THE ANNUAL SUMMER RESEARCH CONFERENCE UC SAN DIEGO

UC San Diego

Virtual Conference
August 13 & 14, 2020

ACADEMIC ENRICHMENT PROGRAMS

Conference Program

2020 Summer Research Conference at UC San Diego

Welcome to the 2020 Summer Research Conference at UC San Diego, which showcases undergraduate research in San Diego each summer.

This year's conference features three hundred and twenty participants who are part of faculty-mentored summer research programs in the San Diego area, and who attend schools ranging from local community colleges to large state universities, small colleges, and Ivy League universities: Bakersfield College; California State Polytechnic University, Pomona; Chaffey Community College; CSU Bakersfield; CSU Fullerton; CSU Northridge; CSU San Bernardino; CSU San Marcos; CSU Stanislaus; Cypress College; Howard University; Morehouse College; Rice University; San Diego City College; San Diego Mesa College; San Diego State University; San Francisco State University; Sonoma State University; Southwestern Community College; Spelman College; UC Berkeley; UC Irvine; UC Los Angeles; UC Riverside; UC San Diego; UC Santa Cruz; University of San Diego; Xavier University of Louisiana

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.

The Summer Research Conference at UC San Diego is planned and coordinated by Academic Enrichment Programs (AEP), which is a unit of Student Retention and Success within Student Affairs.

Thank you to all AEP staff. Additional thanks to Veronica Bejar, Dr. Thomas K. Brown, Dr. Kirsten Kung, Dr. Claire Kim, Tyler Rogers, Dr. Marie Sheneman, and Dr. Sophia Tsai who helped to organize the panels.

#2020SRCUCSD

Contents

Conference Schedule

Thursday, August 13th

8:30 AM – 9:00 AM   Welcome and Opening Remarks by Chancellor Khosla

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 – 1:00 PM   Lunch Break

1:00 PM – 2:00 PM   Afternoon Session I
2:10 PM – 3:10 PM   Afternoon Session II
3:20 PM – 4:20 PM   Afternoon Session III

4:30 PM – 5:30 PM   "Graduate School Application" Workshop

Friday, August 14th

8:30 AM – 9:00 AM   Welcome & Plenary Speaker Dr. Jennifer Tran
     UC San Diego McNair Program Alumna
     Asst. Professor of Ethnic Studies, CSU East Bay

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 – 1:00 PM   Lunch Break

1:00 PM – 2:00 PM   Afternoon Session I
2:10 PM – 3:10 PM   Afternoon Session II

3:30 PM   Closing Remarks

Zoom Room Registration Links - Thursday

Thursday Zoom Rooms		Registration Links
Welcome and Opening Remarks by Chancellor Khosla		https://ucsd.zoom.us/webinar/register/WN_4tb6ofynST6tPCT7Yvbzog
Student Panel Rooms	Falling Star	https://ucsd.zoom.us/meeting/register/tJErfuitqDIrE9JdaNhBp7VU0iKfO59FseXB
	Giraffe Catchers	https://ucsd.zoom.us/meeting/register/tJAtceCvqD0pH9Okalfg6w8VbGW4P_Sp_7Ez
	READ/WRITE/THINK/DREAM	https://ucsd.zoom.us/meeting/register/tJMkc-iurjwuGNKUetEmnZCdDj2ayzBDzPHT
	Red Shoe	https://ucsd.zoom.us/meeting/register/tJYscO6upzMpH9VZ28PICVbMOz06oFgt1Dnl
	Snake Path	https://ucsd.zoom.us/meeting/register/tJMuc-6orzMpH9K6RX57I3xOhfyyh751q6YB
	Stonehenge	https://ucsd.zoom.us/meeting/register/tJAqcO6srjIuHNHsPOaj8p49FCV7F3Eq2VJg
	Sun God	https://ucsd.zoom.us/meeting/register/tJAodu-qqDMtHtwI7xRlUJGZQ8N82dbM-fPF
	Wind Garden	https://ucsd.zoom.us/meeting/register/tJwvc-GgqzMrGtGISwvsDknjykYBy05a7VrQ
"Graduate School Application" Workshop		https://ucsd.zoom.us/webinar/register/WN_cnA72pRhQZyQN1xQMGkd1g

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 Dr. Jennifer Tran		https://ucsd.zoom.us/webinar/register/WN_NyJE0ytBRk23cnEGN-FnKA
Student Panel Rooms	ERC College Room	https://ucsd.zoom.us/meeting/register/tJctfuyvrTgpE9yYvIwcTyTZ28tbIaKNRPZr
	Marshall College Room	https://ucsd.zoom.us/meeting/register/tJ0lcOmqpjssGt3r7_Vuz6bxkoPfJmd0OjbE
	Muir College Room	https://ucsd.zoom.us/meeting/register/tJIrf-2orjMtHtdoGgACvPYEnm0rhfElezJg
	Price Center Room	https://ucsd.zoom.us/meeting/register/tJwuceiopjIuGNeL6xr2ByGU0_jiUqK2iVzf
	Revelle College Room	https://ucsd.zoom.us/j/92205419502?pwd=WnVtNjRpeFhMR3pqNmk5T1VhSFFXUT09
	Seventh College Room	https://ucsd.zoom.us/meeting/register/tJIocuGgpz0vHtw2qvxQbAKQbsOzDpRwu7wf
	Sixth College Room	https://ucsd.zoom.us/meeting/register/tJYsc-GrqzMtGdwWmXaHyAhZ7W1xkKkl8ZEB
	Warren College Room	https://ucsd.zoom.us/meeting/register/tJEtfuCsrT0oGdbGI43xPjXCRxpQmIIHWcad
Closing Remarks		https://ucsd.zoom.us/meeting/register/tJApduGrqzkrE9QaL5nfamRsfLLj8tBBrSMY

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	**ECE I**	Falling Star
2	**ECE II**	Giraffe Catchers
3	**Cancer in Youth**	READ/WRITE/THINK/DREAM
4	**Genetic Anthropology**	Red Shoe
5	**Understanding Ecology Through Data**	Snake Path
6	**Engineering & the Human Body I**	Stonehenge
7	**Medicine I**	Sun God
8	**Engineering & the Human Body II**	Wind Garden

Thursday: Morning Session II, 10:10 AM

Panel #	Panel Name	Location
9	**ECE III**	Falling Star
10	**Living Art**	Giraffe Catchers
11	**Women and Cancer**	READ/WRITE/THINK/DREAM
12	**Circadian Clocks, Diet & Gender**	Red Shoe
13	**Computer Science: Data and Cyber-Security**	Snake Path
14	**Biophysics**	Stonehenge
15	**Neurobiology**	Sun God
16	**Engineering Approaches to Better Vision**	Wind Garden

Thursday: Morning Session III, 11:20 AM

Panel #	Panel Name	Location
17	**Engineering Approaches to Visual Imaging I**	Falling Star
18	**Latinx Experience in Higher Ed.**	Giraffe Catchers
19	**Machine Learning I**	READ/WRITE/THINK/DREAM
20	**Microbiology**	Red Shoe
21	**Cancer Biology**	Snake Path
22	**Disparities in Health Care**	Stonehenge
23	**Substance Abuse**	Sun God
24	**Engineering Approaches to Visual Imaging II**	Wind Garden

Thursday: Afternoon Session I, 1:00 PM

Panel #	Panel Name	Location
25	**Engineering & Optics**	Falling Star
26	**Machine Learning II**	Giraffe Catchers
27	**Gender, Sexuality, and Public Health**	READ/WRITE/THINK/DREAM
28	**Educational Equity**	Red Shoe
29	**Racial Justice in California**	Snake Path
30	**Machine Learning / Behavioral Ecology**	Stonehenge
31	**Medicine II**	Sun God
32	**Black Health Matters**	Wind Garden

Thursday: Afternoon Session II, 2:10 PM

Panel #	Panel Name	Location
33	**Engineering Vehicles**	Falling Star
34	**Identities and Power**	READ/WRITE/THINK/DREAM
35	**Democratizing Higher Education**	Red Shoe
36	**Neuroscience I**	Snake Path
37	**Three Fish and a Giant Tubeworm**	Stonehenge
38	**Viruses**	Sun God
39	**Physical and Mental Health**	Wind Garden

Thursday: Afternoon Session III, 3:20 PM

Panel #	Panel Name	Location
40	**RC Car and Autonomous Driving Technology**	Falling Star
41	**Educational Technology**	Giraffe Catchers
42	**Language/Linguistics**	READ/WRITE/THINK/DREAM
43	**Robotic Systems Simulation**	Red Shoe
44	**Neuroscience II**	Snake Path
45	**The Science of Learning**	Sun God
46	**Ecology & Plant Biology**	Stonehenge
47	**Linguistics and Engineering**	Wind Garden

Friday: Morning Session I, 9:00 AM

Panel #	Panel Name	Location
48	**Microbiomes**	ERC Room
49	**Empowering Black Youth**	Marshall College
50	**Art as Resistance**	Muir College
51	**Engineering and Urban Planning**	Price Center Room
52	**Gene Expression**	Revelle College
53	**Social & Self Perception**	Seventh College
54	**Local and Transnational Politics**	Sixth College
55	**Inflammation & Immune Response**	Warren College

Friday: Morning Session II, 10:10 AM

Panel #	Panel Name	Location
56	**Molecular Genetics**	ERC Room
57	**Power Systems**	Marshall College
58	**Cell Biology**	Muir College
59	**Innovative Engineering**	Price Center Room
60	**Democratizing Higher Education**	Revelle College
61	**Mental Disorders**	Seventh College
62	**Economic, Educational, and Political Impacts of COVID-19**	Sixth College
63	**Heart - Macro & Molecular**	Warren College

Friday: Morning Session III, 11:20 AM

Panel #	Panel Name	Location
64	**Engineering New Solutions**	Marshall College
65	**Empowering Latinx Students**	Muir College
66	**Physics**	Price Center Room
67	**Biology - Structure & Function**	Revelle College
68	**Cognitive Science and Psychology**	Seventh College
69	**Political Economies of Conflict**	Sixth College
70	**Materials Science and Engineering**	Warren College

Friday: Afternoon Session I, 1:00 PM

Panel #	Panel Name	Location
71	**Biomimicry & Engineering**	Marshall College
72	**Health Concerns and Information Dissemination**	Muir College
73	**Engineering San Diego II**	Price Center Room
74	**Challenging Healthcare Disparities**	Revelle College
75	**Physics and Electrical Engineering**	Seventh College
76	**Astrophysics & Astronomy**	Sixth College

Friday: Afternoon Session II, 2:10 PM

Panel #	Panel Name	Location
77	**ECE IV**	Seventh College
78	**Mathematics & Engineering**	Sixth College

Student Spotlights

Alisha Poudel

Pronouns: she/her/hers
Summer Program: URS - Julia Brown Scholar
Class Standing and College: Senior, ERC
Major: Neuroscience and Physiology
Field of Research: Space Physiology and Orthopedics
Presentation Title: *Ground Reaction Forces and Gait patterns during Lower Body Positive Pressure Treadmill Device*
Mentor: Dr. Alan Hargens

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

I am beyond excited to see so many students and faculty involved in such diverse areas of research supporting each other and providing genuine curiosity in each other's research. One of the key aspects of being a researcher means staying curious and respectfully raising questions. I have been lucky to see such intellectual exchange in practice this summer.

Lee Diego Lacasa

Pronouns: He/Him/His
Summer Program: Genentech Scholars Program
Class Standing/College: Senior, Eleanor Roosevelt
Major(s): Biochemistry and Cell Biology, Cognitive and Behavioral Neuroscience
Field of Research: Rheumatology, Allergy, and Immunology
Presentation Title: *The Effect of the STING Pathway on Innate Lymphoid Cell Changes During Type 2 Lung Inflammation*
Mentor: Taylor Doherty, M.D.

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

The most meaningful takeaway I gained through investment in my own research endeavors was experiencing every motion of the transformative process: the good, the bad, in both intra- and inter-personal respects. I gained research training and immersive exposure, but more importantly, I took each step with gratitude, intention, and actively created space and opportunities for collaboration to actively uplift my peers.
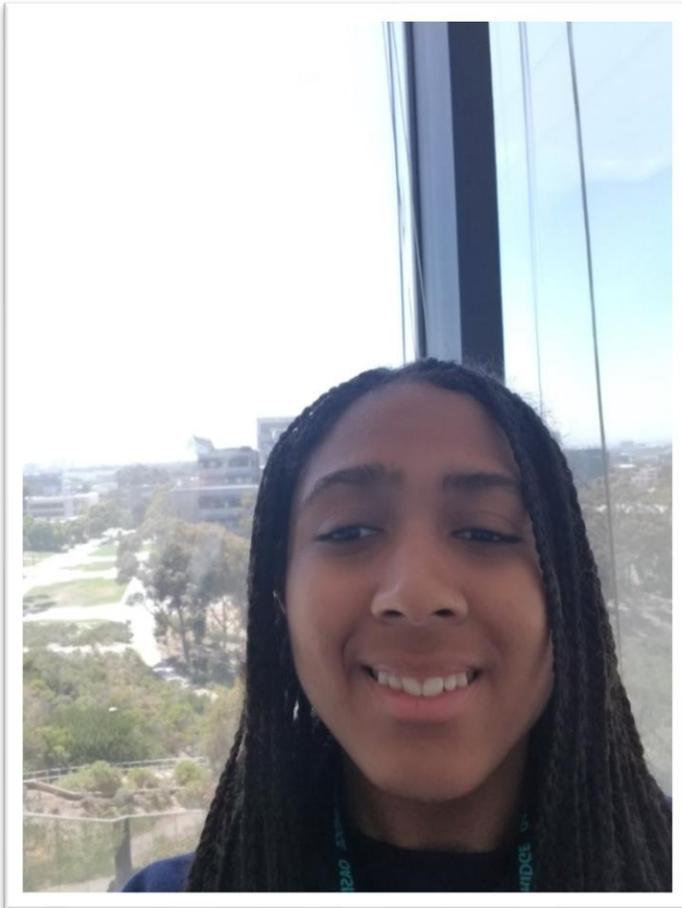
Angela Chapman

Pronouns: She, her, hers
Summer Program: UC Scholars
Class/College: Junior Standing, Muir College
Major: Psychology with a Specialization in Clinical Psychology
Field of Research: Psychiatry
Presentation Title: The Feasibility of Virtual Reality-Based Oddball Paradigm to Assess Information Processing in Schizophrenia Patients
Mentor: Dr. Neal Swerdlow

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

The most meaningful experience I have had during my time in the Summer Research Program has to be the times in which I got mentorship from my faculty mentor and supervisor. Full-time summer research experience has gotten me the opportunity to really develop my relationships with my mentor and supervisor. The advice and guidance that I got from my supervisor and mentor throughout this research experience have resulted in me truly learning how to develop and explore questions as a novel researcher. I think the mentorship I have received and the skills I have developed as a result have made my summer research experience a rewarding one.
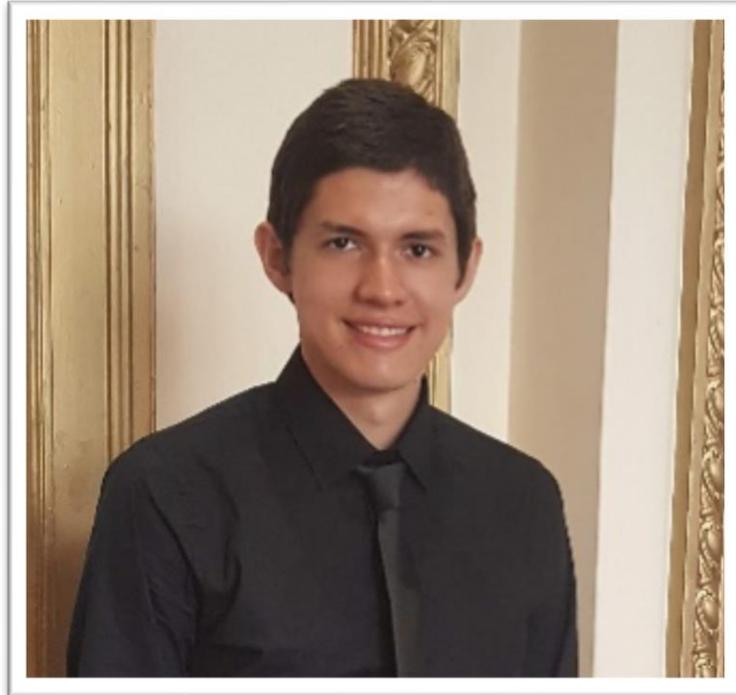
Jesus Villalvazo Fausto

Pronouns: He/His/Him
Summer Program: California Louis Stoke Alliance for Minority Participation (CAMP)
Class/College: Senior, Revelle
Major/Field of Research: Electrical Engineering
Presentation Title: Portable Ophthalmic Instruments
Mentor: Professor Frank Talke

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

With the coronavirus situation separating us, I have appreciated the opportunity to work with my teammates and mentors in this project while staying safe. This has given me the opportunity to network with professors, grad students and peers. It has been helpful to be connected while working in devises that will help the lives of individuals during these difficult times. The CAMP program has also allowed me to hear the stories of people in other projects going through the same difficulties as I have, and to talk with people outside my social circle.

Jacob Ayers

Pronouns: He/Him
Summer Program: Engineers for Exploration SRIP
Academic Status: Good Standing
Class Standing and College: Junior at Thurgood Marshall
Major and Depth: Electrical Engineering with a depth in Machine learning
Field of Research: Applications of Machine learning in Bioacoustics
Presentation Title: Acoustic Species Identification
Mentor Name: Curt Schurgers
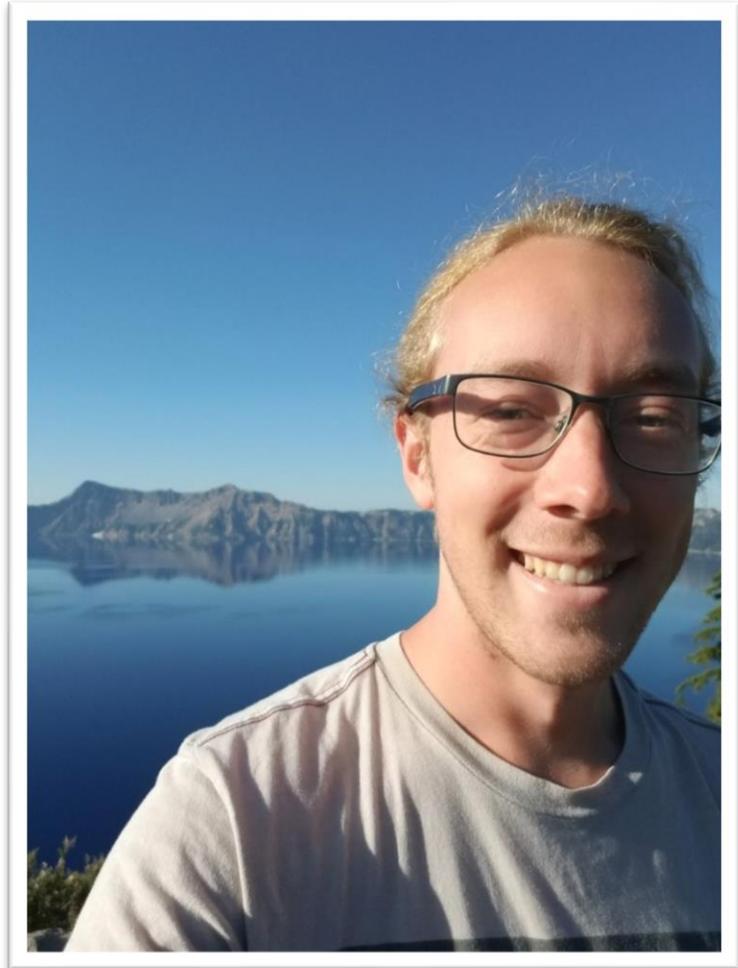
What has been the most meaningful experience you've had during the Summer Research Program?

I have grown to respect the necessity of encountering difficulties while trudging through a relatively new research field. There are some paths that my team and I can follow that have been laid out by others in the field, but eventually when we need to produce results with our data that balance the demands of the collaborators we work with and the capabilities of the paths we have followed, we tend to encounter what appears to be the unknown. When those points are reached I have found it best to listen to those around me more for advice, and any attempts to dive into the unknown to break ground, must be executed quickly, with compromises made, and the ability to analyze successes and failures for the next dive.

Xinyang Yu

Pronouns: They/Them
Summer Program: Hardware design for an autonomous quadrotor robot
Class Standing and College: Senior, Warren College
Major: Electrical Engineering
Field of Research: Autonomous Robotic Hardware Design and Integration
Presentation Title: SLAM Drone System Integration
Mentors: Zhichao Li Ph.D/ Professor Nikolay Atanasov

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

Though most of the time we work remotely with our team, it's been a really great learning experience for me. The most meaningful moment is when I get stuck on getting a driver to work for my drone, my mentors and other students in the lab are all very passionate to help me. I was really moved by their motivation and commitment. I think the open and diverse learning community is the greatest thing about the UCSD ECE department.

Syreeta Nolan

Pronouns: She/her/hers
Summer Program: McNair Scholars
Class Standing and College:
Senior/Warren College
Major: Psychology with a
specialization in Human Health
Field of Research: Psychology and
Medicine
Presentation Title: A Systematic
Review of Methamphetamine Use
Disorder Considering Syndemic
Factors in HIV
Mentor: Dr. Francesca Telese

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

The most meaningful experience for me was winning the [Undergraduate Library Research Prize](#) with the team that I lead for this project. It was one of the most validating and humbling experiences. It has been my honor to lead this team and to be able to recognize each of them for the role that they played in winning this prize. Our project is just getting started and I look forward to seeing what the next year will reveal in the papers that we review. I am just so thankful for McNair and this Summer Research Program shifting to show the value of research that occurs outside of the lab in response to the pandemic around us.
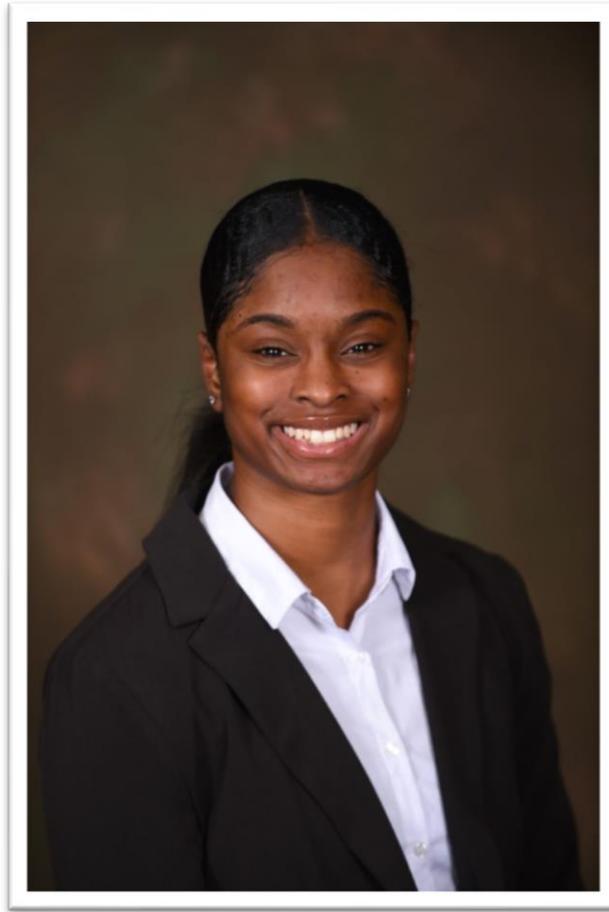
Avyance Ervin

Pronouns: She / Her / Hers
Summer Program: UC San Diego STARS - Summer Research Program
Class Standing and College: *Senior / Spelman College*
Major: Sociology/ Anthropology
Field of Research: Sociology
Presentation Title: Knowledge and Truth: The African American Identity
Mentor Name: Dr. Lane Kenworthy

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

I enjoyed having our weekly grad advocate meetings. It was a space where we could be honest about how we were doing and discuss the exciting or challenging parts of our research.

