyme into the mesoporous nanostructure of pSiNPs: growth of a porous silicon oxide and condensation of calcium silicate. The test enzyme NanoLuciferase (NLuc) is used as a model enzyme, and its performance is quantified by the chemiluminescence reaction that it undergoes with its substrate. The key questions this project is trying to understand are: how does the nature of the pSiNP cage influence substrate transport and accessibility; and how does the cage influence enzyme stability.

Everbrook Zhou

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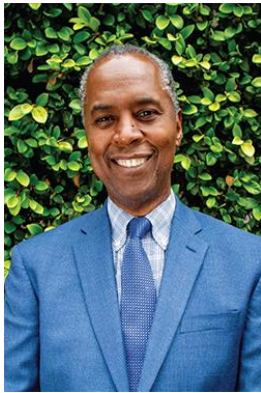
MRSEC REU or RIMSE

Mentored by Professor Tod Pascal, NanoEngineering and Chemical Engineering

Monte Carlo Simulations of the Self Assembly of DNA – Ag Nanoparticle systems

The rise of DNA modification technology has led to new developing interest in the nanoparticle field. DNA strands as scaffolds can assemble nanoparticles to specific shapes and sizes. While ordinary DNA is chemically inert and lacks function, through chemical modification of DNA with nanoparticles, functionality can be achieved. For example, silver nanoparticles (AgNPs) have been used often in the biomedical industry for their intrinsic cytotoxicity: their surface charge increases their antibacterial and anticancer effectiveness. By combining DNA with silver nanoparticles, the nano-device will have the drug delivery capabilities of DNA with the cytotoxicity of silver nanoparticles. However, numerous technical challenges still exist before the successful application of this technology. Studies have not confirmed ideal and stable NP-DNA structures/conformations. The ideal noble metal to use as a nanoparticle has also not been identified. In this study, we investigate the assemble of DNA functionalized AgNPs from Monte Carlo simulations, using interaction potentials obtained from high level Quantum Mechanical calculations and Molecular Dynamics. We thus explore the phase diagram of these hybrid particles as a function of ligand interaction strength, which we relate to the DNA base sequence and chain length. These simulations will provide design principles for complementary experiments.

Undergraduate Research Hub Staff



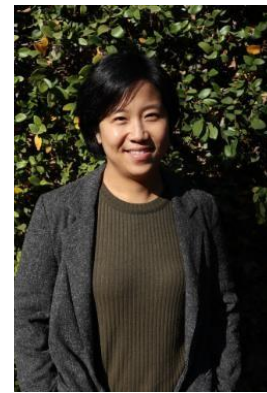
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