Conference Participants and Sponsoring Programs
Academic Enrichment Programs, Summer Research Program
UC San Diego

California Louis Stokes Alliance for Minority Participation (CAMP) in Science, Engineering and Math
Michael Baluja
Pio Blanco Campos
Jesus Fausto
Jesse Garcia de Alva
James Garrafa-Luna
Natalia Henriquez
Bolarin Lawrence
Gabriel Lopez
Jesi Miranda-Santos
Weginbara Youpele

Converge Incubator
Tanvi Bajaj
Neve Foresti
Katherine Ngo
Persephonie Rodriguez
Neha Sahota
Prem Shelat
Calli Suppa
Steven Swee
Amer Tabban
Charlie Tran
Daniel Vazquez
Lindsey Young

Electrical and Computer Engineering SRIP
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Juan Alapizco Vega
Justin Andal
Allan Ateek
Jacob Ayers
Shivani Bhakta
Yuliang Cai
Tyler Chang
Vivian Chiong
Brandon Crame
Xuanxi Du
Jiajian Fu

Qichun Gui
Zijia Guo
Miriam Hamidi
Scott He
Bao Hoang
Gaopo Huang
Hannah Hu
Tanish Jain
Adam Kadwory
Sean Kamano
Merve Kili
Chunjhen Lai
Isaias Larios
Hao Le
Guanqing Li
James Li
Yejun Li
Yidong Li
Jiaxi Liu
Zack Liu
Samantha Long
Songyu Lu
Mia Lucio
Jiachen Luo
Jiayi Luo
Anastasiia Makhniaieva
Greg Maki
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Nicholas Munoz
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Jason Pham
Minh Pham
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Reed Rouland
Keshav Rungta
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Hong Tang
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Carson Valdez
Minh Vo
Henry Wang
Hong Wang
Gaotong Wu
Raini Wu
Anfeng Xu
Haoru Xue
Fei Yin
Xinyang Yu
Zhicheng Yu
Jiawen Zeng
Xiangjian Zeng
Qingyuan Zhang
Minghui Zhao
Zhen Zhai
Siyuan Zhu

Genentech Scholars Program
Natalia Avina-Ochoa
Skylar Bird
Brian Dinh
Delina Kambo
Lee Diego Lacasa
Erin Rosales
Soyoung Shin

Initiative for Maximizing Student Development (IMSD)
Kyle Skelil

Lo Lab
Caleb Schimke

MARC UR STAR
Carmen Castillo

McNair Scholars Program
Enrique Arcilla
Jose Calderon
Vanessa Cervantes
Marin Cross
Sabrina Diaz
Viviana Araceli Dominguez
Alan Guandique

Jasmin Hernandez Santacruz
Tingfei Hu
Jose Jimenez
Unduwap Kandage Don
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Andrea Lin
Yang Lu
Josselyn Marroquin
Morgan Montoya
Jaqueline Munive
Nay Chi Naing
Lucia Nishizawa-Rodriguez
Syreeta Nolan
Naama Nunez
Dora Ogbonna
Thuy Trang Sabrina Pham Vu
Chantal Rabay
Nayeli Rincon
David Sibrian
Rabia Syed
Yordanos Tesfai
Tiffany Tran
Anh Vo

Multidisciplinary Educational Approach to Reducing Cancer Disparities Program
Aleigha Binda
Richard Burnett
Paola Cancino
Priscila Chagolla
Anthony Cirilo
Andres Espinoza
Eduardo Gonzalez
Dina Koes
Dalia Koujah
Nicolette Olivia Le
Juan Andrew Leal
Nicole Lee
Joseph Morales
Shawn Ogden
Andrea Padilla
Ryan Park
Hao Pham
Naomi Pineda
Jocelyn Quiroz
Mariah Romero
Michael Skipworth

Sally Trinh
Rowan Ustoy
Yilin Xu
Ethan Yi Zhu

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Julien Alfaro
Jazlyn Armendariz
Nasir Bakare
Aishwarya Balivada
Francesca Bentley
Arthor Bernal
Nicole Bisente
Daria Bonds
Aldair Bonilla
Katarina Brekalo
Christopher Brown
Brenden Chase
Jojo Chen
Javier Contreras
Francisco Cornejo-Garcia
Ilene Cruz
Cesar De La Torre Castaneda
Sylas Eckhart
Caín Alexander Elizarraras Galván
Avyance Ervin
Rae Therese Fariolen
Noah Gaitan
Ruby Gamboa
Natalie Gevoglanian
Jacob Gill
Taryn Gill
Arianna Girmai
Lauryn Gist-Reed
Peyton Goings
Daisy Gomez-Fuentes
Raed Good
Galilea Guerrero
Varvara Gulina
Loren Heins
David Hernandez
Sidney Huen
Richard Hurtado
Shereen Lam
Maxwell Liu
Livier Lopez Canela
Carolina Lopez

Stephanie Martinez
Samuel Mayfield
Jorge Mendoza
Zahra Mesrizadeh
John Minihan
Dawnielle Mitchell
Cameron Moffett-Smith
Matthew Moldthan
Mariaelena Montanez
Ameen Muhammad
Ali Nekouei
Jacquelyn Ortegon
Jessica Pacheco
Salma Michelle Parra Pulgarin
Xavier Perez
Samantha Pulido
Christina Puzzanghera
Sophia Reyes
Gonzalo Rocha-Vazquez
Erica Ruiz
Julie Salazar
Mark Schara
Alina Shahin
Morgan Sinkfield
Luis Velez Vera
Jacob Watson

STARS and CAMPARE
Chelsea Adelman

Triton Research & Experiential Learning Scholars (TRELS)
Caesar Aceituno
Jehan Ezzulddin
Omar Flores
Parke Funderburk
Marisol Gonzalez
Samantha Gray
Samantha Harmer
Henry Helmuth
Kyra Hulse
Lauren Ibarra
Karanjot Kaur
Eliana Kontokanis
Kate Mallari
Steve Anthony Maravillo
Chad Marks
Xelestiál Moreno-Luz

Yana Pyryalina
Eman Sherif
Justin Skaggs
Gregory Stocker
Donovan Tamkin
Steven Tsan
Gabriel Van Konynenburg
Swan Van
Arely Vasquez
Nancy Xu
Donna Yerat-Rodriguez
Eric Yu
Hanin Zayat
Annie Zhou

UC LEADS
Angela Gao
Briana Prado

UC Scholars
Luis Alvarez
Mirelle Castaneda
Angela Chapman
Zijing Di
Jianan Liang
Can Liu
Ivette Martinez
Animesh Mohapatra

Undergraduate Research Scholarships
Nicole Adamson
Maya Ambroziak
Lauren Apostol
Alberto Avalos
Jacob Buckman
Sierra Byrne
Mariana Carrola
Jaideep Chakladar
Sharlene Diep
Hope Do
David Everly
Michael Fernandez
Julia Guerrero
Nadia Haghani
Michelle He
Helen Jannke
Tiffani Le
Dominique Lie

Kevin Mazo
Sapna Mehta
Asim Mohiuddin
Ryan Myers
Ethan Olson
Cameron Ormiston
Peter Pham
Alisha Poudel
Marina Ramsey
Reeya Shah
Neil Shende
Narinderbir Singh
Theresa Slaiwa
Kirollos Tadrousse
Maria Tiu
Megan Tjuanta
Joey Truong
Joseph Tsai
Alexandria Tso
Joseph Vechinski
James Wang
Benjamin Werb
Clara Wong
Lindsay Wong
Jin Yi Wu
Justin Yang
Claire Zhang

Panel Details

Thursday: Morning Session I

Panel 01: ECE I
Zoom Room: Falling Star
Thursday 9:00AM-10:00AM
Moderator: Dr. Truong Nguyen

Brandon Cramer - UC San Diego
Mentor: Dr. Prasad Gudem
Impact of FR1 5G NR Jammers on UWB Indoor Position Location Systems

Zijia Guo - UC San Diego
Mentor: Dr. Dinesh Bharadia
Hitchhike Mother-board

Isaias Larios - UC San Diego
Mentor: Dr. Duygu Kuzum
Radio modulation classification with neuromorphic computing

Weginbara Youpele - UC San Diego
Mentor: Raghav Subbaraman
Beam-Forming Calibration through UART-to-SPI Data Conversion

Panel 02: ECE II
Zoom Room: Giraffe Catchers
Thursday 9:00AM-10:00AM
Moderator: TBA

Miriam Hamidi, Scott He, Songyu Lu, & Zhicheng Yu - UC San Diego
Mentor: Dr. Truong Nguyen
Spatial Audio Demonstration

Jesse Soto - UC San Diego
Mentor: Dr. Ramsin Khoshabeh
RC Car Chassis

Haoru Xue - UC San Diego
Mentor: Dr. Ramsin Khoshabeh
CV-Based Localization on Educational Autonomous Robotic Car

Panel 03: Cancer in Youth
Zoom Room: READ/WRITE/THINK/DREAM
Thursday 9:00AM-10:00AM
Moderator: Dr. Maryan Rizk

Anthony Cirilo - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Infantile Radioactive Diagnostic Testing as a Possible Indicator of Adolescent Cancer Risk

Eduardo Gonzalez - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Linking pesticide exposure to childhood leukemia among Hispanic Americans

Juan Andrew Leal - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Childhood Cancer Survivorship and Health Outcomes Among Minority Populations

Sapna Mehta - UC San Diego
Mentor: Dr. Dennis Kuo
Universal Cancer Predisposition Screening Protocol within the Pediatric Hematology Oncology Population

Panel 04: Genetic Anthropology
Zoom Room: Red Shoe
Thursday 9:00AM-10:00AM
Moderator: Dr. Amy Non

Carolina Lopez - UC San Diego
Mentor: Dr. Amy Non
The influence of genetic ancestry data on clinician's treatment choice for white and mixed race patients with hypertension

Chantal Rabay - UC San Diego
Mentor: Dr. Amy Non
Analyzing Clinician Views on Race and Genetic Ancestry

Marin Cross – UC San Diego
Mentor: Dr. Amy Non
Effects of acupuncture treatment on immune cell telomerase activity

Sylas Eckhart – UC San Diego
Mentor: Dr. Amy Non
Hair cortisol as a Measurement of Chronic Stress

Panel 05: Understanding Ecology Through Data

Zoom Room: Snake Path
Thursday 9:00AM-10:00AM
Moderator: Dr. Sepid Mazrouee

Alberto Avalos & Julia Guerrero - UC San Diego
Mentor: Dr. Ryan Kastner
Fish Sense

Jacob Ayers - UC San Diego
Mentor: Dr. Curt Schurgers
Acoustic Species Identification

Mia Lucio - UC San Diego
Mentor: Dr. Curt Schurgers
Radio Collar Telemetry

Benjamin Werb - UC San Diego
Mentor: Dr. Ryan Kastner
Smartfin: Gathering Oceanic Data from Recreational Surfers

Panel 06: Engineering & the Human Body I

Zoom Room: Stonehenge
Thursday 9:00AM-10:00AM
Moderator: Dr. Eshani Hettiarachchi

Brenden Chase - CSU Bakersfield
Mentor: Dr. Alina Schimpf
Multi-Media Imaging and Photothermal Therapy of Cancerous Cells utilizing Nanoparticles

Bolarin Lawrence - UC San Diego
Mentor: Dr. Ester Kwon
Visualization of Next-Generation Sequencing Phage Display Data for Identification of Novel Cell-Targeting Ligands After Traumatic Brain Injury

Zahra Mesrizadeh - UC San Diego
Mentor: Dr. Liangfang Zhang
Engineered cell membrane-coated nanoparticles functionalized with MECA-79 to target high endothelial venules for enhanced T cell activation

Animesh Mohapatra - UC San Diego
Mentor: Dr. Liangfang Zhang
Long-Circulating Nanoparticles Inspired by Nature

Panel 07: Medicine I

Zoom Room: Sun God
Thursday 9:00AM-10:00AM
Moderator: Dr. Kellie Church

Michelle He - UC San Diego
Mentor: Dr. Pamela Mellon
Androgen-mediated effects on ovarian morphology in an AMH-induced mouse model of Polycystic Ovary Syndrome (PCOS)

Theresa Slaiwa - UC San Diego
Mentor: Dr. Pamela Mellon
Activin Signaling is Necessary for the Activity of a Novel FSHB Enhancer

Natalia Avina-Ochoa - UC San Diego
Mentors: Dr. Susan Kaech & Dr. Steven Zhao
T cell gene expression in Pancreatic ductal adenocarcinoma

Kirollos Tadrousse - UC San Diego
Mentor: Dr. Kellie Breen Church
Investigating neuronal activation during the response to psychosocial stress in female mice

Panel 08: Engineering & the Human Body II

Zoom Room: Wind Garden
Thursday 9:00AM-10:00AM
Moderator: Dr. Cheolhong An

Pio Blanco Campos - UC San Diego
Mentor: Dr. Pedro Cabrales
Effects of Polymerized Hemoglobin on subjects with pre-existing conditions

Jiachen Luo - UC San Diego
Mentor: Dr. Tina Ng
Electronic harness to assist elbow movement

Reed Rouland - UC San Diego
Mentor: Dr. Ramsin Khoshabeh
Optical Blood Pressure Sensing

James Wang - UC San Diego
Mentor: Dr. Nisarg Shah
Modeling effects of immunosuppressive PD-L1 biomaterials on T cell proliferation in the lymph node microenvironment

Thursday: Morning Session II

Panel 09: ECE III
Zoom Room: Falling Star
Thursday 10:10AM-11:10AM
Moderator: Dr. Truong Nguyen

Xuanxi Du & Ilya Petrov - UC San Diego
Mentor: Dr. Xinyu Zhang
mmWave Software Defined Radio

Yidong Li - UC San Diego
Mentor: Dr. Dinesh Bharadia
Universal IoT Gateway

Eamon Patamasing - UC San Diego
Mentor: Dr. Dinesh Bharadia
Large-scale Retrodirective mm-Wave Tags for Traffic Sign Identification

Minh Vo - UC San Diego
Mentor: Dr. Truong Nguyen
Fall Risk Detection From Video Using Key Joint Locations

Panel 10: Living Art
Zoom Room: Giraffe Catchers
Thursday 10:10AM-11:10AM
Moderator: Jordan Crandall

Omar Flores - UC San Diego
Mentor: Dr. Sarah Hankins
Political Rap and Commercial Sap: Political Authenticity within Contemporary Commercial Rap

Chad Marks - UC San Diego
Mentor: Eva Barnes
Take Two: Drama Therapy From An Actor's Point Of View

Gabriel Van Konynenburg - UC San Diego
Mentor: Dr. Stephanie Jed
Aging in Film

Nancy Xu - UC San Diego
Mentor: Jordan Crandall
Big Brother — A short story and screenplay by Nancy Xu

Panel 11: Women and Cancer
Zoom Room: READ/WRITE/THINK/DREAM
Thursday 10:10AM-11:10AM
Moderator: Dr. Maryan Rizk

Dina Koes - San Diego State University
Mentor: Dr. Georgia Robins Sadler
Stakeholder Suggestions for Potential Intervention Approaches to Facilitate Cervical Cancer Screening among Women Living with HIV in Surat, India

Dalia Koujah - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Age-Related Disparities in Outcomes for ER+ Breast Cancer: Exploring the Role of NUP210

Nicole Lee - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Exploring the Association Between Higher Mortality Rates after Ductal Carcinoma in Situ (DCIS) Diagnosis

Yilin Xu - UC San Diego
Mentor: Dr. Georgia Robins Sadler
A Literature Review of BRCA Mutations and Survival Disparities in Breast Cancer Among Women of African Ancestry (WAA)

Panel 12: Circadian Clocks, Diet, & Gender
Zoom Room: Red Show
Thursday 10:10AM-11:10AM
Moderator: Dr. Granton Jindal

Vanessa Cervantes - UC San Diego
Mentor: Dr. Michael R Gorman
Sex differences in circadian clock flexibility: does it depend on an exercise wheel?

Tiffani Le - UC San Diego
Mentor: Dr. Satchidananda Panda
Time-Restricted Feeding as a Therapeutic Intervention against Cardiovascular Disorders

Cameron Ormiston - UC San Diego
Mentor: Dr. Pam Taub
Influence of time-restricted eating (TRE) on circadian regulation of glucose homeostasis and mitochondrial function

Reeya Shah - UC San Diego
Mentor: Dr. Varykina Thackray
Effects of increased fiber diets on PCOS metabolic phenotype

Panel 13: Computer Science: Data and Cyber-Security

Zoom Room: Snake Path
Thursday 10:10AM-11:10AM
Moderator: Dr. Sepid Mazrouee

Francisco Cornejo-Garcia - Cypress College
Mentor: Dr. Arun Kumar
Featurization of Date-Time Values

Merve Kilic - UC San Diego
Mentor: Dr. Siavash Mirarab
A Fast Implementation of Root-to-Tip Rooting for Virus Phylogenies

Samantha Long - UC San Diego
Mentor: Dr. Dinesh Bharadia
Programming ScatterMIMO Surfaces via BLE Links

John Minihan - San Diego City College
Mentor: Dr. Tsung-Ting Kuo
Health Insurance Claims on Blockchain for Efficiency, Security, and Privacy

Panel 14: Biophysics

Zoom Room: Stonehenge
Thursday 10:10AM-11:10AM
Moderator: Dr. Eshani Hettiarachchi

Rae Therese Fariolen - UC Berkeley
Mentors: Dr. Elena Koslover & Dr. Aidan Brown
Diffusive Transport in Organelles

Cameron Moffett-Smith - Cal Poly Pomona
Mentor: Dr. Liang Yang
Barium Tagging

Kyle Skelil - UC San Diego
Mentor: Dr. Tod Pascal
Molecular Dynamics Simulations of Binding Energy Between Single Strand DNA and Silver Nanoparticles

Swan Van - UC San Diego
Mentor: Dr. Alexis Komor
Atomistic insights into the nucleic acid binding activity of the Trm10 enzyme

Panel 15: Neurobiology
Zoom Room: Sun God
Thursday 10:10AM-11:10AM
Moderator: Dr. Kellie Church

Arthor Bernal - UC Riverside
Mentor: Dr. Amir Zarrinpar
Comprehensive Analysis of Open Source Software for Mouse Behavioral Phenotyping

Peyton Goings - Xavier University of Louisiana
Mentor: Dr. Yimin Zou
The Effect of Ketamine in Planar Cell Polarity

Jorge Mendoza - UC Irvine
Mentor: Dr. Thomas Hnasko
Using chemogenetics to manipulate Lateral Habenula activity

Briana Prado – UC San Diego
Mentor: Lihini Aluwihare
Discovering Organic Chemical Indicators of Environmental Conditions at the Scripps Pier

Panel 16: Engineering Approaches to Better Vision
Zoom Room: Wind Garden
Thursday 10:10AM-11:10AM
Moderator: Dr. Cheolhong An

Jesus Fausto & Jesi Miranda-Santos - UC San Diego
Mentor: Dr. Frank Talke
Portable Ophthalmic Instruments

Chunjhen Lai & William Sun - UC San Diego
Mentor: Dr. Pamela Cosman
Quantifying Reading Order and Completeness Using Eye-tracking

Minh Pham & Xinyang Yu - UC San Diego
Mentor: Dr. Nikolay Atanasov
Autonomous Quadrotor Robots

Thursday: Morning Session III

Panel 17: Engineering Approaches to Visual Imaging I
Zoom Room: Falling Star
Thursday 11:20AM-12:20PM
Moderator: Dr. Truong Nguyen

Jiajian Fu - UC San Diego
Mentor: Dr. Truong Nguyen
Detection and description for feature matching

Tian Qiu & Raini Wu - UC San Diego
Mentor: Dr. Pamela Cosman
Viewport-adaptive 360-degree video streaming

Fei Yin - UC San Diego
Mentor: Dr. Truong Nguyen
Multi-view Reconstruction

Minghui Zhao - UC San Diego
Mentor: Dr. Dinesh Bharadia
ULoc - Robust, Scalable, cm-accurate UWB based localization

Panel 18: Latinx Experience in Higher Ed.
Zoom Room: Giraffe Catchers
Thursday 11:20AM-12:20PM
Moderator: Jordan Crandall

Caesar Aceituno - UC San Diego
Mentor: Dr. Frances Contreras
Qualitative Study: Transfer Student's Transitional Experience Project

Hanin Zayat - UC San Diego
Mentor: Dr. Max Parra
Transcultural Translation: Transcription and Interpretation of Bilingual and Non-native Speakers in Feature-Length Spanish Language Films Through Captioning and Subtitling

Mariana Carrola - UC San Diego
Mentor: Dr. Frances Contreras
Chicanas/Latinas engaging in Transformative Resistance Motivated by their Familias and Social Justice

Donna Yerat-Rodriguez - UC San Diego
Mentor: Dr. Luz Chung
Redefining Success in Higher Education through Testimonios (testimonies) First-Generation College Students at UCSD

Panel 19: Machine Learning I

Zoom Room: READ/WRITE/THINK/DREAM
Thursday 11:20AM-12:20PM
Moderator: TBA

Zijing Di - UC San Diego
Mentor: Dr. Zhuowen Tu
Improved label to image generation

Andrea Lin - UC San Diego
Mentor: Dr. Shabnam Semnani
Machine Learning Data-Driven Method to solve the Mechanical Behavior of Heterogeneous Materials

Gaotong Wu - UC San Diego
Mentor: Dr. Pengtao Xie
self-supervised learning for time-series classification

Jiawen Zeng - UC San Diego
Mentor: Dr. Pengtao Xie
Contrastive Self-supervised Learning for Graph Classification

Panel 20: Microbiology

Zoom Room: Red Show
Thursday 11:20AM-12:20PM
Moderator: Dr. Granton Jindal

Lauren Apostol - UC San Diego
Mentor: Dr. Rutherford Ongkeko
Dysbiosis of the oral microbiome affects head and neck tumor immunology

Carmen Castillo - University of California Riverside
Mentor: Dr. David Gonzalez
16s rRNA Profiling of Large Cohort of Inflammatory Bowel Disease Patients Reveals Potential Microbial Signatures

Nadia Haghani - UC San Diego
Mentor: Dr. Sreekanth Chalasani
Characterization of Caenorhabditis elegans skin microbiome and the effects of naturally-correlated bacteria on nematode undulatory behavior

Joseph Vechinski - UC San Diego
Mentor: Dr. Eric Allen
Trends in Microbial Communities of Southern California Marine Fishes

Panel 21: Cancer Biology

Zoom Room: Snake Path
Thursday 11:20AM-12:20PM
Moderator: Andres Nevarez

Sabrina Diaz - UC San Diego
Mentor: Dr. Nan Hao
Observation of allele switching events in telomerase expression due to cancer mutations

Delina Kambo - UC San Diego
Mentor: Dr. Trey Ideker
The effect of cancer cell's genomic mutations and gene expression on cancer cell's genetic dependencies.

Ryan Park - UC San Diego
Mentor: Dr. Jing Yang
Tumor Micro-environment effects on Breast Cancer Development

Joseph Tsai - UC San Diego
Mentor: Dr. Weg Ongkeko
Characterization of the age-associated intratumoral microbiome in pancreatic adenocarcinoma

Panel 22: Disparities in Health Care

Zoom Room: Stonehenge
Thursday 11:20AM-12:20PM
Moderator: Dr. Eréndira Rueda

Richard Burnett - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Genetic Testing Disparities and Cancer Disparities

Hao Pham - UC San Diego
Mentor: Dr. Christina Jamieson
Promising Strategies to improve Prostate Cancer death rate among Native Americans and Alaska Natives

Rowan Ustoy - UC San Diego
Mentor: Dr. Georgia Robins Sadler
The underrepresentation of HIV+ participants in cancer clinical trials and the barriers faced involving cancer treatment

Panel 23: Substance Abuse

Zoom Room: Sun God
Thursday 11:20AM-12:20PM
Moderator: Dr. Ece Bayram

Ana Boisvert - UC San Diego
Mentor: Dr. Sara Browne
A Rapid Review of Methamphetamine Use Disorder Treatment and Adherence to Antiretroviral Medication in HIV+ Population

Syreeta Nolan - UC San Diego
Mentor: Dr. Francesca Telese
A Systematic Review of Methamphetamine Use Disorder Considering Syndemic Factors in HIV

Jacob Watson - CSU Bakersfield
Mentor: Dr. Chitra Mandyam
The protective effects of Endostatin on the expression of PECAM-1 in the medial prefrontal cortex in chronic ethanol exposed rats

Panel 24: Engineering Approaches to Visual Imaging II

Zoom Room: Wind Garden
Thursday 11:20AM-12:20PM
Moderator: Dr. Cheolhong An

Jiayi Luo - UC San Diego
Mentor: Dr. Cheolhong An
Lensless camera: Simultaneous Depth and Scene reconstruction

Jake Millhiser - UC San Diego
Mentor: Dr. Piya Pal
Overcoming Diffraction Limits with Correlation-based Super-Resolution Algorithms

Keshav Rungta - UC San Diego
Mentor: Dr. Dinesh Bharadia
SensorFusion: Imaging for Autonomous Driving

Siyuan Zhu - UC San Diego
Mentor: Dr. Dinesh Bharadia
FMCW Radar Imaging for Autonomous Driving

Thursday: Afternoon Session I

Panel 25: Engineering & Optics
Zoom Room: Falling Star
Thursday 1:00PM-2:00PM
Moderator: Dr. Saharnaz Baghdadchi

Sean Kamano - UC San Diego
Mentor: Dr. Nuno Vasconcelos
Datasets for Natural World 3D Computer Vision

Jacob Pollard - UC San Diego
Mentor: Dr. Nuno Vasconcelos
Exploring Methods for 3D Reconstruction

Carson Valdez & Henry Wang - UC San Diego
Mentor: Dr. Saharnaz Baghdadchi
Integrated Optical Phased Arrays for Optical Trapping

Panel 26: Machine Learning II
Zoom Room: Giraffe Catchers
Thursday 1:00PM-2:00PM
Moderator: Dr. Paul Siegel

Michael Baluja - UC San Diego
Mentor: Dr. Paul Siegel
Error Correction for Natural Language Processing Networks

Anastasiia Makhniaieva - UC San Diego
Mentor: Dr. Michael Yip
Surgical Robotic System Tracking within an MRI Scanner

Eric Yu - UC San Diego
Mentor: Dr. Sicun Gao
Learning Modular Policies for Robotic Control

Zhen Zhai - UC San Diego
Mentor: Dr. Paul Siegel
Belief Propagation List Decoder for Polar Code

Panel 27: Gender, Sexuality, and Public Health
Zoom Room: READ/WRITE/THINK/DREAM
Thursday 1:00PM-2:00PM
Moderator: Alma Santana

Priscila Chagolla - San Diego State University
Mentor: Dr. Georgia Robins Sadler
Hispanics Have Higher Acceptance of HPV Vaccination Myths: a look into a US/Mexico Border Region

Yordanos Tesfai - UC San Diego
Mentor: Dr. Laramie Smith
Socio Structural Impacts: A Focus on the Relationship between Respect, Trust, and Healthcare Service Engagement among HIV MSM in Tijuana, Mexico

Anh Vo - UC San Diego
Mentor: Dr. Rebecca Fielding Miller
#GameChangers: Sexual Resistance Program in Eswatini

Jehan Ezzulddin - UC San Diego
Mentor: Dr. Sandra Daley
The Relationship Between Social Determinants of Health and Allostatic Load

Panel 28: Educational Equity
Zoom Room: Red Shoe
Thursday 1:00PM-2:00PM
Moderator: TBA

Jianan Liang - UC San Diego
Mentor: Dr. Shannon Ellis
PeAce: Integrating AI-based Tutoring and Collaborative Learning into an Educational System

Naama Nunez - UC San Diego
Mentor: Dr. Abigail Andrews
Across Borders: The Role of Education in Transnational Students' Career Trajectory

Tiffany Tran - UC San Diego
Mentor: Dr. Prashant Bharadwaj
Using Pupil Services Spending and Resources to Predict Student Performance: Understanding the Role of District Leadership and Analyzing Student Performance in California School Districts

Arely Vasquez - UC San Diego
Mentor: Dr. Jingbo Shang
Using Machine Learning Models to Support First-generation Students attend College

Panel 29: Racial Justice in California

Zoom Room: Snake Path
Thursday 1:00PM-2:00PM
Moderator: Dr. Andrew Jan

Christopher Carbajal-Carbajal - UC San Diego
Mentor: Dr. John D. Skrentny
"They're Making It Hard for Us to Exist" - an Empirical Analysis of How Policing Affects the Quality of Life for Black and Brown Communities in the Militarized City of San Diego

Thuy Trang Sabrina Pham Vu - UC San Diego
Mentor: Dr. Yen Le Espiritu
Intergenerationality & Identity-Building within the Oakland Vietnamese Community

Sophia Reyes - CSU Northridge
Mentor: Dr. Prashant Bharadwaj
Examining the Legacy of Residential Security Maps in San Diego County

Rabia Syed - UC San Diego
Mentor: Dr. Leslie Lewis
Somali Refugees: Access to Healthcare

Panel 30: Machine Learning / Behavioral Ecology

Zoom Room: Stonehenge
Thursday 1:00PM-2:00PM
Moderator: Dr. Andreas Härer

Justin Andal & Nicholas Munoz - UC San Diego
Mentor: Dr. Curt Schurgers
Burrowing Owl Classifier

Sierra Byrne - UC San Diego
Mentor: Dr. Anela Choy
Quantifying and categorizing macroplastic consumption by longnose lancetfish (Alepisaurus ferox) in the central North Pacific Subtropical Gyre

Parke Funderburk - UC San Diego
Mentor: Dr. Thomas Levy
Sedimentology and geochemistry of a wetland record from NW Israel: new insights utilizing X-ray fluorescence

James Garrafa-Luna - UC San Diego
Mentor: Dr. Daniel Petras
Analyzing Chemical Anthropogenic Input in the Ocean Using Public Data

Panel 31: Medicine II

Zoom Room: Sun God
Thursday 1:00PM-2:00PM
Moderator: Dr. Laure Campillo-Gimenez

Jesse Garcia de Alva - UC San Diego
Mentor: Dr. Ravinder Mittal
A Novel Gel Bolus to Improve the Impedance Based Measurement of Esophageal Luminal Cross Sectional Area during Primary Peristalsis

Andrea Padilla - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Additional Barriers to End-of-Life Care among Hispanics with Advanced Cancer: Negative Connotations and Financial Limitations

Alisha Poudel - UC San Diego
Mentor: Dr. Alan Hargens
Ground Reaction Force Distribution and Gait Patterns during Lower Body Positive Pressure Treadmill Exercise

Clara Wong - UC San Diego
Mentor: Dr. Stephen Howell
Efficacy of RSPO1-fusion Protein against Cancer Cells containing LGR receptors

Panel 32: Black Health Matters

Zoom Room: Wind Garden
Thursday 1:00PM-2:00PM
Moderator: Dr. Ivan Bassets

Andres Espinoza - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Epigenetic abnormalities and their contribution to cancer outcomes among African Americans

Steve Anthony Maravillo - UC San Diego
Mentor: Dr. Paula Saravia
Examining Vulnerability in Troubling Health Outcomes and Disparities Amidst the COVID-19 Pandemic: Black Homelessness in Los Angeles County, California.

Shawn Ogden - San Diego State University
Mentor: Dr. Georgia Robins Sadler
Researchers Need a Well-Developed Method to Increase African American Participation in Clinical Trials

Ethan Yi Zhu - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Help Us Help You: How Racially and Ethnically Diverse Biobank Contributions Enable Stronger Basic Biology Research

Thursday: Afternoon Session II

Panel 33: Engineering Vehicles
Zoom Room: Falling Star
Thursday 2:10PM-3:10PM
Moderator: Dr. Saharnaz Baghdadchi

Hao Le - UC San Diego
Mentor: Dr. Truong Nguyen
An Automated and Synthetic Testbed for Diverse Driving Data Generation

Yejun Li & Hong Tang - UC San Diego
Mentor: Dr. Ramsin Khoshabeh
3D Machine Learning Training Environment for PCB RC car

Jonathan Mi & Qingyuan Zhang - UC San Diego
Mentor: Dr. Truong Nguyen
A New Camera Platform for Computer Vision Application

Panel 34: Identities and Power
Zoom Room: READ/WRITE/THINK/DREAM
Thursday 2:10PM-3:10PM
Moderator: Alma Santana

Luis Alvarez - UC San Diego
Mentor: Dr. Angela Yu
How Facial Features Influence Social Traits Judgments

Avyance Ervin - Spelman College
Mentor: Dr. Lane Kenworthy
Knowledge and Truth of the African American Identity

Arianna Girmai - UC San Diego
Mentor: Dr. Jacobo Myerston Santana
Effects of Social Networks

Karanjot Kaur - UC San Diego
Mentor: Dr. Federico Rossano
An ethnographic investigation of child begging in Indi

Panel 35: Democratizing Higher Education

Zoom Room: Red Shoe
Thursday 2:10PM-3:10PM
Moderator: TBA

Samantha Harmer - UC San Diego
Mentor: Dr. Bonnie Kaiser
Are UCSD's Resources Sufficient for Former Foster Youth's Needs?

Kate Mallari - UC San Diego
Mentor: Dr. April Sutton
All Bark, No Bite

Ivette Martinez - UC San Diego
Mentor: Dr. Luz Chung
We Do Not All Have A Traditional College Experience

Jaqueline Munive - UC San Diego
Mentor: Dr. Makeba Jones
Understanding the Educational Journey of Undergraduate Latinx Students: Latinx Womxn Perspective

Panel 36: Neuroscience I

Zoom Room: Snake Path
Thursday 2:10PM-3:10PM
Moderator: Gillian Grennan

Samantha Gray - UC San Diego
Mentor: Dr. Douglas Nitz
Spatial Firing Patterns of RSC Neurons at Low Versus High Gamma Frequencies

Yana Pyryalina - UC San Diego
Mentor: Dr. Douglas Nitz
Role of Axis-Tuned Neural Activity and Head Direction Encodings in Construction of Neural Maps of Space

Jin Yi Wu - UC San Diego
Mentor: Dr. Sandra Sanchez-Roige
CADM2, cell adhesion molecule, and its effects on impulsivity and synapse morphology

Panel 37: Three Fish and a Giant Tubeworm

Zoom Room: Stonehenge
Thursday 2:10PM-3:10PM
Moderator: Dr. Andreas Härer

Nicole Adamson - UC San Diego
Mentor: Dr. Martin Tresguerres
Soluble adenylyl cyclase activity modulates hemoglobin deoxygenation rates in fish red blood cells

Helen Jannke - UC San Diego
Mentor: Dr. Richard Norris
A Paleoecological Record of Fish Production in the Aegean During the Rise of Early Mediterranean Civilizations

Ryan Myers - UC San Diego
Mentor: Dr. Martin Tresguerres
Unique strategies for life at hydrothermal vents in the giant tubeworm Riftia pachyptila

Christina Puzzanghera - UC San Diego
Mentor: Dr. Diana Rennison
Determining the role of predation in the evolution of sexual dimorphism in threespine stickleback

Panel 38: Viruses

Zoom Room: Sun God
Thursday 2:10PM-3:10PM
Moderator: Dr. Laure Campillo-Gimenez

Viviana Araceli Dominguez - UC San Diego
Mentor: Dr. Matthew Daugherty
An Evolutionary Perspective on Picornavirus Proteases and their Host Targets

Erin Rosales - UC San Diego
Mentor: Dr. Leonardo Nogueira
Effects of the lung treatment of SARS-CoV-2 spike proteins in mice on lung and diaphragm ACE2 expression and plasma Ang II levels

Sally Trinh - UC San Diego
Mentor: Dr. Georgia Robins Sadler
What Is Contributing to HPV Oral Cancer and What Can We Do About It

Lindsay Wong - UC San Diego
Mentor: Dr. Weg Ongkeko
Immune landscape of cancers caused by viral factors

Panel 39: Physical and Mental Health
Zoom Room: Wind Garden
Thursday 2:10PM-3:10PM
Moderator: Dr. Ivan Bassets

Aleigha Binda - San Diego State University
Mentor: Dr. Georgia Robins Sadler
Using Intervention Mapping to improve uptake of recommended breast, cervical, and colorectal cancer screening among patients living with serious mental illness in San Diego, California

Lauren Ibarra - UC San Diego
Mentor: Dr. Eric Hekler
Development of Digital Adherence Technology for Tuberculosis Treatment in Kampala, Uganda

Morgan Montoya - UC San Diego
Mentor: Dr. Jyoti Mishra
Investigating Cognitive Function in Individuals from Different Racial and Ethnic Backgrounds & its Interactions with Resilience

Joseph Morales - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Assessing Factors Associated with Trust in Physicians among Caregivers of Children with Newly-Diagnosed Cancer

Thursday: Afternoon Session III

Panel 40: RC Car and Autonomous Driving Technology
Zoom Room: Falling Star
Thursday 3:20PM-4:20PM
Moderator: Dr. Saharnaz Baghdadchi

Bao Hoang & James Li - UC San Diego
Mentor: Dr. Ramsin Khoshabeh
IOT communication API for PCB RC car

Zack Liu & Jason Morris - UC San Diego
Mentor: Dr. Ramsin Khoshabeh
Brushed DC Motor Driver Printed Circuit Board (PCB) & Battery Management System (BMS) For Autonomous Remote Control (RC) Car

Jason Pham - UC San Diego
Mentor: Dr. Truong Nguyen
Generating Depth Maps for Autonomous Driving Applications

Panel 41: Educational Technology
Zoom Room: Giraffe Catchers
Thursday 3:20PM-4:20PM
Moderator: Dr. Ferhat Ay

Jared Acord & Justin Sun - UC San Diego
Mentor: Dr. Curt Schurgers
Development of Educational Technologies for Flipped Classrooms

Ali Nekouei - UC San Diego
Mentor: Dr. Thomas Bussey
BioChemAR in the Classroom

Eman Sherif - UC San Diego
Mentor: Dr. Christine Alvarado
Exploring Equitable Pathways to Computer Science

Panel 42: Language/Linguistics
Zoom Room: READ/WRITE/THINK/DREAM
Thursday 3:20PM-4:20PM
Moderator:

Alan Guandique - CSU Fullerton & Richard Hurtado - CSU Northridge
Mentor: Dr. Victor Ferriera
Do people structure sentences and words using shared mechanisms?

Jasmin Hernandez Santacruz - UC San Diego
Mentor: Dr. Tamar Gollan
Cost-Benefit Analysis of Inhibition in Second-Language Learning

Jose Jimenez - UC San Diego
Mentor: Dr. Sarah Creel
The Effects of Native-Accents on Cross-Language Activation in Spanish-English Bilinguals

Jacquelyn Ortegon - San Diego Mesa College
Mentor: Maho Takahashi
"Only" vs "Exactly"

Panel 43: Robotic Systems Simulation
Zoom Room: Red Shoe
Thursday 3:20PM-4:20PM
Moderator: TBA

Angela Gao - UC Los Angeles
Mentor: Dr. Michael Tolley
Simulating Small Robotic Systems Driven by Rotary Pouch Motors

Sidney Huen - UC San Diego
Mentor: Dr. Michael Tolley
Simulation of a Soft Robot Walking Gait with Directionally Adhesive Suction Discs

Hannah Hui & Weifan Ou - UC San Diego
Mentor: Dr. Nikolay Atanasov
Autonomous Robot Exploration and Occupancy Mapping in a 3-D Python Simulation

Panel 44: Neuroscience II
Zoom Room: Snake Path
Thursday 3:20PM-4:20PM
Moderator: Dr. Alicia Avelar

Jojo Chen - UC San Diego
Mentor: Dr. Chengbiao Wu
Mechanisms of Cortical-Striatal Atrophy in Huntington Disease

Natalie Gevoglanian - CSU Northridge
Mentor: Dr. Lindsey Powell
Multichannel Response Patterns to Faces, Bodies, and Scenes in the Infant Brain

Can Liu - UC San Diego
Mentor: Dr. Douglas Nitz
Encoding of Task Phase Versus Environmental Location in Hippocampal CA1 Neurons During Search for Buried Rewards

Panel 45: The Science of Learning

Zoom Room: Sun God
Thursday 3:20PM-4:20PM
Moderator: Ruby Osoria

Jessica Pacheco - CSU Northridge
Mentor: Dr. Stanley Lo
Transfer student experiences and identity formation in STEM

Julie Salazar - CSU Northridge
Mentor: Dr. Melinda Owens
Co-Teaching vs. Single Teaching: Comparing Active Learning Practices within a Course

Gregory Stocker - UC San Diego
Mentor: Dr. Stanley Lo
Transitioning Sophomore Experiences and the Perceived Usefulness in Supporting their Academic, Social, Personal, and Professional Development

Panel 46: Ecology & Plant Biology

Zoom Room: Stonehenge
Thursday 3:20PM-4:20PM
Moderator: Dr Andreas Härer

Jose Calderon – CSU San Marcos
Mentor: Dr. Diego Sustaita
Comparison of grasping and biting forces among rodent species in the Suisun Marsh, California

Skylar Bird - UC San Diego
Mentor: Dr. Eric Schmelz
Maize terpene synthase 8 contributes to a complex blend of fungal-elicited antibiotics

Nicole Bisente - CSU Northridge
Mentor: Dr. Dimitri Deheyn
Is PLA bioplastic really biodegradable? Insights from bioreactor analyses in anaerobic and marine environments

Lauryn Gist-Reed & Morgan Sinkfield - Xavier University of Louisiana
Mentor: Dr. Julian Schroeder
Infrared Thermal Imaging Screen for Mutant Plants with an Impaired Response to Elevated CO_2

Panel 47: Linguistics and Engineering
Zoom Room: Wind Garden
Thursday 3:20PM-4:20PM
Moderator: TBA

Adam Kadwory - UC San Diego
Mentor: Dr. Vikash Gilja
Development of an automated recording and analysis pipeline for avian song

Unduwap Kandage Don - UC San Diego
Mentor: Dr. Vikash Gilja
Automatic Reporting on Song Data

Xavier Perez - UC San Diego
Mentor: Dr. Vikash Gilja
Low-Cost Home-Made Recording Chambers for Zebra Finch Birds

Vivian Chiong & Guanqing Li - UC San Diego
Mentor: Dr. Pamela Cosman
Real-time Detection of Interruptions and Conversational Engagement Cues

Friday: Morning Session I

Panel 48: Microbiomes
Zoom Room: ERC Room
Friday 9:00AM-10:00AM
Moderator: Dr. Jenna Christensen

Jaideep Chakladar - UC San Diego
Mentor: Dr. Jessica Wang-Rodriguez
Osteopontin (OPN) as a central regulator for e-cigarette and tobacco smoking-mediated cancer progression

Galilea Guerrero - UC Santa Cruz
Mentor: Dr. Rachel Dutton
Investigating Bacteriophage Identity and Function in Cheese Microbiomes

Maria Tiu - UC San Diego
Mentor: Dr. Amir Zarrinpar
Sex Specific Adaptations of E. coli Nissle in the Gut

Megan Tjuanta - UC San Diego
Mentors: Dr. Karsten Zengler & Dr. Lívia Zaramela
synDNA: A Standardization Approach for Metagenomics

Panel 49: Empowering Black Youth

Zoom Room: Marshall College
Friday 9:00AM-10:00AM
Moderator: Dr. Eréndira Rueda

Christopher Brown - Morehouse College
Mentor: Dr. Marisa Abrajano
Education's effect on Black youths political Behavior

James King - UC San Diego
Mentor: Dr. K. Wayne Yang
Math Education for Black Students Juxtaposed to the Social Movements of the Past

Dawnielle Mitchell - Spelman College
Mentor: Dr. Lane Kenworthy
To What Extent is the Mass Medias' Use of Negative Black Stereotypes Affecting Black Adolescents Perception of Self?

Panel 50: Art as Resistance

Zoom Room: Muir College
Friday 9:00AM-10:00AM
Moderator: Dino Dinco

Eliana Kontokanis - UC San Diego
Mentor: Dino Dinco
IN HER OWN IMAGE

Xelestial Moreno-Luz - UC San Diego
Mentor: Dr. Marian Wardwell
Transgender Movements of Color and Audio-Visual Culture: Insisting Till Our Last Breath

Lucia Nishizawa-Rodriguez - UC San Diego
Mentor: Dr. Carol Arcos Herrera
El performance, la mujer, el ser y la (r)evolución

David Sibrian - UC San Diego
Mentor: Dr. Carol Arcos Herrera
La disidencia homosexual en Desde Allá (2015) de Lorenzo Vigas: Un análisis de la sexualidad disidente venezolana y sudamericana

Panel 51: Engineering and Urban Planning

Zoom Room: Price Center Room
Friday 9:00AM-10:00AM
Moderator: Jacques Chirazi

Callie Suppa & Daniel Vazquez - UC San Diego
Mentor: Jacques Chirazi
Team Rush Hour

Charlie Tran - UC San Diego
Mentor: Jacques Chirazi
Municipal Microgrid Planning

Henry Helmuth - UC San Diego
Mentor: Richard Chavez
UCSD Active Commute Plan

Panel 52: Gene Expression

Zoom Room: Revelle College
Friday 9:00AM-10:00AM
Moderator: Dr. Natalie Kirkland

Maya Ambroziak - UC San Diego
Mentor: Dr. Mark Estelle
BTB/POZ-MATH Genes in Physcomitrium patens

Jacob Gill - UC San Diego
Mentor: Dr. Edwin Juárez
Demonstrating an Information-Theoretic Metric's Usefulness in Associating Gene Expression with Cellular Phenotypes

Kevin Mazo - UC San Diego
Mentor: Dr. Karl Wahlin
The role of miRNA in late morphogenesis of retinal organoids

Neil Shende - UC San Diego
Mentor: Dr. Weg Ongkeko
Characterization of Small Nucleolar RNA Dysregulation in Head and Neck Squamous Cell Carcinoma

Panel 53: Social & Self Perception

Zoom Room: Seventh College
Friday 9:00AM-10:00AM
Moderator: Corrine Zavala

Jazlyn Armendariz - CSU Northridge
Mentor: Dr. Lindsey Powell
Children's Social Preferences for Imitators of Goals and Means

Varvara Gulina - CSU Fullerton
Mentor: Dr. Lianne Urada
Victims who don't see themselves as victims: Analyzing women's perceptions of forced vs. voluntary sex trade in Russia

Samantha Pulido - University of California, Berkeley
Mentor: Dr. Angela Yu
Human Decision-Making in Social Scenarios

Nayeli Rincon - UC San Diego
Mentor: Dr. Pamela Smith
Exploring Pathways to Power for Individuals in Consensually Non-monogamous Relationships

Panel 54: Local and Transnational Politics

Zoom Room: Sixth College
Friday 9:00AM-10:00AM
Moderator: Julian Haddad

Enrique Arcilla - UC San Diego
Mentor: Dr. Isaac Martin
Agenda Control and Conflict Mitigation in General Plan Workshops

Nasir Bakare - Howard University
Mentor: Dr. Prashant Bharadwaj
Empirical research

Taryn Gill - Spelman College
Mentor: Dr. Tom Wong
Polling Location and the Politics of Voter Suppression in Fulton County, Georgia

Ethan Olson - UC San Diego
Mentor: Dr. Alexander Gershunov
Getting Real: Accounting for Domestic Factors in International Climate Agreements

Panel 55: Inflammation & Immune Response
Zoom Room: Warren College
Friday 9:00AM-10:00AM
Moderator: Dr. Roxana Coras

Noah Gaitan - UC San Diego
Mentor: Dr. Chris Tyler
Investigating the effects of integrin β7 blockade in an interleukin 10 (IL-10) deficient model of chronic colitis

Lee Diego Lacasa - UC San Diego
Mentor: Dr. Taylor Alan Doherty
The Effect of the STING Pathway on Innate Lymphoid Cell Changes During Type 2 Lung Inflammation

Dora Ogbonna - UC San Diego
Mentor: Dr. Nisarg Shah
Literature Review on Cytokine Release Syndrome in Autoimmune Diseases

Peter Pham - UC San Diego
Mentor: Dr. Maripat Corr
Cell Specific Type I Interferon Receptor Signaling is Critical for Arthritis Pain in Mice

Friday: Morning Session II

Panel 56: Molecular Genetics
Zoom Room: ERC College
Friday 10:10AM-11:10AM
Moderator: Dr. Jenna Christensen

Sharlene Diep - UC San Diego
Mentor: Dr. Kyle Gaulton
The Role of Hypoxia in Pancreatic Islet Regulation and Diabetes Risk

Brian Dinh - UC San Diego
Mentor: Dr. Peter Shaw
CFH and HTRA1 exhibit an antagonistic effect on inhibiting oxidized phospholipids uptake in human retinal pigment epithelial cells

Mariam El-karim - CSU Northridge
Mentor: Dr. Colleen McHugh
Identification of novel protein interaction partners of the MALAT1-associated cytoplasmic RNA

Nay Chi Naing - UC San Diego
Mentor: Dr. Pamela Mellon
In vitro regulation of the Kiss1 promoter by VAX1

Panel 57: Power Systems

Zoom Room: Marshall College
Friday 10:10AM-11:10AM
Moderator: Dr. Gaby Baylon

Qichun Gui - UC San Diego
Mentor: Dr. Chris Mi
Modeling of the power system of an all-electric passenger airplane

Greg Maki - UC San Diego
Mentor: Dr. Hanh-Phuc Le
Extremely High Voltage Power Converter for Soft Robots

Hong Wang - UC San Diego
Mentor: Dr. Chris Mi
Modeling of an extremely high power charging system for all electric airplanes

Panel 58: Cell Biology

Zoom Room: Muir College
Friday 10:10AM-11:10AM
Moderator: Dr. Satarupa Bhaduri

Hope Do - UC San Diego
Mentor: Dr. Karl Wahlin
Cell cycle regulation and miRNA function during early development of human stem cell-derived retinal organoids

Michael Fernandez - UC San Diego
Mentor: Dr. Karl Wahlin
Mapping developmental pathways in early ocular growth for stem cell derived retinal organoids

Asim Mohiuddin - UC San Diego
Mentor: Dr. Maripat Corr
Regulation of Bone Erosion in Arthritis

Joey Truong - UC San Diego
Mentor: Dr. Samara Reck-Peterson
Quantifying the Motile Properties of Dynein in the Presence of a Cargo Adaptor Complex

Panel 59: Innovative Engineering

Zoom Room: Price Center Room
Friday 10:10AM-11:10AM
Moderator: Jacques Chirazi

Persephonie Rodriguez, Prem Shelat, & Steven Swee - UC San Diego
Mentor: Jacques Chirazi
Novel Building Materials

Amer Tabban - UC San Diego
Mentor: Jacques Chirazi
Myze

Lindsey Young - UC San Diego
Mentor: Jacques Chirazi
The Gender Minorities in Engineering Initiative

Panel 60: Democratizing Higher Education

Zoom Room: Revelle College
Friday 10:10AM-11:10AM
Moderator: Dr. Natalie Kirkland

Shereen Lam - CSU Fullerton
Mentor: Dr. Stanley Lo
Using mathematical graph theory to analyze student discussions in small groups

Caleb Schimke - UC San Diego
Mentor: Dr. Stanley Lo
Assessment of the Validity and Reliability of Data Gathered by Undergraduate Students in Course-Based Undergraduate Research Experiences (CUREs)

Alina Shahin - CSU Northridge
Mentor: Dr. Melinda Owens
The Frequency and Type of Active Learning Techniques utilized by Professors changes within a Quarter, and the effects of Co-teaching on these Changes

Panel 61: Mental Disorders

Zoom Room: Seventh College
Friday 10:10AM-11:10AM
Moderator: Corrine Zavala

Angela Chapman - UC San Diego
Mentor: Dr. Neal Swerdlow
Feasibility of a Virtual Reality-Based Oddball Paradigm to Assess Auditory Information Processing in Schizophrenia Patients

Javier Contreras - CSU Bakersfield
Mentor: Dr. Lisa Eyler
Investigating the relationship between sleep and social interactions in adults with bipolar disorder

Marina Ramsey - UC San Diego
Mentor: Dr. Ellen Lee
Link Between Compassion and Health in People with Schizophrenia

Daniel Sandoval - UC San Diego
Mentor: Dr. Bonnie Kaiser
Depression: Psychopathology as Defined By Underrepresented Adolescents

Panel 62: Economic, Educational, and Political Impacts of COVID-19

Zoom Room: Sixth Collge
Friday 10:10AM-11:10AM
Moderator: Julian Haddad

Kailen Aldridge - Spelman College
Mentor: Dr. Thad Kousser
Voting During a Global Pandemic: What are factors that curve voter participation?

Mirelle Castaneda - UC San Diego
Mentor: Dr. Sherice Clarke
Impacts of COVID19 on education

Samuel Mayfield - UC San Diego
Mentor: Dr. Richard Carson
Implications of Temporal Misalignment of Reported COVID-19 Statistics for Forecasting the Pandemic's Progression

Annie Zhou - UC San Diego
Mentor: Dr. Pamela Ban
Media Bias and What it Reveals About Political Power during the COVID-19 Pandemic

Panel 63: Heart - Macro & Molecular
Zoom Room: Warren College
Friday 10:10AM-11:10AM
Moderator: Dr. Roxana Coras

Tingfei Hu - UC San Diego
Mentor: Dr. Darren Casteel
The Function of MYPT2, a Myosin Regulatory Subunit for Myosin Phosphatase in Cardiac Myocytes

Salma Michelle Parra Pulgarin - UC San Diego
Mentor: Dr. Hemal H. Patel
Caveolin-3 Modulation of Heart Function in Type 2 Diabetes

Alexandria Tso - UC San Diego
Mentor: Dr. Ju Chen
The Role of Neuronal Precursor Cell-expressed Developmentally Downregulated 4 (Nedd4) in Cardiac Development

Claire Zhang - UC San Diego
Mentor: Dr. Kevin King
Time-Resolved Single Cell Analysis of Neutrophil Diversity In Myocardial Infarction

Friday: Morning Session III

Panel 64: Engineering New Solutions
Zoom Room: Marshall College
Friday 11:20AM-12:20PM
Moderator: Dr. Gaby Baylon

Shivani Bhakta - UC San Diego
Mentor: Dr. Dinesh Bharadia
BLE Localization / COVID

Tanish Jain - UC San Diego
Mentor: Dr. Tara Javidi
UV-C Drone: Drone Localization / COVID

Tai Truong - UC San Diego
Mentor: Dr. Hanh-Phuc Le
Renewable Power Supply System for Remote Area

Panel 65: Empowering Latinx Students
Zoom Room: Muir College
Friday 11:20AM-12:20PM
Moderator: Dr. Frances Contreras

Daisy Gomez-Fuentes - CSU Fullerton
Mentor: Dr. Frances Contreras
Cruzando Puentes para Alcanzar el Sueño Americano

Stephanie Martinez - Southwestern College/UCLA
Mentor: Dr. Frances Contreras
Puente: Crossing the Bridge of Education

Mariaelena Montanez - Chaffey Community College
Mentor: Dr. Frances Contreras
"Once a Puentista, always a Puentista."

Erica Ruiz - Southwestern Community College
Mentor: Dr. Frances Contreras
Bridging Classrooms & Communities: An Examination of The PUENTE Project Throughout California's Community Colleges

Panel 66: Physics
Zoom Room: Price Center Room
Friday 11:20AM-12:20PM
Moderator: TBA

Julien Alfaro - CSU Stanislaus
Mentor: Dr. Monica Allen
Simulating the Quantum Hall Effect in a Microwave Impedance Microscopy (MIM) Model

Daria Bonds - CSU San Marcos
Mentor: Dr. Monica Allen
2D Heterostructures and Imaging

Aldair Bonilla - California State Polytechnic University, Pomona
Mentor: Dr. Tenio Popmintchev
Efficient Generation of High Harmonic X-rays for Ultrafast Coherent Diffractive Imaging Using UV Lasers

Cesar De La Torre Castaneda – CSU San Bernardino
Mentor: Dr. Tenio Popmintchev
Efficient Generation of High Harmonic X-ray Light Using UV Lasers

Panel 67: Biology - Structure & Function

Zoom Room: Revelle College
Friday 11:20AM-12:20PM
Moderator: Dr. Juliana Rangel

Kyra Hulse - UC San Diego
Mentor: Dr. Ferhat Ay
Improving Resolution of HiChIP data with a Generative Adversarial Network

Dominique Lie - UC San Diego
Mentor: Dr. Soumita Das
The interaction of enteric bacterial effectors with the host engulfment pathway regulates inflammatory responses

Gabriel Lopez - UC San Diego
Mentor: Dr. Lidija Vukovic
The H3-like region of SARS-CoV-2 protein E is acetylated by p300 HAT

Narinderbir Singh - UC San Diego
Mentor: Dr. Sonya Neal
Characterizing Dfm1's Features in ERAD Retrotranslocation of Integral Membrane Proteins

Panel 68: Cognitive Science and Psychology

Zoom Room: Seventh College
Friday 11:20AM-12:20PM
Moderator: Dr. Madison Pesowski

Livier Lopez Canela – CSU Northridge
Mentor: Dr. Drew Walker
Seductive details: How do they affect learning outcomes?

Josselyn Marroquin - CSU Fullerton
Mentor: Dr. John Wixted
Applying Basic Models to Eyewitness Identification

Donovan Tamkin - UC San Diego
Mentor: Dr. Michael McCullough
Measures of Morality

Justin Yang - UC San Diego
Mentor: Dr. Judith Fan
Communicating what we perceive and know about objects by drawing

Panel 69: Political Economies of Conflict

Zoom Room: Sixth College
Friday 11:20AM-12:20PM
Moderator: Julian Haddad

Francesca Bentley - Spelman College
Mentor: Dr. Erik Gartzke
The Morality of Nuclear Warfare: How Concern for Citizens Impacts Nuclear Weapons' Structure

Raed Good - UC San Diego
Mentor: Dr. Akos Rona-Tas
Predictive Policing: A Comparative Analysis of Four Countries

Gonzalo Rocha-Vazquez - Bakersfield College
Mentor: Dr. Erik Gartzke
Closing the Gap: The Influence of Conflict and Distance on Nuclear Platforms Development

Panel 70: Materials Science and Engineering

Zoom Room: Warren College
Friday 11:20AM-12:20PM
Moderator: Dr. Ramsin Khoshabeh

Tyler Chang - UC San Diego
Mentor: Dr. Dinesh Bharadia
Robotic SLAM Platform Development

Ameen Muhammad - Howard University
Mentor: Dr. Jinhye Bae
Solute Diffusion in Hydrogels

Mark Schara - Rice University
Mentor: Dr. Nicholas Boechler
Optimized Human Robot Interface for Wearable Technology

Soyoung Shin - UC San Diego
Mentor: Dr. Jinhye Bae
Diffusivity of water in homogeneous polyacrylamide (PAAm) hydrogels

Friday: Afternoon Session I

Panel 71: Biomimicry & Engineering
Zoom Room: Marshall College
Friday 1:00PM-2:00PM
Moderator: Dr. Molly Matty

Caín Alexander Elizarraras Galván - UC San Diego
Mentor: Dr. Dimitri Deheyn
Imaging of vine holding pads to find inspiration for mechanical interlocking adhesive device

Ruby Gamboa - UC San Diego
Mentor: Dr. Dimitri Deheyn
The Potential of Spectral Reflectance altering Thermal Properties of Bird Feathers

Rachel Luu - UC San Diego
Mentor: Dr. Marc Meyers
Bioinspired Horse Hoof Model

Matthew Moldthan – CSU Northridge
Mentor: Dr. Shaochen Chen
3D Bioprinting Approaches for Biomimetically-Patterned Tissue Constructs: A Comparative Overview

Panel 72: Health Concerns and Information Dissemination
Zoom Room: Muir College
Friday 1:00PM-2:00PM
Moderator: Dr. Andre Der-Avakian

Paola Cancino - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Improving Cancer Care with Better Diagnostic for Autism Spectrum Disorder

Ilene Cruz – CSU Northridge
Mentor: Dr. Terry Jernigan
Examining Race/Ethnicity as a Moderator on the Relationship Between Family Conflict and Adverse Children Experiences in Youth

Yang Lu - UC San Diego
Mentor: Dr. Susan Tapert
Adolescents' Perceptions of Substance Use Harms are Contingent on Mode of Administration

Michael Skipworth - University of San Diego
Mentor: Dr. Georgia Robins Sadler
Tobacco Marketing Evolution and Influence in African American Youth Smoking

Panel 73: Engineering San Diego II

Zoom Room: Price Center Room
Friday 1:00PM-2:00PM
Moderator: Jacques Chirazi

Tanvi Bajaj & Katherine Ngo - UC San Diego
Mentor: Jacques Chirazi
Municipal Microgrid Planning

Neve Foresti & Neha Sahota- UC San Diego
Mentor: Jacques Chirazi
Flybility — Improving Airport Accessibility at SAN

Panel 74: Challenging Healthcare Disparities

Zoom Room: Revelle College
Friday 1:00PM-2:00PM
Moderator: Dr. Yvonne Kwan

Nicolette Olivia Le - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Disparities in the Patient Pain Experience

Naomi Pineda - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Genetics may put Hispanic Americans at Higher Risk of Liver Cancer and Science may not be Able to Help due to Lack of Participation.

Jocelyn Quiroz - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Cancer risk among victims of human trafficking

David Everly - UC San Diego
Mentor: Dr. Jill Blumenthal
What constitutes a good vs a bad clinical program for transgender patients

Mariah Romero - UC San Diego
Mentor: Dr. Georgia Robins Sadler
Cervical Cancer Screening, Practices, and Barriers among the LGBTQ+ Community: A Literature Review

Panel 75: Physics and Electrical Engineering

Zoom Room: Seventh College
Friday 1:00PM-2:00PM
Moderator: Dr. William Gaieck

Katarina Brekalo - CSU Stanislaus
Mentor: Dr. Tenio Popmintchev
Efficient Generation of High Harmonic X-rays for Femtosecond-to-Attosecond Spectroscopies Using UV-VIS-IR Lasers

Jacob Buckman - UC San Diego
Mentor: Dr. Michael Simmonds
Impact of Helium Plasma on Plasma Facing Component of PISCES-RF Device

Justin Skaggs - UC San Diego
Mentor: Dr. David Fenning
Accelerating the Characterization of Perovskite Solar Cells Via Automated IV Testing and Efficiency Loss Analysis

Steven Tsan - UC San Diego
Mentor: Dr. Javier Duarte
Autoencoders for Anomaly Detection

Luis Velez Vera - San Diego State University
Mentor: Dr. Tenio Popmintchev
Efficient Generation of High Harmonic X-rays for Femtosecond-to-Attosecond Spectroscopies Using UV-VIS-IR Lasers

Panel 76: Astrophysics & Astronomy

Zoom Room: Sixth College
Friday 1:00PM-2:00PM
Moderator: Dr. Gaurav Mendiratta

Chelsea Adelman - California State Polytechnic University, Pomona
Mentor: Dr. Christopher Theissen
Low-Mass Stars and Their Very Low-Mass Companions

Aishwarya Balivada - San Francisco State University
Mentor: Dr. Carl Melis
Transiting Planet Sensitivity Around Early Type Stars

Loren Heins - Sonoma State University
Mentor: Dr. Carl Melis
LCO Monitoring of a Sun-like Star with a Transiting Dust Clump

Natalia Henriquez - UC San Diego
Mentor: Dr. Tongyan Lin
Using CMB measurements to gain more precise understanding of dark matter density and interactions.

Friday: Afternoon Session II

Panel 77: ECE IV
Zoom Room: Seventh College
Friday 2:10PM-3:10PM
Moderator: Dr. William Gaieck

Juan Alapizco Vega, Allan Ateek, & Gaopo Huang - UC San Diego
Mentor: Dr. Saharnaz Baghdadchi
Optical Waveguide-based Biosensor

Yuliang Cai - UC San Diego
Mentor: Dr. Truong Nguyen
Unity-based data collection for object detection in autonomous vehicles

Xiangjian Zeng - UC San Diego
Mentor: Dr. Imanuel Lerman
RLS Harmonic Powerline Noise Cancellation in Median Nerve Recording

Panel 78: Mathematics & Engineering
Zoom Room: Sixth College
Friday 2:10PM-3:10PM
Moderator: Dr. Gaurav Mendiratta

Marisol Gonzalez - UC San Diego
Mentor: Dr. Jonathan Novak
Compressed Sensing and its applications to Image Processing

David Hernandez - UC San Diego
Mentor: Dr. Daniel Kane
Queen Packing on an Infinite Chessboard

Maxwell Liu - UC Berkeley
Mentor: Dr. Yi-Zhuang You
A.I. Approximation in Statistical Mechanics

Anfeng Xu - UC San Diego
Mentor: Dr. Tara Javidi
Mathematical Underpinning of Information Acquisition Systems

Abstracts

Caesar Aceituno

Sociology: Social Inequalities, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Frances Contreras, Education Studies

Qualitative Study: Transfer Student's Transitional Experience Project

This research focuses on Latinx transfer student's experiences and how well they adapt to the university climate. Using Latinx Critical Race Theory (LatCrit) theory as an approach to understanding how Latino students used their culture and social awareness to navigate through their transition into their university. Identifying what resources and programs are being used to help with their transition is a key tool used to identify what leads to their educational, professional, and personal developments when adapting to the university. This information is gathered through interviews and scholarly articles that cover similar findings of transfer students. Also, through this research, we are gathering information that can highlight how Latino transfer students are neglected. Leading, to how students who have shortcomings in their goals, while they trying to adapt. This research will show how there are ways to navigate such systems and provide a service on how Latino students can successfully have positive experiences. Universities have a historical elitist culture that is not accessible to all students. In this research, I will highlight the gatekeeping that is used around these schools. This awareness is to help these students prepare themselves for the realities of university life.

Jared Acord

Electrical Engineering and Mathematics, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Curt Schurgers, Electrical and Computer Engineering (ECE)

Development of Educational Technologies for Flipped Classrooms

Lecture has traditionally been the main means of information transfer from the instructor to the student, leaving the burden of understanding on the student at a later time. However, by having students learn the material ahead of time, by video lectures prepared by the instructor, the instructor is free to lead a more collaborative, comprehension-oriented lecture, maximizing the efficacy and overall value of the class. But doing so requires an emphasis on student participation during class time. To promote this participation, we are developing an online student response system that integrates the popular iClicker system alongside a smartphone-accessible web application, while adding functionality that benefits both the student and the instructor. One such functionality is the incorporation of a real-time slide deck, to ensure students do not have premature access to slides, with an aim to encourage

participation and peer discussion during class. We are expecting to have a working prototype by the end of summer 2020, for classroom testing in the fall term of 2020, and usage in lower division ECE courses in subsequent terms.

Nicole Adamson

Marine Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Martin Tresguerres, Scripps Institution of Oceanography

Soluble adenylyl cyclase activity modulates hemoglobin deoxygenation rates in fish red blood cells

This study aims to investigate the role of soluble adenylyl cyclase (sAC) in fish red blood cells (RBCs). sAC is a widespread regulatory enzyme that is activated by HCO_3^-. Inside RBCs, HCO_3^- and H^+ are readily formed through the hydration of CO_2, a reaction catalyzed by another enzyme, carbonic anhydrase. Additionally, the O_2 affinity of hemoglobin (Hb) is influenced by the pH within the RBC. These factors point to a potentially new and largely uninvestigated relationship between sAC and Hb O_2 affinity. Specifically, this study analyzes the effect of sAC activity on the rate of Hb deoxygenation at different CO_2 tensions in white sea bass RBCs. The deoxygenation rate was measured spectrophotometrically when fully oxygenated RBCs were exposed to 0% O_2 conditions, simulating the deoxygenation of Hb at the blood capillaries. At each CO_2 level, trials were conducted with RBCs incubated with DMSO alone, or with one of two sAC inhibitors, KH7 or LRE1, dissolved in DMSO. Results indicate that at a typical resting arterial CO_2 level, inhibiting sAC decreases the rate of Hb deoxygenation. However, at higher CO_2 levels such as those found in venous blood of a resting fish or blood under respiratory acidosis conditions, sAC did not have a significant impact on the rate of Hb deoxygenation. This indicates that sAC is more active at lower CO_2 levels, and that it influences the intracellular RBC environment in a way that promotes oxygen offloading. This investigation is ongoing.

Chelsea Adelman

Physics, California State Polytechnic University, Pomona
STARS and CAMPARE
Mentored by Dr. Christopher Theissen, Astronomy, Astrophysics, and Space Sciences

Low-Mass Stars and Their Very Low-Mass Companions

Understanding the mechanics of stellar systems is imperative to comprehend how the constituents of the universe formed. Observations help inform and provide a basis for theoretical models, which then refine our understanding of stellar systems. However, theoretical models have difficulty recreating some observed system architectures. Our sample consists of low-mass stellar/sub-stellar wide binary

systems. The separations between the primary stars and their companions are anomalously wide, with separations > 100AU, and current theoretical models have difficulty keeping the multi-gigayear binary systems bound with such large separations, due to their low binding energies. One possible solution is to add a tertiary or higher-order component, which would increase the system mass, and therefore, increase the gravitational binding energy. Using medium-resolution spectroscopy from the Near Infrared Echellete Spectrometer (NIRES) instrument on the Keck 10-m telescope, we are analyzing new spectra of what have been previously determined to be common proper motion systems. In addition to the correct proper motion, these systems have the correct parallax to say they appear to be co-moving; while this gives us 2-D kinematic and 3-D spatial confidence, we are using radial velocities (RVs) to measure the third dimension for the kinematics of these systems. This will allow us to more confidently say these systems are gravitationally bound. We are also using these data to see if spectral binaries are present (blended light of closely bound systems), which would indicate the presence of triple or higher-order systems. This would help alleviate tension between theory and observations regarding these wide binaries.

Juan Alapizco Vega

Electrical and Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Saharnaz Baghdadchi, Electrical and Computer Engineering

Optical Waveguide-based Biosensor

Over the last decade, optical biosensors have found a spotlight in the biological and medical sciences. Optical Waveguide Interferometric Biosensors are one such device that has garnered interest for its sensitivity, simplicity, and efficiency. By applying the principles of waveguide propagation, Optical Waveguide Interferometric Biosensors allow for the detection of a wide range of biochemical interactions. The simplest of optical waveguides consists of a core material where propagating light is contained, using Total Internal Reflection (TIR), and a cladding material with a refractive index lower than that of the core. The refractive indices and the structure of waveguide characterize the propagation of the light in terms of the effective refractive index. The presence of biological substances at the surface of the cladding will result in a change in the refractive index of the cladding and consequently the effective index of the propagating mode. This is a consequence of the presence of the evanescent field in the cladding created from TIR at the interface of the core and cladding of a waveguide. Using a Mach-Zehnder Interferometer setup the shift in the effective refractive index of waveguide mode can be measured and the concentration or the presence of the indicator quantified, Using the optical simulation software, Lumerical, we have designed, simulated, and optimized an Optical Waveguide Interferometer Biosensor operating based on these principles.

Kailen Aldridge

Political Science, Spelman College
STARS
Mentored by Dr. Thad Kousser, Political Science

Voting During a Global Pandemic: What are factors that curve voter participation?

COVID-19 has hit America at a crucial time in its democracy. The presidential election is scheduled for November 2020, but with COVID-19 looming, a big question has arisen: How does a global pandemic affect voter turnout? Will people vote by mail, or in person amid the pandemic. I argue that age is negatively related to a voter preference for casting a vote by mail. Through factors of lack of trust and the pending question of suppression and fraud, on average, older voters will stick to their habit of voting in-person. This project uses national survey data collected in April and June 2020 by The New Electorate project. I will plot the correlation between age and the preference Americans have for voting by mail. If COVID-19 has been identified to affect who plans to vote in the November 2020 election, then age could possibly play a vital role in voter turnout by mail.The results I found while plotting is, I learned that age groups 55 and up, prefer to vote by mail, more than the younger generations. Factors allude to the heavy affects of COVID-19 on older generations. The logistic regression shows that age groups 55 and up preference to vote by mail is scientifically significant.

Julien Alfaro

Physics, CSU Stanislaus
STARS
Mentored by Dr. Monica Allen, Physics

Simulating the Quantum Hall Effect in a Microwave Impedance Microscopy (MIM) Model

The quantum Hall effect is a phenomenon in a 2D material under a strong magnetic field normal to the material and at a low temperature. The conductivity of the material will become quantized in integer multiples of $(e^2)/h$, and a current along the edge of the material will be produced due to the magnetic field. This project models this behavior using microwave impedance microscopy (MIM) in COMSOL simulation software by reproducing these edge currents. Microwaves are emitted from a probe tip at a distance from the sample shorter than the wavelength. The reflection coefficient of microwaves gives information on the impedance of the system. Exploration of the quantum edge states at the interface of superconductor and semiconductor can lead to the development of a topological quantum computer.

Luis Alvarez

Cognitive Behavioral Neuroscience, UC San Diego
UC Scholars
Mentored by Dr. Angela Yu, Cognitive Science

How Facial Features Influence Social Traits Judgments

"Don't judge a book by its cover" is a popular idiom used to warn people from making premature decisions. Against this common wisdom, a vast body of research shows people often engage in precipitate judgments about numerous subjects and circumstances. One of these lines of research, which has gathered considerable attention, is how facial features impact judgments about character traits. Study after study demonstrates people will promptly judge a stranger's demographic, emotional, and social characteristics, even if they only had a glimpse of the stranger's face. The present review will discuss the ongoing research of how facial features influence judgments about social traits; that is, attributes people have in relation to other people or to society at large. In order to provide a proper representation of the subject, the review will be divided into two sections. The first section will introduce the general findings, the debates in the field, and the implications these judgments bring to everyday decisions. The second section will make a detailed analysis of the different hypothesis- and data-driven methodologies that have been used to investigate the subject, highlighting their strengths, weaknesses, and significance for the field.

Maya Ambroziak

General Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Mark Estelle, Biology

BTB/POZ-MATH Genes in Physcomitrium patens

In recent years, RNA-sequence studies (RNAseq) have become more common due to their analytical and predictive power. Here, we use published RNAseq-based online tools to study the expression pattern of BTB/POZ-MATH (BPM) genes in the model bryophyte, Physcomitrium patens. The BPM genes are known to be involved in thermoregulation and drought tolerance pathways in vascular plants. If they have similar roles in a vascular plant and nonvascular plants, it is likely that the BPMs' functions are conserved across all plants. Also, recent data suggest that they play a role in regulating the signaling pathway of the phytohormone auxin. In this project, we use bioinformatics tools to study the expression patterns of the BPMs. Analysis of BPM expression was done with the website PEATmoss to understand the expression patterns of the BPM genes across different tissue types and experimental conditions. Also, we investigated the loss-of-function phenotypes in P. patens plants lacking all three PpBPMs. Using CRISPR/ Cas9, we knocked out BPM1, BPM2a, and BPM2b. Strangely, we detected large scale chromosomal rearrangements caused by

CRISPR/Cas9. A possible cause for these is the similarities between PpBPM sequences of all three BPMs. In two independent lines, we found the chromosomal region between PpBPM2a and 2b was completely removed. While these three mutants have unique phenotypes and are resistant to the effects of auxin, this may be due to unintentional deletion of open reading frames between the two PpBPMs. We describe these deleted genes, and how they may contribute to the observed phenotype. All of this work builds an important foundation to studying the BPM genes in P. patens and better understanding their role in the regulation of auxin signaling.

Justin Andal

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

Burrowing Owl Classifier

Behavioral ecologists rely on a variety of technologies to study animal population and their behaviors in order to help certain species. The burrowing owl population has been declining in the Southern California area and researchers are using camera trap images to develop science-based solutions to reverse this decline. Unfortunately, a significant amount of time is used to label and filter their data manually. With the use of machine learning techniques, we are developing a pipeline to automate the labeling, ultimately saving time for researchers. Our pipeline uses detection and classification to extract information from the images and label interesting events. This allows us to get to our ultimate goal of behavior classification. To design this pipeline, we integrated an open sourced software(Microsoft MegaDetector) with our pre-trained owl classifier model. With this pipeline researchers will be able to save time by filtering and classifying their data, bringing them closer to their goal of protecting these burrowing owls.

Lauren Apostol

Biochemistry/Chemistry, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Rutherford Ongkeko, Research

Dysbiosis of the oral microbiome affects head and neck tumor immunology

Head and neck squamous cell carcinoma (HNSCC) is currently the sixth most common cancer across the globe, with about 650,000 cases diagnosed annually and a 34-46% mortality rate. Past research on HNSCC focused on correlating genomic and transcriptomic elements to HNSCC carcinogenesis. However, recent developments have emphasized the potential of immune therapies, treatment modalities that target the immune system and that may be more effective in treating HNSCC patients who do not respond well to more traditional therapy. Despite growing interest in and purported significance of the tumor microbiome in the field of

oncology, little research has been done to correlate the oral microbiome to HNSCC prognosis. We aim to characterize the bacterial components of the oral microbiome and correlate bacterial abundance to immune dysregulation that may lead to poor HNSCC outcomes. RNA-sequencing data was downloaded from The Cancer Genome Atlas (TCGA) and the Pathoscope2 computational framework was used to quantify microbial reads. Contamination correction was performed to filter out microbial species that may be present as a result of the sequencing process. Microbial abundance data was grouped into cohorts corresponding to patient smoking and HPV status. We used the Kruskal-Wallis comparison to determine differentially abundant (DA) microbes between patient cohorts. DA microbes were determined to be clinically relevant if their abundance was correlated to clinical variables such as pathologic state, survival, and TNM staging. We will use computational analyses to correlate microbial abundance to dysregulation of immune and cancer-associated pathways and to specific metabolic pathways.

Enrique Arcilla

Urban Studies & Planning, UC San Diego
McNair Scholars Program
Mentored by Dr. Isaac Martin, Urban Studies & Planning

Agenda Control and Conflict Mitigation in General Plan Workshops

In California, a city's general plan is the definitive document guiding its growth for the next 20 to 25 years. Before writing a plan, cities sometimes hold public workshops, which are often advertised as opportunities for regular citizens to make their voices heard. However, cities and citizens do not always agree with each other, especially on divisive issues like density, new development, or neighborhood change. Using a grounded theory approach to documentary data from just under 100 cities in California, this article examines how cities exert their influence in public workshops: events framed as open-ended & collaborative, but haunted by the political conflict that often characterizes land use planning. This paper argues that cities advocate for their political goals by using an array of rhetorical strategies to define the bounds of acceptable speech inside of a given workshop.

Jazlyn Armendariz

Psychology, CSU Northridge
STARS
Mentored by Dr. Lindsey Powell, Psychology

Children's Social Preferences for Imitators of Goals and Means

Infants and children are able to identify differences between an imitator versus a non-imitator by observing their choices and actions. Previous research suggests that they prefer imitators over non-imitators and will behave preferentially towards them. However, there is limited research regarding if these preferences are due to imitators'

surface-level similarities to the models they are matching, or their alignment with the model's underlying goals. Participants will watch a series of counterbalanced videos in which two responding actors will match and mismatch the goals and body movements of a central character. The participants' preferences for actors who match body movements versus goals will be evaluated through a preference test after watching these videos. The preference test will consist of questions such as, "Who is nicer?" and;" "Who do you want to play with?" and will also include a social inference question and a manipulation check question. We hypothesize that infants and children will prefer a responder who imitates the model's goal over one who does not, regardless of whether the imitator matches the model's body movement. We also expect to see that children will say that the model will prefer the goal imitator.

Allan Ateek

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Saharnaz Baghdadchi, Electrical and Computer Engineering

Optical Waveguide-based Biosensor

Over the last decade, optical biosensors have found a spotlight in the biological and medical sciences. Optical Waveguide Interferometric Biosensors are one such device that has garnered interest for its sensitivity, simplicity, and efficiency. By applying the principles of waveguide propagation, Optical Waveguide Interferometric Biosensors allow for the detection of a wide range of biochemical interactions. The simplest of optical waveguides consists of a core material where propagating light is contained, using Total Internal Reflection (TIR), and a cladding material with a refractive index lower than that of the core. The refractive indices and the structure of waveguide characterize the propagation of the light in terms of the effective refractive index. The presence of biological substances at the surface of the cladding will result in a change in the refractive index of the cladding and consequently the effective index of the propagating mode. This is a consequence of the presence of the evanescent field in the cladding created from TIR at the interface of the core and cladding of a waveguide. Using a Mach-Zehnder Interferometer setup the shift in the effective refractive index of waveguide mode can be measured and the concentration or the presence of the indicator quantified, Using the optical simulation software, Lumerical, we have designed, simulated, and optimized an Optical Waveguide Interferometer Biosensor operating based on these principles.

Alberto Avalos

Nanoengineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Ryan Kastner, Computer Science and Engineering

Fish Sense

Various organizations monitor fish species to keep track of their population growth and general health, particularly for endangered species. However, this is typically done through the "capture and release" method which can be invasive, and even harmful, to the fish being monitored. We are developing a device that monitors fish from a distance and constructs 3D models to catalog demographics, all without needing to capture the fish. Previous underwater attempts have seen the use of an infrared light (IR) 3D camera to scan for depth information, however, this method has been very difficult to execute because IR stereo scanning is very noisy and it becomes attenuated underwater. To combat this, we are experimenting with the Intel RealSense depth cameras. This includes comparing a stereo IR camera which emits two rays of light and calculates the depth from the difference between them and a light detecting and ranging (LiDAR) which emits one ray of light and calculates the depth based on the time it takes to return.

Natalia Avina-Ochoa

Molecular and cell biology, UC San Diego
Genentech Scholars Program
Mentored by Dr. Susan Kaech & Dr. Steven Zhao, Biological Sciences

T cell gene expression in Pancreatic ductal adenocarcinoma

The goal of cancer immunotherapy is to invigorate immune cells within tumors to eliminate cancer cells. However, it is now appreciated that cancer cells acquire multiple mechanisms to avoid or suppress immune responses. One such mechanism may be through metabolism. Cancer cells rewire their metabolism by increasing nutrient demand and changing nutrient usage to proliferate. This establishes a unique metabolic environment within the tumor that is different from healthy tissue. Immune cells, such as T cells, also modify their metabolism upon activation by antigens. Yet how immune cells interact with and respond to the unique metabolic environment of a tumor remains largely unknown. Therefore, the primary goal of our study will be to characterize the metabolic features of immune cells in the context of The goal of cancer immunotherapy is to invigorate immune cells within tumors to eliminate cancer cells. However, it is now appreciated that cancer cells acquire multiple mechanisms to avoid or suppress immune responses. One such mechanism may be through metabolism. Cancer cells rewire their metabolism by increasing nutrient demand and changing nutrient usage to proliferate. This establishes a unique metabolic environment within the tumor that is different from healthy tissue. Immune cells, such as T cells, also modify their metabolism upon activation by

antigens. Yet how immune cells interact with and respond to the unique metabolic environment of a tumor remains largely unknown. Therefore, the primary goal of our study will be to characterize the metabolic features of immune cells in the context of pancreatic ductal adenocarcinoma (PDAC).

Jacob Ayers

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

Acoustic Species Identification

As ecosystems decay around the world, a demand for large-scale monitoring of anthropogenic impacts on natural landscapes has become clear and present. This demand has led many organizations to deploy low-cost passive-acoustic-monitoring (PAM) systems that record soundscapes over long periods of time. The benefit of producing information-rich audio on a large scale begets a substantial challenge of the PAM field: minimizing the labor of region-specific domain experts listening to intimidatingly long amounts of unlabeled audio. In collaboration with the San Diego Zoo's Population Sustainability researchers; we are working to address this problem with over fifteen-thousand hours of audio they collected from the Madre De Dios region of the Peruvian Amazon. The ultimate goal of this collaboration is to leverage machine learning and digital signal processing to build an infrastructure to automatically identify species vocalizations from various regions around the world. Along that path, we are currently developing and vetting techniques to narrow down the scope of audio clips to prioritize. Using signal to noise ratios and power spectral density values we have detected faulty recordings, rain, and motor vehicle activity. Binary classification techniques have enabled us to isolate a subset of bird vocalizations. Furthermore, we are vetting unsupervised clustering methods in their ability to correlate species calls to individual clusters.

Tanvi Bajaj

International Business, UC San Diego
Converge Incubator
Mentored by Jacques Chirazi, Office of Innovation and Commercialization -
Basement / Blackstone Launchpad Program

Municipal Microgrid Planning

Cities are at the forefront of the national conversation about climate change. Increasingly, elected officials and city residents are finding ways to deploy more clean energy and reduce their carbon footprints. Our team was tasked by the city of San Diego to establish a methodology for identifying ideal municipal microgrid locations. The City is interested in installing renewable microgrids (both campus-style and single building) to increase resiliency in response to climate-driven energy

disruptions. Our solution was a detailed ranking system that took into account of several criteria including: cost benefits, GHG (greenhouse gases) emissions, resilience value, and community impact.

Nasir Bakare

History and Political Science, Howard University
STARS
Mentored by Dr. Prashant Bharadwaj, Economics

Empirical research

This study focuses on and analyzes Supreme Court cases and how empirical research/social science research is used in cases of discrimination. During oral litigation, evidence is presented in a myriad of ways and empirical research is one of the ways in which evidence is presented in order to strengthen arguments. Empirical research is defined as research done by way of observation and the collection of scientific data through scientific methods. This type of evidence is often used during litigation to support arguments and provide real world examples of hypotheticals. This evidence is also used to reveal and support relationships between variables that might not have been previously acknowledged. These relationships could include variables such as racial discrimination and incarceration rates or Gay marriage and a positive child support system. It is essential to understand the way empirical research is evaluated by the Supreme Court because of the importance of social science research to society in the advancement of human knowledge. Through the use of empirical research America acknowledged the existence of segregation being a violation of the 14th Amendment as evidence was presented that showed that discrimination, prejudice, and segregation created a feeling of inferiority among Black children which damaged their self-esteem. In the wake of the current climate of the world where systematic racism is so preeminent, it is important now more than ever to understand how social science research is used to advance human knowledge on the topic and importantly how this knowledge is received by the highest court of the United States. My study reviews the oral transcripts of multiple Supreme Court cases to answer the primary question, does the Supreme Court respond to empiric

Aishwarya Balivada

Astrophysics, San Francisco State University
STARS
Mentored by Dr. Carl Melis, Astronomy

Transiting Planet Sensitivity Around Early Type Stars

Planetary systems are ubiquitous in the Galaxy and the most prolific method of identifying them to date has been through detecting exoplanet transits across the face of their host star. Exoplanet populations for early-type stars (stars a few times the mass of the Sun) are not as well-characterized as those around Sun-like or less

massive stars. Through this project, we seek to determine if we are capable of detecting for early-type stars the same kinds of planetary systems seen to date around Sun-like stars. With space-based photometric monitoring data of early-type stars from the TESS and Kepler satellites, we conduct planet injection sensitivity tests -- model planet transits are inserted into the data and we see if we can recover them. Results from this work will tell us if early-type stars host different planet populations or if detection sensitivity prevents us from finding Sun-like star planetary systems.

Michael Baluja

Cognitive Science, UC San Diego
California Louis Stokes Alliance for Minority Participation (CAMP) in Science, Engineering and Math
Mentored by Dr. Paul Siegel, Electrical and Computer Engineering

Error Correction for Natural Language Processing Networks

Machine learning is being rapidly introduced into countless applications. An important area of concern for these machine learning models is achieving and maintaining robust performance. One aspect of ensuring robustness involves the protection of the network weights from errors that can occur when storing the weights in standard imperfect hardware devices. Research has been conducted on application of noise addition and Deep Reinforcement Learning-based selective protection for the weights of neural networks used for image classification tasks. These protection techniques utilize two different methods of weight protection, and also consider both an ideal error correcting code as well as a standard BCH error correcting code. We extend those results for text classification tasks through the state-of-the-art Very Deep Convolutional Neural Network Architecture. Experimental results have shown that while the larger fully-connected layers in the latter part of the network are indicative of overall performance, the smaller convolutional layers occurring earlier in the network can be given more protection in order to see the best performance results. Current work is being done to evaluate performance-to-redundancy trade-offs in both 32-bit floating-point weight representations and 8-bit fixed-point representations, as well as to further analyze the importance of protection for each layer of the network in consideration.

Francesca Bentley

Political Science, Spelman College
STARS
Mentored by Dr. Erik Gartzke, Political Science

The Morality of Nuclear Warfare: How Concern for Citizens Impacts Nuclear Weapons' Structure

States' nuclear force structures are determined by several prominent factors – from fear of adversaries' attainment of successful nuclear programs to a need to establish a powerful presence and footing in a region. As a great majority of the factors behind states' decisions on nuclear proliferation and structure focus on external considerations, the literature has frequently overlooked significant domestic elements. This investigation attempts to fill this lacuna by posing the question – how does a state's level of care for its citizens interact with a country's nuclear force structure selections? For the purposes of this examination, nuclear states whose primary adversary is a neighboring state with whom they share a border or is located within the established nuclear fallout zone will be included – as such states' citizens face greater potential health consequences following a nuclear deployment due to their proximity to the radioactive fallout. This investigation stipulates that states which provide greater care for their citizens will prioritize their populace's health throughout the nuclear weapons creation process and ergo support missiles with low yields. In order to measure the level of care a state possesses for its citizens the Human Development Index (HDI) will be employed, while the assigned yield - or amount of energy which will be released upon detonation - to states' short and medium-range missiles will act as the measure for potential nuclear force structure influence. Following a regression analysis, an inverse relationship between yield and HDI was uncovered in which high HDI scores lead to higher yields.

Arthor Bernal

Mechanical Engineering, UC Riverside
STARS
Mentored by Dr. Amir Zarrinpar, Department of Medicine, Division of Gastroenterology

Comprehensive Analysis of Open Source Software for Mouse Behavioral Phenotyping

Behavioral phenotyping in mice is a common way to assess neurocognitive abnormalities in response to experimental interventions in the study of health and disease. Human assessment of video recordings of behavioral tests can be time consuming and unreliable with high interindividual and inter-institution variability that would require hours of training to make reproducible. Thus there is a need for automated, reliable scoring tools. Software suites frequently used by behavioral experts, including Ethovision XT, can be cost prohibitive. We hypothesize that open

source software can reliably reproduce findings across multiple study paradigms, indicating value in application across mouse models and institutions. The aim of this study was to evaluate several open source video processing programs (e.g. ezTrack, Tracktor) to assess the best one for its ease of use and reproducibility of data. Of the programs tested, eZtrack was selected for further analysis in the present study. Behavioral metrics that were evaluated include attention, grooming, rearing, locomotor behavior, and anxiety-like behavior. Wild type C57Bl/6 specific-pathogen free mice from various experimental groups were evaluated. We identified several strengths and weaknesses associated with each method assessed and proposed a suggestion for researchers aiming to select an ideal scoring program. Ultimately, we select an open source program that best meets our criteria for ease of use and is capable of reproducing previous findings generated by hand scoring and Ethovision XT software for several neurocognitive tests of short term memory and anxiety-like behavior in mice.

Shivani Bhakta

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Dinesh Bharadia, ECE

BLE Localization / COVID

BluBLE is a contact tracing app which aims to protect the users and provide them with personalized risk scores for covid-19 based on their physical interactions. The app uses wireless signals like those from Bluetooth and Wifi to localize the people's position and track their interaction with the other people in the environment. One of the important features BluBLE proposes is notifying users about possible hotspots in the environment, i.e, the most visited places or spots in a room like in a supermarket. Our current work includes using Bluetooth Low Energy beaconing devices to determine these hotspots in the environment. This algorithm is fully based on RSSI (Received Signal Strength Indicator), collected from various Beacons in the environment, that are received on the user's phone. Our future work will incorporate filtering and estimation to get Angle of Arrival (AoA) of these signals from different beaconing devices (APs) to measure more precise location of the devices in an indoor environment.

Aleigha Binda

Psychology, San Diego State University
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

Using Intervention Mapping to improve uptake of recommended breast, cervical, and colorectal cancer screening among patients living with serious mental illness in San Diego, California

Individuals living with serious mental illness (SMI) have a higher risk of dying from cancer and are less likely to engage in recommended cancer screening. SMI is a mental, behavioral, or emotional disorder that hinders basic daily living skills. This study examined the perspective of individuals living with SMI and their mental health care providers regarding the design of a cancer screening promotion intervention. The study design followed Intervention Mapping guided by the Social Ecological Model (SEM). Purposeful sampling yielded 25 (mean age: 71.4 years; 60% female) individuals with SMI and 15 stakeholders (mean age: 45.3 years; 80% female) who provide mental health services to people living with SMI in San Diego. The participants took part in semi-structured in-depth interviews to assess the needs and assets of a potential intervention to facilitate adherence to recommended breast, cervical, and colorectal cancer screening. Content analysis and the constant comparison method were used to analyze interview data. Participants suggested interventions that educate patients about the importance of screening and screening procedures, provide a reassuring and comforting environment, and provide assistance for exacerbation of mental health symptoms during screening. These study findings provide valuable guidance for developing interventions that could potentially improve uptake of breast, cervical, and colorectal cancer screening among individuals living with SMI.

Skylar Bird

Biochemistry and Cellular Biology, UC San Diego
Genentech Scholars Program
Mentored by Dr. Eric Schmelz, Developmental and Cellular Biology

Maize terpene synthase 8 contributes to a complex blend of fungal-elicited antibiotics

Plants possess elaborate innate immune responses to counteract biotic stress. Following fungal elicitation, maize (Zea mays) accumulates multiple transcripts encoding terpene synthase (TPS) and cytochrome P450 monooxygenase (CYP) enzymes responsible for antibiotic biosynthesis. Despite significant advances, the number of pathways contributing to maize terpenoid antibiotics remains unknown. The B73 x M162W recombinant inbred line (RIL) population and Goodman diversity panel were utilized in forward genetic analyses to link gene candidates to metabolites present in fungal-elicited tissues. Five oxygenated sesquiterpenoids were statistically associated with chromosome 1 spanning ZmTPS31 and ZmTPS8. Heterologous expression of ZmTPS31 in Nicotiana benthamiana resulted in geraniol production, while ZmTPS8 yielded α-copaene, d-cadinene and four sesquiterpene alcohols (epicubebol, cubebol, copanol and copaborneol) matching the newly detected maize analytes. Mapping results further supported linkage of α-copaenoic acid to ZmTPS8 despite the product requiring additional pathway enzymes. Further expression studies of ZmTPS8 with a promiscuous CYP450 (ZmCYP71Z19) were sufficient to result in α-copaenoic acid. Ongoing in vitro antifungal assays with cubebol seek to determine the additive role for ZmTPS8 in maize antifungal defense. Our data supports the hypothesis that ZmTPS8 contributes to the production of antibiotics through complex nteractive pathways.

Nicole Bisente

Ecology, CSU Northridge
STARS
Mentored by Dr. Dimitri Deheyn, Marine Biology Research

Is PLA bioplastic really biodegradable? Insights from bioreactor analyses in anaerobic and marine environments

Polylactic Acid (PLA) is an increasingly popular bioplastic made from plant starches that is expected to be able to decompose faster in organic environments than standard plastics. However, experience has shown that PLA has still been unable to mineralize (fully degrade into its simplest molecules) in landfills, industrial composting, and the marine environment, which has led to ecosystem devastation. Anaerobic digestion has been shown to be a good candidate for successful bioplastic degradation. Therefore, this study compiles the literature investigating PLA degradation in anaerobic environments, proposes the best conditions to degrade the biopolymer PLA in the laboratory, and analyzes its mineralization potential in realistic conditions that can be reproducible in larger facilities. Biopolymer degradation is a relatively new field of study and therefore little is known on the exact mechanisms needed to efficiently degrade it in realistic environments. This project attempted to fill this gap, and although more research needs to be done in this field, we hope that our research will bring attention to the importance of sustainability and the potential of recyclable techniques (whether land-based or marine-based) to have access to fully biodegradable materials.

Pio Blanco Campos

Bioengineering, UC San Diego
California Louis Stokes Alliance for Minority Participation (CAMP) in Science, Engineering and Math
Mentored by Dr. Pedro Cabrales, Bioengineering

Effects of Polymerized Hemoglobin on subjects with pre-existing conditions.

Hemoglobin (Hb)-based oxygen (O_2) carriers (HBOCs) are one of the promising therapies that have been developed as an alternative for Red Blood Cells (RBCs) for use in transfusion. Multiple studies on HBOCs have demonstrated their advantages over RBCs and revealed side effects of their use. The study of the side effects of the first generations of HBOC's have revealed conditions such as: Nitric Oxide (NO) scavenging leading to vasoconstriction and hypertension, oxidative stress, liver damage, kidney damage, and systemic inflammation. In reducing the severity of these effect, a new generation of HBOC has been created and is under testing. A study that assesses the severity of these side effects on subjects with preexisting conditions has not been conducted. Thus, the goal of this study is to understand how subjects already under the stress of a preexisting condition would respond to the transfusion of large-MW Polymerized human Hb (LPolyhHb). A Guinea pig model will

be used because of their inability to produce vitamin C, which makes them more susceptible to oxidative stress, and their predisposition to attaining metabolic disease, the preexisting condition that will be studied. My contribution to this project will be assisting in the editing and redaction of the paper that will be published. Task such as the writing process, literature search, and some of the interpretation of results are what I will help with. The objective set for me is to gain a deeper understanding of the writing process, the analysis of results, and the drawing of conjectures.

Ana Boisvert

Cognitive Science, UC San Diego
Mentored by Dr. Sara Browne, Infectious Diseases

A Rapid Review of Methamphetamine Use Disorder Treatment and Adherence to Antiretroviral Medication in HIV+ Population

Comorbidities are common in people living with HIV infection (PLWH), and include methamphetamine use disorder (MUD). PLWH, known to have a high incidence of mental illness, child and adulthood trauma and neuropathic pain disorders, may be uniquely vulnerable to methamphetamine use for self-medication of both painful physical and emotional symptoms. MUD may adversely affect the HIV treatment process, including adherence to treatment recommendations, most notably adherence to anti-retroviral therapy (ART) . Our Rapid Review will investigate pharmaceutical treatments for MUD in PLWH, alone and in combination with psychosocial interventions, along with the impact of such interventions on post-acute withdrawal syndrome and long term abstinence . We will also include examination of additional factors including adherence to (ART), implications of gender, and polypharmacy. With the execution of the search strategy developed by our librarian to create a reflection of the current body of research in this field, we have begun the process of screening articles methodically to reduce bias. As we move forward, it is clear that there are only a handful of studies that intersect MUD treatment with PLWH, further demonstrating need for this research. This review will allow us to increase our understanding of associations between currently available MUD treatment, post-withdrawal syndrome and abstinence in PLWH. In addition, it will identify whether current treatments cause a change in level of adherence to ART and continuity of care amongst PLWH. Our findings may identify gaps in currently available treatments, or support tailored treatment for PLWH with MUD.

Daria Bonds

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

2D Heterostructures and Imaging

We are employing recently developed microwave impedance microscopy and electronic device measurements in our study of fundamental properties of 2D heterostructures. Our use of the microwave impedance microscope (MIM) focuses on locally mapping sample conductivity, permittivity, and current density. For example, twisted bilayer graphene exhibits unusual superconducting phases at twist angles near 1.1 degrees. Single layer tungsten ditelluride (WTe2) has unusual Superconductivity and a quantum spin hall insulating phase below 100K. I have been utilizing TurboCAD software and developing written procedures for device designs as well as running MIM microscopy simulations with COMSOL software. We aim to find how different interactions amongst structures, the wave behavior of electrons, and the topology of materials affect a system's properties. Understanding more about twisted bilayer graphene could provide insight into unconventional superconductors. Observing and manipulating edge currents in WTe2 could have applications in quantum information processing.

Aldair Bonilla

Physics, California State Polytechnic University, Pomona
STARS
Mentored by Dr. Tenio Popmintchev, Physics

Efficient Generation of High Harmonic X-rays for Ultrafast Coherent Diffractive Imaging Using UV Lasers

Aldair Bonila (California State Polytechnic University, Pomona), Cesar De La Torre Castaneda (CSU San Bernardino) Katarina Brekalo (CSU Stanislaus), Luis Velez Vera (San Diego State University), Meghan Shen (UC San Diego), Yingying Cui (UC San Diego), Siyang Wang (UC San Diego), Dimitar Popmintchev (UC San Diego), Tenio Popmintchev (UC San Diego/Photonics Institute, Vienna)

When an electron is accelerated nonlinearly, it releases a photon with a shorter wavelength related to the energy of the electron. One way to accelerate an electron is to focus a laser beam into a vacuum chamber filled with a desired gas. The laser beam would give the electrons enough energy to escape the Coulomb potential of the atom and then accelerate to recombine while emitting a high energy photon. This project's objective is to produce bright coherent X-ray photons using ultraviolet lasers focused into a noble gas of our choice. By composing simulations in MATLAB, we can predict theoretically the ionization rates of the preferred gas as a result of manipulating different parameters of a Gaussian laser beam. Finding the right

parameters allows us to go onto SolidWorks and design in 3D the apparatus needed in the lab. Once the experimental setup is constructed, the performed simulations will be used as a starting point of experimentation in the lab. The produced coherent X-rays will be used for Coherent Diffractive X-ray imaging to create very high resolution images of near one light wavelength.

Katarina Brekalo

Physics, CSU Stanislaus
STARS
Mentored by Dr. Tenio Popmintchev, Physics Department

Efficient Generation of High Harmonic X-rays for Femtosecond-to-Attosecond Spectroscopies Using UV-VIS-IR Lasers

Katarina Brekalo (CSU Stanislaus), Aldair Bonila (California State Polytechnic University, Pomona), Cesar De La Torre Castaneda (CSU San Bernardino), Luis Velez Vera (San Diego State University), Meghan Shen (UC San Diego), Yingying Cui (UC San Diego), Siyang Wang (UC San Diego), Dimitar Popmintchev (UC San Diego), Tenio Popmintchev (UC San Diego/Photonics Institute, Vienna)

Coherent X-ray pulses can be generated by an intense infrared laser beam directed into a chamber of gas. When the infrared laser intensity is high enough, it is able to extract an electron from the atom through tunnel ionization. The electron is then accelerated and due to the oscillatory behavior of the laser field, the electron is redirected back and collides with the atom. This recollision transforms the kinetic energy acquired and releases it in the form of high-order harmonic light which has laser-like properties. The goal of this project is to investigate theoretically the ionization rates of noble gases that will achieve efficient high harmonic generation by using simulation codes in MATLAB. This will ensure phase-matching techniques are properly implemented. The wavelengths of the resulting X-ray light will be measured experimentally using a spectrometer which will be designed in ZEMAX ray-tracing software. Once desired ionization rates are met, the resulting X-ray pulses will be used for Coherent Diffractive X-ray imaging to reach atomic spatial resolution and attosecond-to-femtosecond temporal resolution.

Christopher Brown

Political science, Morehouse College
STARS
Mentored by Dr. Marisa Abrajano, Political Science

Education's effect on Black youths political Behavior

Research question: Does the lack of educational opportunities for black youth education affect their political behavior? Does educational advancement change

amongst black youth help to explain their political behavior? How does education relate to black youth's political behavior? Does education open the door for them to become more involved in political activities? I will be examining the relationship between educational advancement and political involvement amongst black youth using the Genforward dataset from the University of Chicago. There have not been enough policies in place that help black youth get the education that they need which, in turn, should reduce inequalities in political participation. The existing literature indicates that when people have an advanced education they are more likely to contact public officials and tend to be more interested in politics. I am trying to identify the link between the two because there can be some bias when interviewing Black youth since the racial background can also be an effect. I hope to be able to understand what resources black youth need to open up opportunities for them so they can be more politically active. Looking at my finding I was able to see that college student that has some college do not trust their government and in return may get into more political activities because the skills they have now may influence to talk to officials to make a change.

Jacob Buckman

Mechanical Engineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Michael Simmonds, Center for Energy Research

Impact of Helium Plasma on Plasma Facing Component of PISCES-RF Device

PISCES-RF, formerly known as the Controlled Shear Decorrelation eXperiment (CSDX), is a linear plasma device capable of producing dense plasmas meant to study PMI (Plasma Material Interactions). The machine has been upgraded with a novel water cooled ceramic window to create plasma using Radio Frequency (RF) sources up to 20kW. The increased power allows gases such as hydrogen, deuterium and helium to reach high enough densities to study fusion relevant PMI. However, experimentation with the device has revealed through heat flux mapping that the plasma does not uniformly affect the plasma source ceramic window. This phenomenon may result in the non-uniform expansion of the ceramic window that could cause stress that leads to mechanical failure. The continued study and analysis of why this occurs is critical to the viability of prolonged operation of the device without damage. Study of Helium plasmas' effect on the ceramic source will also yield useful data for the next generation linear plasma devices capable of sustaining plasma at much higher RF powers such as the Materials Plasma Exposure eXperiment (MPEX) being developed at Oak Ridge National Laboratory (ORNL) which will be capable of producing 200 kW of RF power.

Richard Burnett

Microbiology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

Genetic Testing Disparities and Cancer Disparities

The discovery of next-gen sequencing technologies has made genetic counseling an essential tool for preventative medicine. While in 2010 it would cost an individual $50,000 to sequence their genome with Illumina technologies, currently, a whole genome can be sequenced for under $1,000 and can be covered by most insurances if referred by a doctor. Are genetic testing disparities contributing to cancer ethnic disparities? If so, why? A literature review was conducted using databases PubMed and CINAHL. This diagnostic tool is indispensable in identifying high-risk individuals. Genetic testing allows for preventative measures to be used to greatly improve cancer outcomes and improves incidence rates. For example, individuals found to be carriers of BRCA1 or 2 were more likely to undergo surgical procedures that greatly reduced their risk of developing ovarian and breast cancer. This incidence improvement is directly attributed to the uptake of genetic testing and counseling. However, the literature review found that ethnic minorities, and even those with a family history of cancer were less likely to use genetic testing and counseling than their white counterparts. Low awareness and knowledge of genetic testing and counseling played a role in determining uptake among ethnic minority groups, including African Americans, Asian Americans, and Hispanics. Ultimately, lower rates of genetic testing and counseling uptake in racial minorities contribute to cancer disparities.

Sierra Byrne

Ocean and Atmospheric Sciences, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Anela Choy, Integrative Oceanography Division at SIO

Quantifying and categorizing macroplastic consumption by longnose lancetfish (Alepisaurus ferox) in the central North Pacific Subtropical Gyre

Studies show that the North Pacific Subtropical Gyre (NPSG) contains plastic debris varying in shape and sizes, weighing up to 96,400 tons at the sea surface alone. Previous work is dominated by plastic abundance quantified from the surface ocean, leaving the largest habitat on earth, the midwater, greatly understudied. Sources of midwater ocean plastics include transport of surface plastics to deeper waters via physical and biological methods such as wind-driven mixing, downwelling of water masses, or biofouling, which can result in ingestion by midwater species. We investigate plastic consumption in longnose lancetfish (Alepisaurus ferox), a deep-dwelling species inhabiting surface waters to as deep as ~2km. This work provides insight into the plastic available for consumption at depth. A. ferox is an opportunistic

predator reported to ingest large plastics and marine debris and is distributed throughout the central North Pacific. Prey and plastics ingested by lancetfish are often not well digested, enabling visual identification of stomach contents. As part of an ongoing project, I use an existing diet and plastics dataset from A. ferox specimens collected in the central NPSG. Plastics from the stomachs were visually identified and characteristic information was recorded. I will quantify the amount of plastics found per stomach, explore if fibers are more common than fragmented pieces, and see if there is a preferential color of debris consumed by this predator. Further work will correlate physical measurements of plastics found (i.e. maximum length, mass) with fish capture location to examine spatial trends and links to oceanographic conditions.

Yuliang Cai

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Truong Nguyen, ECE

Unity-based data collection for object detection in autonomous vehicles

While training object detection neural networks for autonomous vehicles, the data collection causes hours and hours, and to collect comprehensive data with different weather conditions, such a collection almost takes years. Instead, we are approaching another technique to collect data: in a virtual environment through Unity, which is a powerful 3D game engine. To achieve this goal, I developed a realistic city testbed, which mimics the real world traffic, to apply data-gathering and generating data, then test the performance of object detection on YOLOv3, which is a state-of-the-art and real time object detection system based on darknet, with my dataset. I am working on generating different dataset from Unity testbed with different circumstances, such as rain, night, fog, etc., and train the neural network model with YOLOv3, to get a better performance on object detection under various conditions.

Jose Calderon

Biology, UC San Diego
McNair Scholars Program
Mentored by Dr. Diego Sustaita, Biology

Comparison of grasping and biting forces among rodent species in the Suisun Marsh, California

Studying functional performance in rodents can help us understand how they use their habitat. For example, studying bite force might help us understand their feeding ecology. Similarly, studying grasping force might help us understand their climbing abilities. However, not much is understood regarding how biting and grasping forces vary among species that occupy the same habitat. We measured grasping and biting forces of four different species found in the Suisun Marsh, including the endangered

salt marsh harvest mouse (Reithrodontomys raviventris), western harvest mouse (Reithrodontomys megalotis), California vole (Microtus californicus), and house mouse (Mus musculus) using a force transducer. In addition, we measured the relative sizes of the forefeet and rostrum of each individual to explore anatomical correlates of these forces. According to our preliminary results, peak grasping and biting forces (scaled to body size) were greatest in the California vole, followed by the western harvest mouse, salt marsh harvest mouse, and house mouse. This pattern could reflect differences in foraging and/or locomotion, such as the voles' tendency to burrow and the house mouse's generalized behavior. Further analyses are currently underway to examine if and how forefoot size and rostrum length explain these bite and grasp force differences among species.

Paola Cancino

Psychology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

Improving Cancer Care with Better Diagnostic for Autism Spectrum Disorder

Autism is an increasingly prevalent developmental disability that presents complex challenges to healthcare and treatment. Literature regarding both current disparities in health outcomes for individuals with Autism and the unique challenges cancer care presents with those individuals. Modifications are proposed to improve cancer outcomes for people with ASD. Scientific literature related to effective information dissemination methods for individuals coping with Autism and cancer was explored. Articles were found using PubMed, Science Direct, PsycINFO, CINHAL, and Google Scholar, and by reviewing the reference lists of eligible articles. The National Institutes of Health, Autisms Speaks, and the CDC websites were reviewed. Because no studies were found that addressed ASD and cancer, learning disability (LD) was the common term and was often utilized to categorize those on the Autism Spectrum Disorder (ASD) in regards to incidence rates for cancer. There were discrepancies in cancer screening rates between people with and without LD. Factors that are possibly linked to this discrepancy included the inability to understand the implications of their diagnosis or their prognosis, fear of procedure, healthcare provider discomfort and suboptimal access to healthcare. As in ASD, those with LD also experience difficulties in communication. Programs that enhance communication between healthcare worker and patient are necessary for discussing diagnosis, prognosis and treatment.

Christopher Carbajal-Carbajal

Sociology - Law & Society and Political Science - Data Analytics, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. John D. Skrentny, Sociology

"They're Making It Hard for Us to Exist" - an Empirical Analysis of How Policing Affects the Quality of Life for Black and Brown Communities in the Militarized City of San Diego

San Diego County, located on the U.S.-Mexico border, is a military hub with a population of more than 3 million people and a history of class, racial, and migrant discrimination. For those most impacted and marginalized within the militarized County -- namely its poor, Black, and Brown residents -- policing by the local and federal police may be detrimental to their quality of life. Despite this, little scholarship is available on the effect of policing on the most impacted communities within the County. This study analyzes arrest and incarceration data from the San Diego Sheriff's Department, various police departments within the County, U.S. Immigration Customs & Enforcement, and U.S. Customs & Border Protection. Additionally, this study analyzes interviews from system-impacted people to examine how policing affects the quality of life for many of the County's residents. Although the following is only a selection of my larger project, the study focuses on how policing in San Diego may affect the life experiences of many of its poor, Black, and Brown residents. The findings suggest that, although many variables quantify "quality of life", policing plays a pertinent role in understanding communal prosperity, or lack thereof, within the County of San Diego.

Mariana Carrola

Education Studies and Public Health, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Frances Contreras, Education Studies

Chicanas/Latinas engaging in Transformative Resistance Motivated by their Familias and Social Justice

Despite the increasing numbers of Chicanas/Latinas undergraduates at four-year universities, they remain an underrepresented group in higher education and continue to have some of the lowest college completion rates of all women (Gandara, 2015). To better support the increasing rate of Chicanas/Latinas in higher education, it is important to center their experiences navigating the institution as well as the central role of family and social justice in their college experiences. The frameworks guiding this research include Latinx Critical Race Theory (LatCrit) and transformational resistance theory. These theories provide a lens to examine student experience in a manner that focuses on the role of race, gender, and social justice (Solorzano & Delgado Bernal 2001). This study centers on the experiences of 15 undergraduate Chicanas/Latinas from immigrant families and the different ways in

which they engage in transformational resistance that is motivated by their familias and social justice. Preliminary findings demonstrate that undergraduate Chicana/Latina students are aware of the systems of oppression that create challenges for their families in accessing healthcare, living wages, and equitable treatment in social institutions Chicana/Latina undergraduates are driven by the promise of educational advancement for their familias, and they serve as a bridge between opportunity structures in the United States and their families.

Mirelle Castaneda

Education, UC San Diego
UC Scholars
Mentored by Dr. Sherice Clarke, Education

Impacts of COVID19 on education

The focus of this research is on how the COVID19 pandemic and distance learning is impacting educational equity in K-12 school contexts. The goal of this research is to better understand inequities that have emerged in the context of the pandemic in order to promote equity in schools. I conducted a literature review and secondary analysis of teacher interviews and social media posts to examine themes around teachers beliefs and practices of students. The preliminary results suggest that COVID19 is uprooting teacher practices as a result of the social climate, resources available, and developed greater awareness of diverse and unique challenges of their students. This results may have important implications for policy making around teacher development and teacher practices around promoting equity.

Carmen Castillo

Biochemistry, UC Riverside
MARC UR STAR
Mentored by Dr. David Gonzalez, Departments of Pharmacology

16s rRNA Profiling of Large Cohort of Inflammatory Bowel Disease Patients Reveals Potential Microbial Signatures

Gut microbiota plays an essential role in human health and influences a variety of human functions. Moreover, it has been shown that changes in the composition of microbial communities are associated with gastrointestinal conditions such as inflammatory bowel disease (IBD). Approximately 1.6 million people in the U.S. are afflicted with IBD, with over 70,000 new cases being reported each year, split between the two IBD subtypes, Crohn's disease (CD), and ulcerative colitis (UC). While bouts of inflammation characterize both UC and CD, UC is restricted to the colon, while CD can affect any portion of the intestinal tract. Currently, both UC and CD are primarily diagnosed by endoscopy, an invasive procedure not without inherent risks to the patient. Moreover, UC and CD share many symptoms, making a

precise diagnosis difficult for clinicians and delaying effective treatment for patients. Thus, there is a critical need for tools that non-invasively differentiate these states. Thanks to advancements in "omics" technologies such as 16s rRNA amplicon sequencing, we can study the gut microbiota on a massive scale, allowing the enumeration of entire gut communities in both healthy and diseased states, such as IBD. In light of this, we performed 16s rRNA taxonomic profiling on a cohort of human subjects (103 CD patients, 60UC patients, and 19 healthy controls) to characterize variations in the microbial profiles of these patients. Using these data, we will establish a non-invasive set of biomarkers that distinguish healthy subjects from IBD patients, CD from UC, as well as information about the location of current inflammation, with the long-term goal of replacing the need to perform endoscopies and leading to a more precision-medicine focused therapeutic approach.

Vanessa Cervantes

Cognitive Science, UC San Diego
McNair Scholars Program
Mentored by Dr. Michael R Gorman, Department of Psychology and Center for Circadian Biology, University of California, San Diego

Sex differences in circadian clock flexibility: does it depend on an exercise wheel?

Humans have internal clocks facilitating synchronization (or entrainment) to regular day-night variations in environmental conditions. These clocks are not easily shifted such that shift workers, people working under abnormal conditions, are poorly prepared to meet their physiological and environmental demands. Mice housed under certain 24h light:dark:light:dark (LDLD) cycles are able to adapt their behavioral rhythms to two activity periods and two resting periods per day, an entrainment pattern known as bifurcation. Female mice can adapt to this unusual 24h cycle more readily than male mice, suggesting greater flexibility entraining to their environment. Studies demonstrated running wheels, a commonly used tool to monitor day-night activity levels, have feedback effects on various aspects of circadian entrainment. Little is known about wheel access effects on bifurcation abilities of mice or if sex differences are induced by its presence. The current study focuses on the necessity of running wheel access for bifurcated entrainment, and if prior sex differences in entrainment are observed in the absence of running wheels. Male and female mice were placed under a previously validated 59 day assay for bifurcation with passive infrared (PIR) motion detectors to measure rest-activity cycles. Some animals without a wheel did bifurcate indicating it is not necessary for bifurcation. However, bifurcation was less robust than in animals with wheels. On average, female mice without a wheel bifurcated more readily than male mice suggesting sex differences are not wheel dependent. By further understanding sex differences and running wheel effects, translating these results could improve health and productivity of human shift-workers.

Priscila Chagolla

Public Health, San Diego State University
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

Hispanics Have Higher Acceptance of HPV Vaccination Myths: a look into a US/Mexico Border Region

Human Papillomavirus (HPV) vaccine series completion is lower in Hispanic Americans than non-Hispanic whites (NHW), impacting vaccine-preventable cancers. An HPV vaccine myth scale was created and validated to assess the nature of misperceptions among Hispanic San Diego County residents. A random sample of 5,000 households in San Diego County, California received a mailed bilingual health survey. The survey included 12 items to assess acceptance of HPV vaccination myths. Factor analysis was used to create a multidimensional scale and three subscales (age-related concerns, vaccine safety/efficacy, and association with sexual behaviors). Independent samples t-tests were conducted to assess subscale differences by ethnicity (NHW vs Hispanics). Among returned surveys, 419 had complete responses for the scale of the myth. Overall, Hispanics had higher vaccine myth acceptance than NHW ($p < 0.001$). Each of the three subscales also demonstrated significantly higher myth acceptance by Hispanics compared to NHW. Hispanics demonstrated greater acceptance of HPV vaccination myths compared to NHW. Culturally and linguistically appropriate interventions are needed in the San Diego County Hispanic community to reduce myth endorsement, improve vaccine uptake, and ultimately reduce the burden of HPV-related cancers.

Jaideep Chakladar

Biochemistry and Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Jessica Wang-Rodriguez, Pathology

Osteopontin (OPN) as a central regulator for e-cigarette and tobacco smoking-mediated cancer progression

Smoking is a well-established risk factor in cancer pathogenesis, as almost half of all deaths from twelve different cancer types are attributed to smoking. Although there has been extensive research into the mechanisms that may be unique to smoking-induced carcinogenesis, there is little known about the effects of E-cigarette smoke (e-cig) on cancer development. The goal of this project is to investigate osteopontin (OPN), a gene that we have previously implicated in smoking-induced carcinogenesis. Specifically, we aim to determine OPN's role in e-cig-mediated carcinogenesis and whether attenuation of OPN may decrease tumor viability in tumors exposed to tobacco and e-cig smoke. We have downloaded cancer patient RNA-sequencing data obtained from The Cancer Genome Atlas (TCGA). Computational analyses will determine the expression of OPN in OSCC patients and

how OPN expression is correlated to dysregulation of pertinent cancer and immune pathways. Mining of patient sequencing data will be used to infer intratumoral microbiome dysbiosis that may be correlated with OPN dysregulation. OPN expression in the context of cigarette and e-cig smoke will be validated using tumor organoids.

Tyler Chang

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Dinesh Bharadia, Electrical and Computer Engineering

Robotic SLAM Platform Development

In order to deal with expanding sensor combinations used in SLAM (simultaneous localization and mapping) research, a cheap, customizable robotic platform is necessary to collect data. Current SLAM platforms such as Turtlebot and Jackal can be costly and include sensors that may be unnecessary for the intended SLAM research. The goals of our team include designing a process for selecting and optimizing sensor networks through the ROS simulation software Gazebo as well as developing a robotic platform specializing in the specific SLAM area, WiFi SLAM. Basing our platform on ROS, sensors can be easily integrated into our data collection system. The simulation software, Gazebo, allows for simulation of sensor data, providing a simple method of comparing sensors. Our specific WiFi SLAM implementation utilizes LiDAR in regards to mapping, and gyroscope, wheel odometry, and WiFi APs for localization. WiFi localization is conducted through triangulation of AoA (angle of arrival) to AP's without special hardware modification. The platform we develop will connect to multiple routers and collect CSI. Our methods have shown Gazebo to be reliable in generating sensor data similar to that of real world data. Continued work is necessary to determine accuracy of different sensors in simulation. Further experimentation on the WiFi SLAM platform will give greater insight into the effectiveness of our sensor selection process and provide a unique platform dedicated to WiFi SLAM data collection.

Angela Chapman

Psychology with Specialization in Clinical Psychology, UC San Diego
UC Scholars
Mentored by Dr. Neal Swerdlow, Psychiatry

Feasibility of a Virtual Reality-Based Oddball Paradigm to Assess Auditory Information Processing in Schizophrenia Patients

Schizophrenia (SZ) is a neuropsychiatric disorder, characterized by cognitive impairment that contributes to socio-occupational disability. Although there are no FDA-approved procognitive medications for SZ, a cognitive-enhancing treatment called Targeted Cognitive Training (TCT) has significantly improved the cognitive

performance of SZ patients. However, TCT is time and labor-intensive, and only benefits half of SZ patients. Recent findings suggest that mismatch negativity (MMN) may identify patients who will benefit most from TCT. By increasing its sensitivity, it might be possible to use MMN as a biomarker that predicts TCT response. We hypothesize that an MMN paradigm using ecologically valid "oddball" stimuli, rather than standard laboratory-generated tones, will enhance the predictive validity of MMN. We propose to develop an ecologically valid MMN paradigm using stimuli delivered in the context of virtual reality (VR). We will compare the amount of MMN generated by VRbased vs. standard oddball stimuli in 20 SZ patients (M:F = 10:10; ages 18 – 45y). After careful clinical and neurocognitive assessment, participants will complete both VR-based and standard MMN paradigms in a balanced order. EEG data will be processed and analyzed using Python. The amplitude of MMN generated using VR vs. standard stimulus presentations will be compared using repeated-measures ANOVA (SPSS). Due to COVID restrictions, the study is on hold. If findings support the hypothesis, a future study will test the ability of this novel VR-based measure to predict clinical sensitivity to TCT in SZ patients

Brenden Chase

Biochemistry, CSU Bakersfield
STARS
Mentored by Dr. Alina Schimpf, Chemistry

Multi-Media Imaging and Photothermal Therapy of Cancerous Cells utilizing Nanoparticles

Nanoparticles are a widely utilized and developed structure in Inorganic Chemistry that aid in further understanding the relationship between metal and/or nonmetals in a metal-based-lattice structure. These structures can be manipulated to alter conductivity and other chemical properties associated with them. One such property that is in high demand is the ability to turn light energy more efficiently into heat which is often important in the context of solar-based energy systems; however, this property also has potential for use in biomedical systems. Because these compounds can efficiently conduct light into heat, they can be used for enhanced imaging of affected areas in the body containing cancerous cells for example. These nanoparticles can also be used as a potential treatment for cancerous cells. With the conversion of light energy into heat, cancerous cells can be eliminated using high temperatures to cause the death of cancerous cells bound to the nanoparticles. This could potentially allow for a more effective treatment of the cancerous cells with a less invasive procedure to halt further progression and kill present cancerous cells. Accordingly, this presentation is going to go over the details of these two biomedical topics and discuss the problems that are currently being faced with the application of these materials.

Jojo Chen

Cognitive Behavioral Neuroscience, UC San Diego
STARS
Mentored by Dr. Chengbiao Wu, Neuroscience

Mechanisms of Cortical-Striatal Atrophy in Huntington Disease

The genetic neurodegenerative disorder, Huntington's Disease (HD) impacts patients' muscular, cognitive, and psychological abilities. The cause of this neurodegeneration is due to a mutation in the Huntingtin gene that results in a mutant Huntingtin protein (mHTT) with an expanded polyglutamine (PolyQ) track near its N-terminus. The neurotoxicities of mHTT have been under intensive investigation. Autophagy, a cellular process for degrading misfolded proteins such as mHTT, emerges as one of the likely targets for mHTT toxicity. This process consists of autophagosomes that encapsulate faulty proteins and then fuses with lysosomes to form autophagolysomes, where the defective proteins/organelles are degraded. To this end, I propose to test the hypothesis that mHTT impairs the autophagic pathways to induce neurotoxicity. In addition to striatum, cortex also shows significant atrophy in HD patients. We will thus culture cortical neurons from a mouse model of HD (bacterial artificial chromosomes of Huntington's Disease: BACHD) using wild type (WT) neurons as control. To measure autophagic flux, we will use lenti virus to transduce a mCherry-GFP-LC3 vector into neurons. LC3 is the autophagy marker, GFP as green fluorescence and mCherry being red fluorescence. While appearing yellow in autophagosomes, the probe will become red once autophagosome fuses with lysosomes to form autophagolysosomes. The ratio of Red:Yellow fluorescent intensity will be measured. If the result in the BACHD neurons are different from that of WT, we will conclude that mHTT alters the autophagic flux. An increase in autophagosomes would mean the process of degrading unwanted proteins is slowed down leaving many defective proteins in the cell.

Vivian Chiong

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Pamela Cosman, Electrical and Computer Engineering (ECE)

Real-time Detection of Interruptions and Conversational Engagement Cues

Individuals on the autism spectrum often have strong cognitive abilities, offering unique strengths to the workforce, but deficits in communication skills lead to high unemployment rates exceeding 80%. This project aims to develop assistive technologies to help individuals on the spectrum improve their social communication skills, especially in the workplace. We aim to do real-time detection of interruptions as well as of conversational engagement cues such as "uh huh" and "yeah" which are called backchannels. The system will give feedback to the speaker on how to

correct their speech behavior as the conversation continues. To detect these events, we are applying deep learning and signal processing techniques to audio data. Using the audio annotation tool ELAN, we have annotated hours of audio from the CallHome English Corpus dataset of conversations to create labeled data for training a neural network. We are implementing a Long Short Term Memory (LSTM) neural network to detect backchannels and interruptions present in conversations. In order to get enough data to train the model for these conversational events, we are investigating data augmentation methods for time series data, including frequency domain and time domain augmentation methods.

Anthony Cirilo

Microbiology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

Infantile Radioactive Diagnostic Testing as a Possible Indicator of Adolescent Cancer Risk

This review investigated evidence from scientific literature that compared rates of radiation exposure and absorbance in infancy to understand the role radioactive diagnostic testing plays in adolescent cancer development, as it is implied that ionizing radiation from diagnostic tests causes tissue damage. Key databases searched included PubMed/Medline, PsycInfo, CINAHL, Embase, and Google Scholar for the articles published in and after 1980. The literature provided indirect evidence for the cancer-infant radiation link. The cancer rates of adolescents and young adults, roughly 13-26 years of age, have increased by 25% over the last three decades. Radiation exposure through recent medical practices has also increased, accounting for 50% of American's average annual radiation exposure. In CT scans, a key medical radiation source, parameters are typically unadjusted between adults and children. With a higher radio-sensitivity, infantile tissue has an increased susceptibility to irreparable tissue damage and DNA mutations. This susceptibility is hypothesized to predispose these infants to cancer development in comparison to non-radioactively tested infants. While the literature suggests a correlation between radioactive testing and cancer development in children, no direct evidence corroborates this link. Studies are needed to fully understand this phenomenon to aid practitioners and parents, who need this information, to guide clinical decision-making.

Javier Contreras

Biology, CSU Bakersfield
STARS
Mentored by Dr. Lisa Eyler, Psychiatry

Investigating the relationship between sleep and social interactions in adults with bipolar disorder

Bipolar disorder involves abnormal shifts in mood, energy, and activity, including both manic and depressive mental states. Social behaviors and sleep are both affected by bipolar disorder and influence daily function. While sleep and social interactions have been frequently studied independently, the relationship between them has not been widely investigated. Furthermore, few studies have used ecological momentary assessment (EMA) methods, even though real-time, repeated measurement of behavior can better capture daily experiences that are relevant for people's ability to function well in the community. As part of a completed study, data were collected from people with and without bipolar disorder over a two-week period using mobile surveys delivered three times a day and wrist-worn actigraphy watches worn continuously. Self-report of current mood, activities, social context of these activities, and stressors were surveyed; objective measurements of sleep, activity, circadian rhythm, and light exposure were captured by the actigraphy watch. We will examine the number of social interactions an individual experienced and the proportion of interactions that were positive or negative, and relate that to a measure of sleep efficiency. We predict that lower sleep efficiency will be associated with a higher proportion of negative social interactions, and that this will be particularly true in those with bipolar disorder compared to healthy volunteers, even after accounting for current depressed mood.

Francisco Cornejo-Garcia

Computer Science, Cypress College
STARS
Mentored by Dr. Arun Kumar, Department of Computer Science and Engineering

Featurization of Date-Time Values

The featurization of the date-time format involves the use of three downstream models that include classifiers such as logistic regression, random forest, and a multi-layer perceptron (MLP). Specific features are extracted from the date-time format in order to have different types of data that could potentially improve accuracy or decrease bias when utilized in an upstream machine learning model. The format of a date-time value could include a variety of specialized characters like a hyphen and/or a combination of a string with a number. The potential features that could be extracted from a date-time format include the season, year, month, day, hour, and minute. One of the schemes adopted was using a bi-gram as a baseline. This scheme was tested on multiple data-sets that have a variety of distinct data-types

such as time, date, temperature and condition. As the extra features are extracted and compiled into a data-set, several benchmarks were performed with varying results on each data-set. The first benchmark focused only on the original features of the data-set to serve as a baseline to the other benchmarks. The second benchmark classified the extracted features as categorical while the third benchmark viewed them as numeric. The fourth benchmark combined specific characteristics of the previous benchmarks to provide a potentially more accurate result. The results of these experiments led to increased accuracy in determining the data-type of date-time values. This suggests that these experiments have the potential to improve automated data preparation when combined with other Auto-ML techniques.

Brandon Cramer

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Prasad Gudem, Electrical and Computer Engineering

Impact of FR1 5G NR Jammers on UWB Indoor Position Location Systems

Ultra-wide band (UWB) technology is widely used in precise location systems for its resilience to out-of-band interference (2G/3G/4G cellular, Wi-Fi), low energy consumption, superior object penetration, etc. 5G technology, which is quickly becoming the standard for cellular communications, poses a threat to UWB positioning systems. In particular, wideband signals within the FR1 5G NR bands overlap with portions of the UWB bands and are therefore expected to significantly degrade ranging accuracy. The goal of this research is to determine the extent of the impact that in-channel FR1 5G NR jammers have on ranging performance. Specifically, we are measuring the impact of these jammers on the achievable range of a DecaWave Trek1000 positioning system. The wideband jammer signals used in this experiment are generated with vector signal generators and added to the Trek1000 TX/RX signals with a power combiner. Prior testing used the Trek1000 module antennas to exchange ranging data and showed that the maximum achievable range with the added jammer signals was significantly less than the predicted range based on the Cramer-Rao lower bound. We are repeating these tests with a cabled approach to eliminate sources of error caused by over-the-air transmission (e.g. multipathing) in an attempt to converge our measurements with our predicted values. Should these results continue to deviate from the prediction, it may be necessary to revisit the method of obtaining the predicted values.

Marin Cross

Biochemistry & Cell Biology, UC San Diego
McNair Scholars Program
Mentored by Dr. Amy Non, Anthropology

Effects of acupuncture treatment on immune cell telomerase activity

In this study we examined how acupuncture may influence telomerase activity, a mechanism ofcellular aging, among a group of individuals aged 50 years and older. While previous studieshave found associations between acupuncture and reduced report of physical pain andpsychological stress, this is the first study to examine changes in telomerase activity followingacupuncture treatment, in individuals with symptoms of anxiety and depression. Telomeraseactivity is an important biomarker of cellular aging because it regulates telomere length, whichserves as a protective mechanism against the innate loss of essential genetic material that canoccur as a cell replicates. The study included participants, of ages 50 and over, with self-reportedanxiety and depression living in either San Diego, California or Appalachia, North Carolina. 44participants donated blood samples and responded to surveys at least once and up to 4 differenttime points, before, during, and after 2-4 months of acupuncture treatment, 3x/week. Thesesurveys gathered information about levels of psychological stress and depression, social support,well-being, and other stress-reducing activities from the participants. Telomerase was isolatedfrom lymphocytes and enzyme activity was measured using a quantitative PCR protocol. Weexamined changes in levels of telomerase activity and mental health and well-being in responseto acupuncture treatment over time. Preliminary results indicate no consistent or significantchanges in telomerase activity following acupuncture treatment, but significant improvements inmental health.

Ilene Cruz

Psychology, CSU Northridge
STARS
Mentored by Dr. Terry Jernigan, Center for Human Development

Examining Race/Ethnicity as a Moderator on the Relationship Between Family Conflict and Adverse Children Experiences in Youth

Higher family conflict and stressful life events are risk factors for developing an affective disorder among adolescent populations (Cummings et al., 2015; McLaughlin & Hatzenbuehler, 2009). However, little is known about how these risks relate to race and ethnicity during development. Data from the Adolescent Brain Cognitive Development (ABCD) study 2.0.1 release was used to analyze 4,936 youth aged 9 to 12 years with available data for youth report of family conflict and life events, and parent report for youth psychopathology. Internalizing and externalizing subscale scores from the parent report Child Behavior Checklist were used. We hypothesized

that higher family conflict and stressful life events, as reported by youth, would be associated with higher externalizing and internalizing behaviors among youth, including youth who identified as a member of a minority group (i.e., Latinx). Further, we hypothesized that higher identification with positive cultural values would moderate the associations between negative family environment and externalizing and internalizing behaviors. Preliminary results revealed significant main effects and an interaction between race/ethnicity and number of stressful life events when predicting internalizing and externalizing behaviors: higher negative life events predicted both higher externalizing and internalizing behaviors more strongly in Whites than in Hispanic youth (internalizing Beta=-.59, p<.001; externalizing Beta=-.42, p<.008). The relationship between negative life events and internalizing/externalizing problems may differ in Latinx youth compared to Whites. The role of cultural identification as a possible protective factor among Latinx youth will be examined.

Cesar De La Torre Castaneda

Physics, CSU San Bernardino
STARS
Mentored by Dr. Tenio Popmintchev, physics

Efficient Generation of High Harmonic X-ray Light Using UV Lasers

Cesar De La Torre Castaneda (CSU San Bernardino), Aldair Bonila (California State Polytechnic University, Pomona), Katarina Brekalo (CSU Stanislaus), Luis Velez Vera (San Diego State University), Meghan Shen (UC San Diego), Yingying Cui (UC San Diego), Siyang Wang (UC San Diego), Dimitar Popmintchev (UC San Diego), Tenio Popmintchev (UC San Diego/Photonics Institute, Vienna)

Energy of photons can be absorbed or released by electrons. When an electron absorbs a photon, the energy can free the electron to move around, or the electron can release the energy in the form of another photon of a different wavelength. In order for the electron to release a photon of much shorter wavelength, it can be accelerated through a laser beam focused into a vacuum chamber filled with a gas. This allows the electron to escape the Coulomb potential of the atom and emit high energy photons in a well-directed beam with laser properties. Our goal is to produce enough X-ray photons using various ultraviolet femtosecond lasers. Using MATLAB software we will simulate what atomic ionization rates we can produce with given laser intensity and focal length parameters. These initial predictions and optimal parameters will be used to design vacuum X-ray beamlines using SOLIDWORKS. This equipment will then be used in the lab to generate X-rays with laser properties and perform Coherent Diffractive X-ray imaging (CDI) which will be paired with a form of equally sloped tomography (EST) to image femtosecond dynamics of bio- and nano-systems.

Zijing Di

Computer Science, UC San Diego
UC Scholars
Mentored by Dr. Zhuowen Tu, Department of Cognitive Science

Improved label to image generation

Conditioning image generation on input information has been a popular research domain in machine learning, which can be used for practical purposes such as art generation. This difficult task asks to generate a vivid image corresponding to an input, which can be texts or labels. Generative models such as Generative Adversarial Networks (GANs) and Variational Autoencoders (VAEs) are extensively used for the task. In order words, the research conducted here also depends on the well-established models, but we developed a few different features. Previous research has used VAEs to generate images conditioned on labels, but it is also desirable to use GANs on this task due to its ability to produce high-quality images. Different from other generative tasks which only require models to generate realistic images, our task further requires the model to generate images conditioned on inputs. There are several state-of-the-art GAN-based models, such as the StackGAN, which condition on inputs while remains the ability to generate high-quality images. We explore these existing models on both label-to-image and text-to-image tasks, and conduct experiments to improve the image generation quality while sustain the models' ability to generate conditioned images. We will show several failure attempts illustrating our progress towards the final product and that our final results are as at least effective as the existing models on datasets such as MNIST and Cifar10.

Sabrina Diaz

Molecular and Cell Biology, UC San Diego
McNair Scholars Program
Mentored by Dr. Nan Hao, Biological Science

Observation of allele switching events in telomerase expression due to cancer mutations

Telomerase, which is a reverse transcriptase (TERT), is involved in maintaining the length of telomeres in chromosomes throughout a cell's lifespan. Ninety percent of patients, regardless of tissue type, have activating mutations in TERT. These mutations are found in the core promoter of TERT, rather than a coding mutation like many other cancer mutations. These supposedly identical mutations (C228T/C250T) increase the expression of TERT by 2-8 fold depending on the cancer type. In order to observe heterogeneity in clonal expression, we imaged mammalian cells with an expression reporter for each TERT allele. Upon observing the expression of each allele, we noticed an occurance of switching alleles in single cells harboring the C228T mutation over a period of 4 days. We hypothesize that expression switches

between alleles over multiple generations and may be epigenetically controlled. It has been previously shown, these specific mutations of the telomerase promoter show distinct patterns of repressive methylation and histone modifications that only occur on the WT allele of the cancer mutated gene. This causes unusual epigenetically distinct states of TERT and may contribute to the allele switching phenomenon. We will be using computational image analysis using a combination of open-source software and custom written code that segments the cell images and quantifies the intensity of the fluorescence throughout a time span of four days, while maintaining the cell's lineage information. Furthermore, we will be exposing the cells to various aspects of the tumor microenvironment to elicit a change in allele switching frequency.

Sharlene Diep

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Kyle Gaulton, Pediatrics

The Role of Hypoxia in Pancreatic Islet Regulation and Diabetes Risk

Hypoxia occurs when there is a lack of oxygen in the body and can be damaging to human cells and tissues. In pancreatic beta cells, hypoxic conditions can contribute to cell death and the development of diabetes. Since the genomic responses of islets to hypoxia are poorly understood, I will evaluate the role of hypoxic conditions on beta cell gene regulation using cobalt chloride (CoCl2) exposure as a model. The first step of my project is to optimize conditions in which beta cells respond to hypoxia. I will culture MIN6 beta cells with CoCl2 for different durations and then determining if hypoxia was induced by measuring the expression of HIF1a, a master regulator of hypoxia response, using qPCR. Second, I will perform ATAC-seq and RNA-seq to measure accessible chromatin and gene expression, respectively, in CoCl2-treated and untreated MIN6 cells as wells as primary human pancreatic islets. Using these data, I will then identify accessible chromatin sites and genes activated in hypoxia. Lastly, I will identify genetic risk variants for type 1 and 2 diabetes that map in hypoxia induced chromatin sites and prioritize variants with the strongest disease associations. For several most associated variants, I will clone sequences around variant alleles into a luciferase gene reporter vector. I will then transfect untreated and CoCl2-treated MIN6 cells and then test for significant differences in luciferase expression between variant alleles in both conditions.

Brian Dinh

Molecular & Cell Biology, UC San Diego
Genentech Scholars Program
Mentored by Dr. Peter Shaw, Opthamology

CFH and HTRA1 exhibit an antagonistic effect on inhibiting oxidized phospholipids uptake in human retinal pigment epithelial cells

Age-related macular degeneration (AMD) is a progressive retinal degenerative disease. AMD is a leading cause of vision loss globally, affecting 170 million people. A hallmark symptom of AMD is the development of drusen deposits, containing oxidized lipids, in the subretinal space. Genetic variants in the Complement Factor H (CFH) and HTRA1 gene loci are highly associated with AMD development, however how HTRA1 contributes to AMD pathogenesis is unclear. To investigate the interactions between CFH, HTRA1 and oxidized lipids in relation to AMD, we treated ARPE-19 cells with oxidized low-density lipoproteins (oxLDL) with or without CFH and HTRA1 variants. Lipid uptake was then assayed with Oil Red O staining. RT-qPCR was also performed to test gene expression levels. Lipid uptake following incubation with oxLDL was significantly decreased in the presence of WT HTRA1 or risk-variant CFH. However, lipid uptake levels with HTRA1 and CFH did not significantly change compared to CFH alone. RT-qPCR also suggests a novel interaction between a lipid uptake protein and HTRA1 and CFH. Our results indicate that HTRA1 contributes to AMD pathogenesis by regulating cellular uptake of oxidized lipids, which may play a critical role in drusen accumulation. Novel interactions of HTRA1 and CFH also suggest a possible mechanism by which the uptake of oxidized lipids is modulated. These results may indicate that HTRA1 plays a major role in drusen development.

Hope Do

Microbiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Karl Wahlin, Ophthalmology

Cell cycle regulation and miRNA function during early development of human stem cell-derived retinal organoids

Retinal degenerative diseases (RD), such as retinitis pigmentosa (RP) and glaucoma, are leading causes of blindness worldwide. Many forms of RD irrevocably damage weak links within the intricate system between the eye, optic nerve, and brain that constitutes the ability to see. One promising solution comes in the form of endogenous regeneration, which alludes to inherent regeneration of pre-existing tissues in the body. While best characterized in zebrafish, regeneration following injury to the retina is an ability that many other species possess. In these circumstances, Müller glial cells with stem cell-like properties re-enter the cell cycle and generate new neuronal cells. In the human retina, however, much of the cells are

post-mitotic and incapable of partaking in reparative processes. To uncover the latent regenerative properties of human retinal cells, we must first explore processes involved in normal retinal development, including retinal differentiation and cell growth. As a first step in this process, we analyzed mRNA and microRNA (miRNA) transcripts in developing human 3-D retinal organoids grown in vitro and obtained transcriptional profiles of cells from pluripotent stem cells (hPSCs) through early retinal development. To elucidate the significance of miRNA within retinal cell cycle mechanisms and cell fate commitment, RNA-seq and small RNA-seq were performed. Subsequent bioinformatics analyses identified 28 miRNAs that were differentially and significantly expressed between days 0 and 20 of differentiation. Our analyses of these miRNAs and their target genes may clarify their functions as post-transcriptional regulators of gene expression in human retinal development and, ultimately, regeneration.

Viviana Araceli Dominguez

Microbiology, UC San Diego
McNair Scholars Program
Mentored by Dr. Matthew Daugherty, Molecular Biology

An Evolutionary Perspective on Picornavirus Proteases and their Host Targets

A major goal in the field of virology is to identify new host-viral interactions that shape the diversity of both host and viral players. To advance our understanding toward this goal, I will contribute to a scientific review article focused on leveraging evolution as a means to identify new functional consequences of the common virally-encoded protease antagonism strategy deployed by (+)ssRNA viruses. To approach this, I first aim to catalog published instances of host antagonism by proteases of a single family of (+)ssRNA viruses, Picornaviridae. Next, I aim to assess the relevance of each research article by examining the methodology and experiments conducted by previous researchers. I will then compile data describing the substrate specificity of a diverse set of picornaviral proteases, including sites of cleavage within host genes. Taken together, the data presented in this review will prove to be valuable as I continue my functional work that was interrupted by COVID-19.

Xuanxi Du

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Xinyu Zhang, Electrical Engineering

mmWave Software Defined Radio

Millimeter-wavelength (mmWave) RF technologies represent a cornerstone for emerging wireless network infrastructure, and for RF sensing systems in security, health, and automotive domains. By using hundreds of antenna elements, mmWave can boost wireless bit rates to 100+ Gbps, and potentially achieve near-vision

sensing resolution. However, the lack of an experimental platform has been impeding research in this field. M-Cube is the first mmWave massive multiple-input multiple-output (MIMO) software radio. We extend M-Cube to enable real-time processing on a Field Programmable Gate Array (FPGA), which bypasses the relatively slow processing previously performed on commodity PC hardware. This will allow us to achieve near real-time processing of multiple 48 Gbit/s RF data streams, and near real-time radar imaging and communications performance evaluation.

Sylas Eckhart

ESYS EBE, UC San Diego
STARS
Mentored by Dr. Amy Non, Biological Anthropology

Hair cortisol as a Measurement of Chronic Stress

Despite being known as the "stress hormone", the relationship between cortisol and stress is not always a clear, direct correlation. Under normal circumstances, the cortisol response from the body will increase in response to a stressor and subsequently diminish when the stimulus is removed. However, when individuals are faced with chronic stress, some may have a skewed cortisol response, resulting in attenuated or overactive cortisol production. Race/ethnicity, socioeconomic status, age, and sex are all variables that can influence cortisol production, though their effects are not clear. A literature review was conducted on chronic and acute stress and cortisol to determine consistency in directions of effect in relation to stress and various covariates and representation across various populations. From a series of google scholar searches including the terms: chronic stress, acute stress, and hair cortisol, ten articles were identified. My review primarily focuses on studies utilizing hair cortisol concentration (HCC) because of its ability to provide a more stable, long-term measure when studying chronic stress. Due to the negative health implications associated with exposure to chronic stress, this research may be useful to identify which individuals or populations are at greater risk of having maladaptive cortisol responses.

Caín Alexander Elizarraras Galván

Electrical Engineering, UC San Diego
STARS
Mentored by Dr. Dimitri D. Deheyn, Scripps Institute of Oceanography

Imaging of vine holding pads to find inspiration for mechanical interlocking adhesive device

Many plants use adhesion to attach in different ways to the environment. Varieties of vines and ivy use adhesive pads or holdfasts to support the plant when climbing surfaces to reach brighter areas that are more suitable for growth. The Ficus vine adheres to surfaces with strong tenacities, however they cannot use actuation to vary

and adapt attachment under changing substrate. They can however handle external changes of the environments, such as wind forces and water loads. This makes the Ficus vine an interesting candidate to understand structural adhesives when the substrate is unchanged, but the surrounding environment is variable. This project aims to use photo-acquisition and imaging processing techniques to look at the organization of the holdfasts, such as their number, geometric characteristics, and relation (relative size, thickness, positioning) to the main body of the plant. This information would be crucial to design vine holdfast-inspired adhesive pads that use mechanical interlocking as an anchor for adhesion to substrates. The understanding of these types of bioinspired adhesive structures can lead to "permanent" engineered adhesives for use on surfaces that are impacted by strong winds, like the case for the Ficus vine. However, other applications involving biosurfaces could lead to applications in biomedicine and bioengineering.

Mariam El-karim

Biochemistry, CSU Northridge
UC Scholars
Mentored by Dr. Colleen McHugh, Chemistry and Biochemistry

Identification of novel protein interaction partners of the MALAT1-associated cytoplasmic RNA

MALAT1 is a long-noncoding RNA which is upregulated in many types of cancers, and whose function contributes to cancer progression and metastasis. While the majority of the MALAT1 transcript is retained in the nucleus, its 3' end is processed to form the MALAT1-associated small cytoplasmic RNA (mascRNA), a 61-nucleotide transcript that is transported to the cytoplasm. The function of the mascRNA is totally unknown, although the predicted mascRNA secondary structure is similar to a tRNA. However, the mascRNA is not aminoacylated and has an undeveloped anticodon region, so it is not likely to function as a classical tRNA. The goal of this project is to identify the proteins that bind specifically to mascRNA in vitro using an RNA pulldown experiment coupled with peptide mass spectrometry. We used the MaxQuant analysis software and custom Python scripts to identify and compare the protein binding profiles of in vitro transcribed tRNA, mascRNA, and negative control RNAs. We found that proteins that take part in cellular localization are specifically enriched in the mascRNA sample compared to the tRNA and control RNAs. Among these proteins are the translocation protein SEC62, Ras-related protein Rab-17 and the general vesicular transport factor p115, suggesting that mascRNA may play a role in vesicle trafficking or protein secretion. The discovery of these protein interaction partners will enable future mechanistic studies of mascRNA function in cancer cells.

Avyance Ervin

Sociology and Anthropology, Spelman College
STARS
Mentored by Dr. Lane Kenworthy, Sociology

Knowledge and Truth of the African American Identity

Truth and knowledge aids the identity of people. It helps us evaluate who we are and who we don't want to be. The way we perceive truth and knowledge is often linked to our identity, and our identity is connected to the external experiences we have in life. Within African American culture, knowledge and truth is greatly surrounded by systematic oppression. The identity we possess is in contrast to the identity of the world around us. Within the world of academia African American's use subjectivity to prevail through the disoriented knowledge and truth that surrounds their identity. In a world where blackness is parallel to whiteness, the identity of African American people becomes the reflective identity of their counterparts. In many cases the people who evaluate the truth and knowledge of African American lives, are the people who have not experienced a life like them. Within my research I will be summarizing scholarly articles that depict how African American's knowledge and truth reflects the identity of an oppressed person living in the United States. In doing so, I will be addressing what systematic oppression looks like in America and synthesizing how this affects the African American identity, therefore their truth and knowledge. I hope to convey that truth and knowledge is formed through awareness of identity, and that the truth of the African American identity has been dismantled through their social experiences. My work will provide an analysis of double consciousness and allow readers to understand the positionality of those othered within society.

Andres Espinoza

Human Biology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

Epigenetic abnormalities and their contribution to cancer outcomes among African Americans

African Americans (AA) experience the highest cancer mortality rates. Studies indicate epigenetic modifications impact cancer progression and survival. This literature review aims to identify differences in epigenomic profile between AA and Non-Hispanic White (NHW) cancer patients. Databases PubMed, PsycINFO, CINAHL, and Google Scholar were used to search for evidence of epigenetic modifications among AA in association with cancer outcomes. While the scientific literature identified specific epigenetic alterations that promote oncogenic expression among AA, only a few articles explored these differences in comparison to other ethnic groups. Some studies revealed that AA expressed higher frequency of DNA

methylation abnormalities of prostate and breast cancer patients than NHW. Genes TRPC5, S100A14, and MIR662 were prevalently expressed among AA cancer patients as a result of hypomethylation and were associated with chemotherapy resistance. Evidence shows lifestyle factors such as diet, stress, smoking levels, alcohol consumption, and environmental toxin exposure change the epigenomic conformation. These long-term stressors can contribute to burdens in AA health outcomes, including cancer. This research confirmed the critical need for more racial and ethnic diversity in epigenetic studies. Further studies should elucidate the mechanism of how these genes are differentially expressed and how their expression could be modified, which could potentially improve cancer outcomes.

David Everly

Public Health, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Jill Blumenthal, Medicine

What constitutes a good vs a bad clinical program for transgender patients

Research shows that children, adolescents and adults with gender dysphoria are presenting for medical attention at an increasing rate in recent years. There are significant barriers to accessing appropriate and culturally competent care, which contributes to health disparities in the transgender population; including but not limited to different types of cancer, mental health conditions and increased rates of death from infectious diseases and substance abuse. Standards of care have been developed in various parts of the world to give an outline for appropriate treatment of transgender individuals including hormonal intervention, mental health support and gender-affirming surgeries. This project defines important terminology related to transgenderism, reviews the history of the pros and cons of past medical interventions related to transgenderism, discusses mental health disparities faced by this population, and provides six key elements of what constitutes a successful transgender health clinic. I conclude with support for the development of a lexicon for transgender patients and the establishment of a trans-inclusive patient environment with well-educated staff who are aware of gender-affirming treatments and surgeries. Through improving the delivery of quality health care services, we can reduce the health disparities this community currently experiences.

Jehan Ezzulddin

Human Biology, UC San Diego
TRELS
Mentored by Dr. Sandra Daley

The Relationship Between Social Determinants of Health and Allostatic Load

This research assessed how social determinants of health impact levels of allostatic load overtime among individuals, 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.

Rae Therese Fariolen

Physics, UC Berkeley
STARS
Mentored by Dr. Elena Koslover / Aidan Brown, Physics

Diffusive Transport in Organelles

Organelles are tiny compartments within eukaryotic cells, with different organelle types having a distinct morphology and housing a specific population of molecules to perform particular biochemical tasks. The Endoplasmic Reticulum is a labyrinthine network of microscopic tubules that branches off the nucleus, an organelle essential for protein quality control and regulating calcium ion concentration. Despite extensive study, the structure-function relationship for the ER is poorly understood yet important, as mutations to ER morphogens are associated with several human diseases. ER function requires diffusive movement of molecules within the ER lumen and membrane, including diffusion of proteins to specialized ER exit site (ERES) zones, allowing these proteins to leave the ER. We explore how the convoluted ER structure impacts this search process by quantitatively modeling diffusion on ER structures to calculate molecule arrival time at the ERES. We want to know if there is a functional benefit to varying ERES placement relative to sites of protein production and have found that ERES closer to the network's bulk are more efficient for protein export. We also found that locating ERES at nodes of high connectivity shortens search times. These findings align with live-cell observations, which qualitatively show denser ERES near the core of the ER network, suggesting that ERES locations may be regulated for efficient diffusive search and protein export.

Jesus Fausto

Electrical Engineering, UC San Diego
California Louis Stokes Alliance for Minority Participation (CAMP) in Science,
Engineering and Math
Mentored by Dr. Frank Talke, Electrical Engineering

Portable Ophthalmic Instruments

The portable ophthalmic instruments project aims to create a portable eye
examination system device for the convenience of both the client and doctor. It is a
series of basic eye tests that can be taken at home that will determine if there is a
need for further examination in person. The two sub-projects focused on were the slit
lamp and the acuity test devices. The slit lamp works by taking pictures (via a mobile
phone) at different places of the back of the eye using a slit light. Improvements were
made for the printed circuit board (PCB) design by updating individual components to
the latest versions available on the market, fixing software and hardware issues, and
testing the new design. Keeping replicability in mind, the PCB was designed with
surface mount devices for the manufacturers, which would allow for faster production
of the board and reduce the assembly time of the entire system. On the other hand,
the acuity test device minimizes the size needed for one to do the Snells test
examination and then send the result to the doctor. For this device we are in the
process of designing an android application that will fit the device to show the
different image sizes for the test.

Michael Fernandez

Microbiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Karl Wahlin, Opthalmology

*Mapping developmental pathways in early ocular growth for stem cell derived retinal
organoids*

Human stem cell research offers a valuable tool for human disease modeling through
the ability to experimentally manipulate human cells in vitro. Furthermore, organoids
produced by human pluripotent stem cells (iPSCs) can be a non-invasive solution for
studying early retinal development - especially during fetal stages of growth. By using
Next Generation Sequencing (NGS) and bioinformatic analyses, we explored gene
regulation of iPSCs derived retinal organoids to investigate the regulation of early
ocular development. This was accomplished by temporal analysis of RNA and
miRNA transcripts in iPSCs organoids from day 5 - 25, a period covering early neural
and retinal development. miRNA functions as a post-transcriptional regulator to RNA
by binding to their mRNA products- inhibiting translation to proteins. The functional
correlation of miRNA to RNA is vital to further understanding developmental
processes of the retina because of its influence in protein expression and ultimately -
cell differentiation. Our NGS data underwent Differential analysis through the web

based Oasis portal which predicts and quantifies miRNA sequences. Further statistical analyses of these miRNAs identified 30 distinct sequences based on a significant p and q value. Pathway Analysis was done using the miRSystem and DAVID web page which correlate and cluster genes targeted by the miRNAs and our mRNA database. Through this, a developmental pathway was mapped with genes influencing specific stages of retinal and neural growth. This experiment's data will (1) further deepen our understanding of gene regulation for retinal organoid development (2) can lead to further optimization of iPSCs organoids by inducing developmental pathways through targeted genes.

Omar Flores

ICAM, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Sarah Hankins, Music

Political Rap and Commercial Sap: Political Authenticity within Contemporary Commercial Rap

Since the conception of Hip-Hop in the late 70's, the genre has given great importance to idea of an unspoken authenticity within the artform. While originally this meant rappers would have to prove themselves as "real" survivors of harsh inner-city life, the commercialization of the genre has opened the door to new interpretations of what authenticity means in rap. Simultaneously political themes that were once at the forefront of the genre, have now become a precarious subgenre, often omitted for greater market sales. Despite this, notable artists like Kendrick Lamar and Logic have found ways to incorporate political issues into their songs while remaining commercially successful. Although both are similar in this regard, their approaches vary and pose questions regarding authentic political rap within the current post-commercial era of Hip-Hop. For these reasons, my research aims to define what authenticity means by culminating both academic and ethnographic sources, in order to determine what distinguishes an authentic approach to political themes between artists. I hope to find what traits of a rapper and their work are able to be perceived as authentic when tackling current political issues.

Neve Foresti

Cognitive Science with Specialization in Design and Interaction, UC San Diego
Converge Incubator
Mentored by Jacques Chirazi, Office of Innovation and Commercialization - Basement / Blackstone Launchpad Program

Flybility — Improving Airport Accessibility at SAN

Even when accessibility regulations are met by the San Diego International Airport (SAN), the airport experience for passengers with disabilities still has room for improvement. SAN is not the only airport to face these challenges; 36,930 airport

accessibility complaints were filed in 2018. Recent ACRP reports suggest that accessibility tends to be an afterthought in airport design, which results in passengers bearing the burden of self-advocacy. However, airports are complex institutions, and with information constantly changing, it is difficult to implement lasting solutions and divide responsibilities appropriately. Our research has highlighted a multifaceted gap in communication between SAN, 3rd-parties, and passengers with disabilities. After consulting with passengers, airline and airport staff, and relevant experts, we have created a guide to shift SAN's approach from reactive to proactive by leveraging technology and addressing social causes of accessibility gaps. In addition, training and disability councils will improve awareness and prioritize opportunities for improving airport experiences. Increasing involvement and decision-making power of people with disabilities is a necessary step to sustainably improve accessibility. Because this approach goes hand in hand with universal design, these changes will not only benefit the 61 million disabled adults across the country as they travel, but it will also ensure that all passengers have a more positive journey.

Jiajian Fu

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Truong Nguyen, ECE

Detection and description for feature matching

Metric learning for descriptors is an important part of the feature matching task in computer vision. Nowadays, people are starting to move to neural network learning methods from hand crafted methods. In hand crafted ways, we defined descriptors to describe features from the interest points extracted from the images. However, they might not layout nicely in the euclidean space. For example, two interesting points that are not a pair of matching points have similar features, i.e. the euclidean distance between them is small. In this case, we will make a mistake in matching interest points. So, the neural network not only learns to extract features but also learns to transform the extracted features so that they align better in the euclidean distance space. So, we usually define a loss function that tends to increase the distance between not matching points and decrease the distance between matching points. A state of art neural network, D2-net, uses a triplet loss function to train the network. While a lot of feature matching networks are using these kinds of loss functions, a better loss function based on ranking a list of interest points was proposed. This new loss function is trying to optimize the average precision of the list of descriptors. So, I tried to improve the D2-net results by training the network with the new loss function.

Parke Funderburk

Mathematics (Applied), UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Thomas Levy, Anthropology

Sedimentology and geochemistry of a wetland record from NW Israel: new insights utilizing X-ray fluorescence

An understanding of past climate variation and the mechanisms causing such variation is integral to predicting future changes in climate. In this study in progress, we hope to add to the discussion on the paleoclimate of the Levant through the sedimentological and chemical analysis of two sediment cores that capture a late Pleistocene-Holocene sequence deposited in the Carmel coastal plain of north west Israel. The coring locations high depositional rate and its history as a wetland suggest the potential to capture in high-resolution hydrological and climatic variation at a local and regional scale. In addition to lithology, we utilize X-ray fluorescence (XRF), scanning each core at intervals of 10mm, in an attempt to resolve the potential high-resolution variability. The lithology of the cores agree with the wetlands interpretation of previous studies. The core KBMN2 has 13 units (determined by texture, color, and contents) which were organized into five groups. Groups G1 and G2 are made up of clayey silt and primarily differ in color, G2 being gray to dark gray suggesting anerobic conditions. The core KBMN4 consists of 24 units organized into six groups. Groups BR3 and G3 of KBMN4 differ predominantly in color and contents, G3 having significantly more organic remains, and consist of silt and clayey silt. Both cores also have brown sandy units which are possible paleosols, though the type has not yet been identified. Both cores have been scanned using XRF, and we are currently in the process of analyzing the data.

Noah Gaitan

General Biology, UC San Diego
STARS
Mentored by Dr. Chris Tyler, Medicine

Investigating the effects of integrin β7 blockade in an interleukin 10 (IL-10) deficient model of chronic colitis

Ulcerative colitis (UC) remains a formidable health complication that affects roughly 10 million people internationally. UC identifies as chronic colonic inflammation through environmental and genetic factors that trigger an irregular immune response. A therapeutic strategy for UC is the blockade of leukocyte-specific integrins, molecules that allow cells to enter the inflamed colon to perpetuate disease. Despite the strategy's success, the exact cellular targets remain undetermined. In this study, we consider the functionality of etrolizumab, a drug currently in clinical trials, by using the mouse-specific version of this drug, FIB504, on chronic colitis mouse models. We will use IL-10 mice that adequately function as a model for chronic colitis. FIB504

interacts with integrin beta 7, blocking its role in immune cell adhesion that governs cell migration and homing observed in inflammatory responses. Over eight weeks, we administered FIB504 twice a week in 100 microgram injections. Immune cell behavior and population analysis were done via spectral flow cytometry and serum and stool via ELISA's. We observed B, T, plasma, and dendritic cells via flow and IgA levels via ELISA. We documented the drug's real-time effects on the immune response as FIB504 inhibits specific immune cells from reaching the intestinal tract and hypothesize we will inversely observe accumulating immune cells in the blood. Understanding etrolizumab's functions will revolutionize future treatment for IBD.

Ruby Gamboa

Mechanical Engineering, UC San Diego
STARS
Mentored by Dr. Dimitri Deheyn, Marine Biology Research Division, Scripps Institution of Oceanography

The Potential of Spectral Reflectance altering Thermal Properties of Bird Feathers

Melanin is a type of biological pigment found in almost all organisms. In birds, melanin is often stored in melanosome arrays, which are associated with nanostructures in the feathers. Often,the melanosomes are responsible for structural coloration and iridescence, but this does not eliminate the possibility of other functions (like mechanical strengthening and/or thermo-regulation). Previous research states that melanin in feathers can facilitate heat dissipation, regulate body temperature, and/or protect skin from direct sunlight exposure. Here,we aim to determine whether color and/or melanin content of feathers affect their thermo-regulation ability. Our research will use feathers (white, colored, and black, representing increasing amounts of melanin) that we will spray paint with different colors (half of the feather is colored, the other being used as unpainted control). Once applied, we use a hot plate (thermal conductance heat source) or a blackbody light (spectral heat) to assess the change in temperature of the feather over time, paying attention to whether the heating/cooling rate differs with the parts of the feathers. These rates will be measured using a FLIR-thermal camera in time lapse mode. This approach will allow us to determine whether color affects thermo-regulation, with or without melanin content. The results will further our understanding of how feather color/chemistry can affect thermal properties, which can also be used for biomimetic design.

Angela Gao

Mechanical Engineering, UC Los Angeles
UC LEADS
Mentored by Dr. Michael Tolley, Mechanical and Aerospace Engineering

Simulating Small Robotic Systems Driven by Rotary Pouch Motors

The control of insect-scale robots poses unique challenges due to a lack of small-scale actuators capable of providing large range of motion, power density, and actuation speed. Rotary pouch motors are novel, pneumatic actuators that offer these desirable characteristics and can be manufactured in a convenient process. While physical experiments can be developed to characterize robotic linkages driven by pouch motors, the time and material costs of these experiments increase with the complexity of the linkages. A simulation platform for pouch-motor-driven linkages would lighten these challenges. However, no such platform currently exists.

In this work, we present a framework for 1) producing three-dimensional models of existing small-scale linkages in a computer-aided design tool, 2) transferring these models to a robot simulation environment, and 3) simulating the dynamics of the linkages according to previously established models of pouch motor behavior. We compare the simulated responses of simulated models to the response shown in previously established theoretical models. Unlike other simulation frameworks based on analytic modelling of a specific linkage, our framework can be easily applied to arbitrarily complex linkages driven by pouch motors. With this simulator, we provide an alternative avenue for understanding the dynamics of insect-scale robotic linkages driven by pouch motors that does not depend on fabricating physical systems.

Jesse Garcia de Alva

Electrical Engineering, UC San Diego
California Louis Stokes Alliance for Minority Participation (CAMP) in Science, Engineering and Math
Mentored by Dr. Ravinder Mittal, UC San Diego Health

A Novel Gel Bolus to Improve the Impedance Based Measurement of Esophageal Luminal Cross Sectional Area during Primary Peristalsis

Introduction: Impedance-manometry is becoming a popular tool to assess esophageal motility. The goal of our research is to use impedance data from this widely available tool to measure the distension of the esophagus. However, air present in the bolus during swallowing causes noise in the signal making this less feasible.

Aims: We present a novel swallow gel intended to minimize the air in the bolus as a solution to this problem. Additionally, the novel gel presents the benefit of moving more slowly in the esophagus.

Methods: 12 human subjects were studied using 5 different swallow conditions: 1) the novel gel in the supine position, 2) the novel gel in the trendelenburg position, 3) the commercially available viscous in the supine position, 4) saline in the supine position, and 5) saline in the trendelenburg position.

Results: The novel gel is capable of providing more accurate impedance measurements leading to a better trendline r^2 values: 1) 0.8792, 2) 0.9037, 3) 0.0089, 4) 0.0008, and 5) 0.7613. Additionally, by visual assessment the time it takes for the esophagus to reach peak distention is greater in swallows using the novel gel. Conclusion: As a result, our novel gel will provide more accurate distension readings due to less noise and a slower velocity. In turn this will support the development of better diagnostics.

James Garrafa-Luna

Environmental Chemistry, UC San Diego
California Louis Stokes Alliance for Minority Participation (CAMP) in Science, Engineering and Math
Mentored by Dr. Daniel Petras, Scripps Institution of Oceanography and Skaggs School of Pharmacy & Pharmaceutical Sciences

Analyzing Chemical Anthropogenic Input in the Ocean Using Public Data

In this study an assessment of anthropogenic input in the ocean was performed using existing mass spectrometry data from public data.. The data sets used in this studies from ten different locations and during the years 2016-2020 were from the MassIVE mass spectrometry data repository . These data are non-targeted tandem mass spectrometry. The data obtained was processed using the GNPS molecular networking platform including the GNPS, Massbank and NIST MS/MS libraries to identify the compounds found in each of the data sets. The compounds were given several categories or tags to classify them by the compound type and potential use and origin: natural product, biocide, drug, food additive, etc. The results of the data analysis show that distinct types of anthropogenic compounds in different environments,Within the identified compounds we observed 187 natural products, 87 drugs, and 5 food additives were found over eleven locations around the world. This study is an important example on the importance of standardized non-targeted chemical analysis and data organization and sharing for long-term monitoring of anthropogenic influences in marine environments. cWe anticipate that the data storage, organization and processing presented here will provide a fundamental framework to trace human activity and effects on the ocean.

Natalie Gevoglanian

Psychology, CSU Northridge
STARS
Mentored by Dr. Lindsey Powell, Psychology

Multichannel Response Patterns to Faces, Bodies, and Scenes in the Infant Brain

Functional near-infrared spectroscopy (fNIRS) is a neuroimaging technology that uses near-infrared light to record changes in brain hemodynamic responses to neural activity (blood oxygen levels). This type of neuroimaging is useful in examining infant brain development. Literature shows that infants develop specialized cortical regions for processing faces and scenes. However, research has not identified whether this type of processing also occurs similarly for other visual stimuli such as for bodies. While it is understood that adults process faces, bodies, and scenes separately, it is unclear whether infant brains differentiate all of these categories. In this study, we test the ability of a correlation-based decoding method called multichannel pattern analysis (MCPA) to identify distinct patterns of activity to faces, bodies, and scenes in the infant brain. We also test whether MCPA will prove to be a more sensitive method for fNIRS data analysis than standard univariate comparisons between conditions in single data channels. Overall, we hope to better understand the hemodynamic responses found in the developing infant brain and provide insight into the cortical processing and categorization of different stimuli while using an emerging data analysis method for the interpretation of these results.

Taryn Gill

Political science, Spelman College
STARS
Mentored by Dr. Tom Wong, Political Science

Polling Location and the Politics of Voter Suppression in Fulton County, Georgia.

Voting is imperative for a democratic society to function accurately and properly for the people; however, what if citizens' right to vote is being disenfranchised by systemic barriers? This project seeks to examine polling location as a mechanism of voter suppression. More specifically, it will pursue two questions: (1) If voter turnout is lower among voters of color, does the location of a polling place affect whether or not they cast a ballot? (2) What are the distinct indications of these polling places that influence voters to not vote? I argue that polling places have distinct dissuading functions that suppress voter turnout among racial and ethnic minorities. I test the effects of the polling location, type, and demographics on the turnout for registered minority voters in Fulton County, Georgia during the 2020 primary election. I find that polling location can deter minority voters from casting ballots. By analyzing polling sites as obstructive along different observable dimensions. This project provides an important contribution to the study of voter suppression and behavior in American politics.

Jacob Gill

Mathematics, UC San Diego
STARS
Mentored by Dr. Edwin Juarez, Department of Medicine

Demonstrating an Information-Theoretic Metric's Usefulness in Associating Gene Expression with Cellular Phenotypes

Historically, gene identification and mapping arose from observations of phenotypes that could be seen such as differences in the eye color of fruit flies. However, breakthroughs in large-scale genome sequencing projects have brought swaths of data from various phenotypes, pairing RNA and their corresponding expression level for each sample of that population. Since differential gene expression allows us to find cell phenotypes which correlate with levels of gene expression, the question then becomes how to determine which correlations in the data are statistically and biologically significant. Applied to medicine, factors like external stressors and drug treatment can rapidly affect the genomic expression of oncogenic tissue. It is critical to have a robust understanding of how cancerous lesions behave in treatment in order to make meaningful adjustments to individualized cancer therapies depending on a given patient's response on a cellular level. Here, I will review our statistical reasoning behind a mathematically sophisticated metric called the information coefficient (IC), a tool which allows us to assess how relevant genomic expression is for a given phenotype. My goal is to apply the IC to many accepted phenotype/gene-expression pairs in order to illustrate the clarifying power this tool possesses. Then I will summarize these results in a straight-forward and easily understood way in order to facilitate public outreach and increase public awareness of this specific information-theoretic metric's usefulness in translational biology.

Lauryn Gist-Reed

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

Infrared Thermal Imaging Screen for Mutant Plants with an Impaired Response to Elevated CO 2

Plants use their stomata for the exchange of carbon dioxide and water to enable CO_2 to enter leaves for photosynthesis. Stomata are tiny pores in the leaves of plants which close to save water or open to increase CO_2 uptake. The stomata are surrounded by guard cells which control the function of opening or closing the stomata depending on environmental conditions, including abiotic stresses. Wild type (WT) plant leaves are warmer when exposed to high levels of CO_2 (900 ppm), as they close their stomata, decreasing leaf transpiration. Mutants in the grass

Brachypodium distachyon were analyzed to observe the effects of high CO_2 levels on the stomatal movement responses. Using this approach, a high-CO_2 insensitive mutant was found, denominated "chill1". In order to obtain an F2 mapping population, chill1 mutants and WT plants were crossed and the F2 generation offspring ratio was examined using infra-red thermal imaging of leaf temperatures. The mutant plants may be recessive and would be expected to make up 25% of the offspring or if the mutation is dominant 75% of the offspring would be expected to show the cool leaf phenotype. Thermal images of the plants were inspected and the putative mutant plants were labelled. 114 plants out of the 561 plants (~20%) were assumed to be mutants, as they had cooler leaves. This segregation of possible F2 cross mutants, can be used to rough map the responsible mutated gene. It is important to be aware of how global warming is negatively affecting plant health. Plants are responsible for our oxygen supply, as well as our food supply. It is necessary to have a deeper understanding of the CO_2–triggered gas exchange that occurs in plants so future science can help plants adapt to climate change.

Peyton Goings

Biology, Xavier University of Louisiana
STARS
Mentored by Dr. Yimin Zou, Neurobiology

The Effect of Ketamine in Planar Cell Polarity

Ketamine, better known for its use an animal tranquilizer, has more recently been used for is antidepressant qualities in treating depression. Depression is characterized by long period of stress and lack of activity. While the administration of the drug has short-term effects of the upregulation of excitatory synapses in axon development, it is of our interest to see how long that these effects will last. The effects of ketamine are tested through the administration of the drug in mice and testing to see their neurological response to the drug over the course of 72 hours. In our studies we have concluded that ketamine positively impacts axonal growth and the development of excitatory synapses post treatment. This can possibly lead us to the creation of new, faster-working drugs for treating depression in the future.

Daisy Gomez-Fuentes

Chicanx Studies, CSU Fullerton
STARS
Mentored by Dr. Frances Contreras, Education

Cruzando Puentes para Alcanzar el Sueño Americano

The Puente Project is designed to increase the number of underrepresented Latinx students who enroll in four-year colleges and/or universities. However, little is known about how Puente has impacted these underrepresented students in their journeys to higher education. The purpose of this study is to investigate the impact of Puente in

community colleges throughout Southern California through interview protocol and surveys. It is essential to understand Puente's impact as the transfer rate numbers of underrepresented Latinx students could increase if involved in this program. The future results for this study will provide important implications in understanding how Puente has impacted this group of students.

Eduardo Gonzalez

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

Linking pesticide exposure to childhood leukemia among Hispanic Americans

Whitehead and colleagues' 2016 study showed that from 1988 to 2012 childhood leukemia in California increased among Latino children, more than all races combined and Non-Latino Whites. We hypothesize that the evidence linking pesticide exposure to childhood leukemia warrants mandates to limit their pesticide exposure. A literature search for articles published in 2015 or later of childhood acute lymphocytic leukemia (ALL) or acute myeloid leukemia (AML) and pesticide exposure among Hispanics was conducted using PubMed and Google Scholar. Twelve out of fourteen articles linked pesticide exposure to childhood leukemia. A study in Costa Rica found maternal exposure to insecticides during breastfeeding a risk to ALL in boys. Children with Latino fathers who were exposed to organic solvents had an increased risk for ALL (OR: 1.48 [95% CI: 1.01, 2.16]). Meta-analyses showed a risk for ALL associated with any pesticide exposure prenatally, during pregnancy, and postnatally were 1.39 [1.25, 1.55], 1.43 [1.32, 1.54], and 1.36 [1.23, 1.51], respectively. For AML the associated risk was 1.49 [1.02, 2.16], 1.55 [1.21,1.99], and 1.08 [0.76, 1.53]. High rates of childhood leukemia in Hispanics are possibly due to working with agriculture's toxic chemicals. Reducing the risk of exposure to pesticides in these communities can be achieved by instituting and adhering to occupational personal protective equipment (PPE) guidelines, and by providing workers PPE education to ensure proper use.

Marisol Gonzalez

Mathematics (Applied), UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Jonathan Novak, Mathematics

Compressed Sensing and its applications to Image Processing

In this presentation I will introduce the main ideas of compressing sensing (CS) at an undergraduate level with the assumption that those who are viewing have some background in linear algebra and some probability. The basics of compress sensing will be motivated by viewing a set of coins and determining which is defective. This will allow us to build the mathematical framework of CS to show how using effective

sampling methods with elementary concepts of linear algebra and probability will allow us to estimate with less sampling of data than the traditional route. I will be looking at sparsity and ℓ1-minmization in order to see and understand how CS is more efficient in reconstructing a signal by the use of an undetermined linear system and its solution. After establishing this framework we will see how these methods are then applied to reconstructing images via compressed sensing. Likewise I will be comparing compression and compressed sensing when it comes to their use in image processing.

Keywords: Compressed Sensing, Matrix Modeling, Sparsity, ℓ1-minmization, Compression

Raed Good

Sociology, UC San Diego
STARS
Mentored by Dr. Akos Rona-Tas, Sociology

Predictive Policing: A Comparative Analysis of Four Countries

On the surface, predictive policing seems like an effective way reduce crime rates in big cities. Previous research claims that algorithms can efficiently make large scale predictions about criminal activity that can be applied to individuals or to locations. However, strong evidence suggests that predictive policing could exacerbate social inequalities. Proponents of predictive policing claim that it will decrease crime, but biased data produces biased results due to machine learning. Our purpose for this study is to compare its manifestation under different legal systems and in contentious regions. In 1994, New York City's police department pioneered CompStat, a primitive predictive policing tool, which was out paced by UCLA's PredPol in 2008. Crime prediction driven by artificial intelligence has grown in popularity ever since and is now being used by over 60 police departments across the U.S. Internationally, Israel uses predictive policing to control Palestinians in the West Bank. Israeli technology is sold to various Gulf countries, including the U.A.E., claiming to defend against terrorism and urban crime. During the 1990s, the U.K. developed a predictive policing tool called ProMap to prevent crime in England. Predictive algorithms rely on big data to make tangible projections from comparisons of similar yet hypothetical scenarios and or individuals. The extent to which these algorithms can influence human behavior is still developing. We suggest that future research focus on the social power of algorithmic predictions and to further investigate the potential for serious consequences resulting from machine bias or from the technologies' misuse.

Samantha Gray

Cognitive and Behavioral Neuroscience, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Douglas Nitz, Cognitive Science

Spatial Firing Patterns of RSC Neurons at Low Versus High Gamma Frequencies

Retrosplenial cortex (RSC) is a unique region of the brain that stands, anatomically, at the interface of the hippocampal formation (HPC) and cortex. As is the case for HPC, neurons in RSC exhibit activity peaks tuned to spatial relationships between an organism at its environment. However, RSc neurons often respond to conjunctions of many different spatial features including position in an environment, position in a route, type of turning action (left versus right), and distance between locations. Additionally, RSC local field potentials exhibit cycling of low and high gamma frequency amplitude modulation as a function of the phase of 8-Hz theta rhythms produced by HPC. Therefore, RSC may encode mixed forms of spatial encoding that are distributed in time across each theta wave. The research performed here demonstrates new methods to use LFP frequency-bands to categorize firing activity of RSC neurons according to the phase of theta. Variations in low and high frequency gamma-band oscillatory activity were identified and used to categorize RSC neuron action potentials. The sub-grouped action potentials of RSC neurons were then compared for their tuning to different spatial relationships to determine how different components of spatial cognition are distributed across theta cycles.

Alan Guandique

Psychology, CSU Fullerton
McNair Scholars Program
Mentored by Dr. Victor Ferriera, Psychology

Do people structure sentences and words using shared mechanisms?

Structural priming paradigms have been used to study structuring mechanisms in language, such as through relative clause attachment in sentences. Studies have shown that structuring mechanisms in language may be involved in other domains, such as in arithmetic (Scheepers & Sturt, 2014; Van de Cavey & Hartsuiker, 2015). For example, the order of operations in arithmetic influences whether producers continue a fragment (e.g., "Someone warned the family of the children who…") by forming a relative clause with high- (i.e., the family) or low-attachment (i.e., the children). Based on analogously ambiguous morphological attachment in noun phrases (e.g., "French teacher" has the high-attachment reading of "someone who teaches French" or the low-attachment reading of "teacher of French descent"), we hypothesize that linguistic units of different grain sizes (i.e. clauses and morphemes) may have shared structuring mechanisms. In Experiment 1, using a structural priming model, we examined whether sentence and morphological attachment preferences affect subsequent attachment preferences in sentence production. In Experiment 2,

we examined whether sentence and morphological attachment preferences affect subsequent attachment preferences in ambiguous noun phrases comprehension. If only sentence (not morphological) attachment preferences affect subsequent sentence production, and the opposite for subsequent interpretations of noun phrases, our findings would suggest that structuring mechanisms are not shared across grain sizes. In contrast, if both sentence and morphological attachment preferences affect subsequent attachment preferences in both sentence production and ambiguous noun phrase interpretations, this would suggest that structuring mechanisms are shared across grain sizes.

Galilea Guerrero

Biology B.S., UC Santa Cruz
STARS
Mentored by Dr. Rachel Dutton, Biological Sciences, Division of Molecular Biology

Investigating Bacteriophage Identity and Function in Cheese Microbiomes

Microbiomes have colonized virtually every surface on Earth, from soil to our gastrointestinal tract, and are of great ecological and medical importance. Bacteriophages are influential members of microbial communities and have the ability to alter microbiome composition and activity. In order to truly understand community dynamics and function, we must investigate the identity and role of the phages present. We studied the biofilms that form on the surface of a cheese due to their ability to be modeled in a laboratory setting. We investigated the identity, function, and persistence of the phages found in natural rind cheese by analyzing phage sequences from a metagenomic coassembly. DNA sequences from cheese rind samples taken at different time points in 2011 and 2017 were co-assembled with metaSPAdes. The resulting contigs were processed and subsequently binned using CONCOCT. Bacterial and eukaryotic taxonomy was assigned using Kraken2, while VIBRANT was used to identify phage sequences and assign functions. These analyses inform us about the functional impact of phages in a naturally-ocurring microbial community and their influence on community composition. While it is possible that specific phage or phage-derived functions are not consistently selected for in this community, we hypothesize that some phage functions, and potentially some specific bacteriophage, will persist in this community over years due to the important consequences that phage may have in a microbiome.

Julia Guerrero

Mechanical Engineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Ryan Kastner, Computer Science and Engineering

Fish Sense

Various organizations monitor fish species to keep track of their population growth and general health, particularly for endangered species. However, this is typically done through the "capture and release" method which can be invasive, and even harmful, to the fish being monitored. We are developing a device that monitors fish from a distance and constructs 3D models to catalog demographics, all without needing to capture the fish. Previous underwater attempts have seen the use of an infrared light (IR) 3D camera to scan for depth information, however, this method has been very difficult to execute because IR stereo scanning is very noisy and it becomes attenuated underwater. To combat this, we are experimenting with the Intel RealSense depth cameras. This includes comparing a stereo IR camera which emits two rays of light and calculates the depth from the difference between them and a light detecting and ranging (LiDAR) which emits one ray of light and calculates the depth based on the time it takes to return.

Qichun Gui

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Chris Mi, Electrical Engineering

Modeling of the power system of an all-electric passenger airplane

The importance of the all-electrical aircraft (AEA) has been highlighted in recent years because of its quiet operation, high efficiency, and zero carbon dioxide emission. Instead of using gasoline as fuel for aircraft, the electric energy source, such as batteries, along with electric machines, are used as sources for AEA to replace conventional engines. Thus, the electrical power system (EPS) for AEA needs a few megawatts to ten megawatts. However, conventional EPS is only designed for kilowatts level. Since the conventional EPS cannot satisfy such a high-power demand, like the propulsion system, it is essential to design a new electrical system architecture from the all-electric-perspective for future aircraft applications. Moreover, the cooling and dynamic control of power generations and conversions are challenged by higher electrical power demand. In this project, the Boeing 737-max is used as the reference to design future all-electric EPS. The power demand and profile for each flighting stage will be estimated by fuel consumption and mechanical efficiency. From previously published literature, the size and power requirement of each electrical load in conventional EPS can be identified. These power requirements are used to model and design the EPS, which will be verified by MATLAB Simulink.

Varvara Gulina

Psychology, California State University, Fullerton
STARS
Mentored by Dr. Lianne Urada, Social Work

Victims who don't see themselves as victims: Analyzing women's perceptions of forced vs. voluntary sex trade in Russia.

Globally, over a third of women have experienced either physical or sexual violence in their lifetime. Up to a third of all adolescent girls report their sexual experiences as being forced, and many victims of forced and coerced sexual labor have experienced other forms of violence (CDC 2020). Applying Sexual Script Theory (Gagnon, Simon, 1973), other studies have found discrepancies between a woman's perceptions of a "typical" rape scenario and her sexual own victimization. This study investigates whether women trading sex in Saint Petersburg and Orenberg, Russia, were more likely to appraise their experiences entering the sex trade as voluntary or forced. Lifetime factors that contribute to this perception were assessed, including experiences of physical, sexual, and emotional abuse. 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; and were less likely to consider leaving the profession. Out of 654 women who were surveyed, Thirty-eight percent claimed that their first commercial sexual contact was voluntary; 35% said it was forced. Analyses showed significant associations between abasement of human dignity within the sex trade (P=0.02) and the view that men who use their services as decent (P=0.009). Implications of this study reveal the importance of assessing a woman's unawareness of her own victimization and the subconscious psychological barriers that prevent her from considering seeking help.

Zijia Guo

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Dinesh Bharadia, Electrical and Computer Engineering

Hitchhike Mother-board

With the increase of devices containing the internet of things, the internet of things is a promising field for future study. Among all the embedded systems, the ideal radio has the lowest energy consumption. Hence this work presents the first low-power IC designed for communicating directly with commodity WiFi transceivers via backscatter modulation. The developed can be woken up directly via a WiFi TRX using a 2.8μW wake-up receiver with -42.5dBm sensitivity - good enough for >30m wake-up range, and backscatters to a frequency-translated WiFi channel via an on-chip 28μW single-side-band QPSK modulator. Wireless tests reveal a range of 21m between WiFi access points. This design has the first hierarchical wake-up for

backscatter and the first network of backscatter tags with individually addressable tags and is the first backscatter system to work with OFDM symbols.

The integrated circuit is designed to achieve low power communication using the backscattering technique on Wi-Fi signals. The IC takes data from a sensor and backscatters it to a Wi-Fi AP. For its operation, the IC needs multiple power supplies and some control signals. The mother-board developed will provide power supplies and control them using an on-board microcontroller unit (STM32L031C6U6). The mother-board also hosts an image sensor(low power camera) and a temperature sensor. The temperature sensor and camera control interface are connected to the MCU via an I2C bus. The camera sends images to the MCU at >1Mbps speed which will be stored in an eternal SRAM memory. The data exchanges between memory, camera, and MCU happen on the SPI bus.

Nadia Haghani

General Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Sreekanth Chalasani, Neurobiology

Characterization of Caenorhabditis elegans skin microbiome and the effects of naturally-correlated bacteria on nematode undulatory behavior

All animals are in contact with communities of microbes, termed the microbiome. Microbiomes play a large part in determining host physiology and even host behavior. While the gut microbiome holds the research spotlight, the skin microbiome is less understood. This is the case for the model nematode, Caenorhabditis elegans; despite subtle implications of surface-adherent bacteria, microbial interactions with its cuticle (skin) remain understudied. We seek to identify, characterize, and define a role for cuticle-resident microbes in C. elegans. To do so, we compared lipid usage, size, and locomotive behaviors between animals either raised on a common laboratory bacterium, Escherichia coli, or a natural model microbiome, CeMBio. Using a well-characterized swimming assay and worm tracking analysis in ImageJ, we gathered that animals reared on different bacterial mixtures show no differences in their undulatory behavior. We also determined that exposure to CeMBio increases animal size yet reduces lipid accumulation. Future work seeks to characterize the skin microbiome through 16S rRNA sequencing. We hypothesize that there is a skin microbiome identifiable by manipulating bleaching protocols and sequencing microbiomes from animals with mutations in genes critical for cuticle structure and function. These studies can provide a deeper understanding of how environmental microbes elicit host behavioral changes and the role of natural microbes in an animal's primary defense—the skin.

Miriam Hamidi

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Truong Nguyen, Electrical & Computer Engineering

Spatial Audio Demonstration

As of now, there are not many online tools available to learn about spatial audio, and almost no demos that experiment with personalization of head-related transfer function (HRTF). HRTF describes how a sound wave is affected by the head and body as it travels through space, so personalizing it to an individual's anthropometric measurements can improve sound localization. The CIPIC database contains ear measurements and corresponding HRTFs of 45 people that can be used by researchers to find an individual's closest HRTF match. Previous HRTF matching techniques have extracted distances from ear pictures, relying mostly on ear size. Our Matlab application offers three algorithms that provide a match based on ear shape. The user can select from block segmentation with Hu moment invariants, principal component analysis, and Q-vector analysis. After the closest ear shape match from the CIPIC database is identified, the corresponding HRTF is used in our demo (instead of the standard MIT KEMAR model HRTF). The demo was created by building on a Github program of a sound moving 360 degrees horizontally. We used C language with Simple DirectMedia Layer 2 libraries, creating a layout for the user to specify the azimuth of the sound that they are hearing. We are creating an easily accessible, streamlined educational module for users to learn about spatial audio, and test for themselves whether the localization of the audio is improved.

Samantha Harmer

Political Science, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Bonnie Kaiser, Anthropology, Global Health Program

Are UCSD's Resources Sufficient for Former Foster Youth's Needs?

According to the Child's Bureau, there are approximately 400,000 children who enter the foster care system in any given year in the United States. Many of these children have suffered from neglect, abuse, and other forms of maltreatment which results in long-lasting trauma. Upon entering the foster care system these experiences are further exacerbated as many children bounce back and forth from home to home and never experience real permanency. Upon turning 18, many foster youth are left to fend for themselves in a world they have not learned to navigate. Oftentimes foster youth are left homeless, incarcerated, or working minimum wage jobs to make ends meet. Unlike the traditional population, higher education is almost impossible to obtain for foster youth due to these experiences. Data show that on average, approximately 10% of foster youth make it to higher education, and only 3% graduate (Airaksinen). My mixed-methods research focuses on conducting interviews and

surveys on food insecurity, housing stability, mental health, and a sense of belonging. This data is used to identify the major stressors foster youth face as students at UCSD. Further, I ask participants to evaluate to what extent campus-based resources support the needs of former foster youth, and I compare these supports to those available through other universities and non-campus organizations. I encourage more mental health and wellness services to be provided to the foster care community and a consistent mechanism to evaluate the proficiency of campus-based resources to be utilized.

Michelle He

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

Androgen-mediated effects on ovarian morphology in an AMH-induced mouse model of Polycystic Ovary Syndrome (PCOS)

Polycystic ovary syndrome (PCOS) is the most common cause of anovulatory infertility, classically presenting with disrupted ovulation, polycystic ovaries, and hyperandrogenism. Androgen excess has previously been demonstrated to be a critical contributing factor in the development of PCOS-like reproductive symptoms in mice. However, precise mechanisms through which excess androgens may act to disrupt the reproductive neuroendocrine axis in PCOS remain unknown. The prenatal anti-Mullerian hormone (pAMH)-induced model of PCOS has been recently shown to recapitulate reproductive phenotypes in mice, and can be a useful tool in investigating contributions of androgens and androgen receptor signaling to pathology. Initial findings report significantly disrupted estrous cycling, decreased fertility, and delayed puberty in female pAMH offspring.

The aims of this project are to (1) characterize the effects of pAMH on ovarian morphology, and (2) determine whether and at what level androgens may mediate these effects. Pregnant dams will receive injections of either AMH or vehicle control (VEH) late in gestation, and female offspring will be assessed for PCOS-like features. To identify pAMH-induced changes in ovarian morphology, ovaries from both treatment groups will be sectioned, stained, and assessed for presence of corpora lutea, as well as abnormalities containing cysts. Similar assessment of mice with a kisspeptin-specific knockout of androgen receptor will then be used to determine the contribution of androgenic signaling in kisspeptin cells to the pAMH phenotype. This project will build upon existing knowledge of the effects of pAMH exposure and provide insight into the causative role of androgen excess in PCOS pathology.

Scott He

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Truong Nguyen, Electrical Engineering

Spatial Audio Demonstration

As of now, there are not many online tools available to learn about spatial audio, and almost no demos that experiment with personalization of head-related transfer function (HRTF). HRTF describes how a sound wave is affected by the head and body as it travels through space, so personalizing it to an individual's anthropometric measurements can improve sound localization. The CIPIC database contains ear measurements and corresponding HRTFs of 45 people that can be used by researchers to find an individual's closest HRTF match. Previous HRTF matching techniques have extracted distances from ear pictures, relying mostly on ear size. Our Matlab application offers three algorithms that provide a match based on ear shape. The user can select from block segmentation with Hu moment invariants, principal component analysis, and Q-vector analysis. After the closest ear shape match from the CIPIC database is identified, the corresponding HRTF is used in our demo (instead of the standard MIT KEMAR model HRTF). The demo was created by building on a Github program of a sound moving 360 degrees horizontally. We used C language with Simple DirectMedia Layer 2 libraries, creating a layout for the user to specify the azimuth of the sound that they are hearing. We are creating an easily accessible, streamlined educational module for users to learn about spatial audio, and test for themselves whether the localization of the audio is improved.

Loren Heins

Astrophysics, Sonoma State University
STARS
Mentored by Dr. Carl Melis, Astronomy

LCO Monitoring of a Sun-like Star with a Transiting Dust Clump

LCO Monitoring of a Sun-like Star with a Transiting Dust Clump
Rocky bodies in inner planetary systems collide with one another throughout a star's lifetime producing dust. Sometimes instabilities between planets within systems generate times of heightened collisional activity, resulting in significant dust production. Identifying and characterizing this dust can inform us on the evolution of Earth-like planets during a star's life. TYC 8830 410 1 is a ~500 million year old Sun-like star that experiences transits from an opaque dust cloud in its inner planetary system. We are conducting optical photometric monitoring of this star to detect more transits and better characterize the structure and origin of the dust. Data is being collected with the robotic Las Cumbres Observatory, and here we present data collected between April and August 2020.

Henry Helmuth

Structural Engineering, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Richard Chavez, Urban Studies and Planning

UCSD Active Commute Plan

Many commuting students at the University of California, San Diego (UCSD) have historically faced difficulty in commuting to campus from the University City area, despite the two regions' close proximity. Students heavily rely on public transportation to commute, however buses are reportedly overcrowded and pass by stops without room for more students. This is an ongoing issue partly due to the fact that UCSD commuters' issues go largely unnoticed in the University Community Plan. The goal of this project is to alleviate transportation and parking demand at UCSD by providing a safe bicycle and walking corridor which connects to dense housing regions in University City. First, a survey, titled The UCSD Commuter Transportation Experience Survey, is created to assess commuter student transportation needs. This survey, along with community demographic, automobile volume, crash statistics, roadway classification, bicycle demand, and housing density data are used to create a performance assessment of the region. These data are then overlaid to locate regions of roadways in University City which have high demand, lack bicycle infrastructure, and which connect to dense housing regions. Based on this model, a cycling and walking corridor is planned which most effectively bridges UCSD and off-campus student housing in University City. Currently, active transport corridors through Regents Road and Executive Drive look like promising candidates. The research will ultimately be given to SANDAG, The City of San Diego, and UCSD, which will bring light to these ongoing issues and motivate further development and implementation of the plan.

Natalia Henriquez

Physics w/ Specialization in Materials Science, UC San Diego
California Louis Stokes Alliance for Minority Participation (CAMP) in Science, Engineering and Math
Mentored by Dr. Tongyan Lin, Physics

Using CMB measurements to gain more precise understanding of dark matter density and interactions.

Properties of the early universe and the Cosmic Microwave Background (CMB) reveal rich physics, specifically in particle physics, that could help lead to the detection of dark matter. Currently, the Big Bang cosmological model finds that dark matter and dark energy account for 95% of the matter-energy content in the in the universe, however, it remains unseen and not yet fully understood. The CMB, this ever-present electromagnetic radiation, a relic of the Big Bang, is a helpful tool in understanding the dark matter interactions detected in the universe. By measuring

different cosmological parameters of recorded data, (such as the dark matter density present in the universe), analyzing the CMB power spectrum, a plot of the temperature variations which reflect density fluctuations in a primordial bath of particles, and through the use of standard statistical forecasting methods, such as Fisher forecasting, improved measurements of the CMB can lead to more precise knowledge of dark matter density and interactions.

David Hernandez

Mathematics, UC San Diego
STARS
Mentored by Dr. Daniel Kane, Mathematics

Queen Packing on an Infinite Chessboard

One of the most studied mathematical chess problems involves placing pieces on a board so that they do not attack each other. Queens are particularly interesting for this problem, given that a single queen attacks the row, column and diagonals on which it is placed; they attack more squares than any other piece. A generalization of this task consists of having two distinct armies of queens such that any queen from one army is not attacking a queen from the other army. As the size of the board gets larger, a reasonable approach is to find the configuration of queens that attacks the least number of squares, so that the opposite army can be placed in those spots that are not being attacked. By packing the queens together, we force them to attack common squares, consequently reducing the total number of cells attacked. In this project, we study the behavior of configurations of queens on an infinite chess board. We look to maximize the number of queens and minimize the number of rows, columns and diagonals attacked. We find the ideal configuration of queens and the optimal rate of queens to rows, columns and diagonals attacked that results from said arrangement.

Jasmin Hernandez Santacruz

Linguistics, Psychology with Cognitive Science Spec., UC San Diego
McNair Scholars Program
Mentored by Dr. Tamar Gollan, Health Sciences

Cost-Benefit Analysis of Inhibition in Second-Language Learning

One of the most efficient methods to learn a second language (L2) is through immersion in a country where that language is spoken. What aspects of language immersion enable adult learners to acquire an L2 more efficiently? An obvious consequence of immersion is more frequent and varied exposure to the L2, but another possibility is that immersion makes it easier to inhibit the first language (L1). If so, learning an L2 would involve cognitive mechanisms that lead to some benefits but also produce some cost to the learner, and if so, it would be of interest to know exactly how and to what extent does immersion negatively impact the learner? In this

study, we tested a group of English-speaking college students learning Italian through a study abroad program in Rome, Italy for a period of ten weeks. Our hypothesis was that language immersion would reduce fluency in the L1, in order to obtain the benefit of acquiring greater gains in fluency in the L2. To test this hypothesis, participants completed a fluency task in which they were given 30 seconds to write down members of a semantic category, including five categories in English, and then they repeated the task in Italian. Fluency testing was done on the first and last days of the term to consider if English fluency decreased, and if Italian fluency increased. Through this study, we hope to determine the benefits and consequences of immersive effects to better understand aspects that are critical for adult language learners. These findings can improve foreign language teaching methods and potentially aid immigrant populations throughout the world in which any means of accelerating language acquisition would be invaluable.

Bao Hoang

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Ramsin Khoshabeh, Electrical and Computer Engineering

IOT communication API for PCB RC car

There is a great barrier of entry for students wishing to prototype an IOT PCB RC car. It requires multidisciplinary engineering aspects including hardware, machine learning, and communication, and demands a great deal of effort. This research seeks to provide the communication layer needed by a student to make a RC car IOT-capable without needing to understand the necessary technology and skills. Three primary IOT use-cases were identified: car-to-car, car-to-computer, and car-to-cloud. Considering the computation equipped on a car, different protocols were explored and compared, including MQTT, CoAP, and WebSocket. MQTT was chosen due to its popularity, lightweightedness, and reliability. A library was created containing different functions which streamlines and simplifies the MQTT process of connection, publishing, subscription, and disconnection. The library further connects the broker with a database to facilitate channel and car management, as well as security features such as channel authentication and restriction. Different database management systems were also explored and compared to reduce latency and concurrency issues. This research seeks to improve the experience currently offered in ECE 140A and ECE 140B. By reducing time needed to tinker with the communication layer, students can have more time developing more important aspects of the smart car such as ML models.

Tingfei Hu

Biochemistry and Cellular Biology, UC San Diego
McNair Scholars Program
Mentored by Dr. Darren Casteel, Medicine

The Function of MYPT2, a Myosin Regulatory Subunit for Myosin Phosphatase in Cardiac Myocytes

Cardiac muscle contraction and relaxation are dependent on the formation of myosin-actin cross bridges, which are modulated by the phosphorylation level of regulatory myosin light chain (MLC). The phosphorylation state of regulatory MLC is dependent on the activity of MLC kinases (i.e. Ca 2+ /calmodulin-activated myosin light chain kinase) and MLC phosphatases. Studies have shown that reduction of MLC phosphorylation leads to cardiac hypertrophy, cardiac dilation, decreased fractional shortening and cardiac failure, emphasizing the importance of MLC phosphorylation in proper cardiac function. MYPT2 is a myosin-targeting/regulatory subunit for MLC phosphatase which appears to play a crucial role in cardiac muscles as it is predominantly expressed in striated muscle, including cardiac myocytes. However, little is known about the exact physiological function of MYPT2. Conversely, a great deal is known about the homologous myosin targeting subunit MYPT1, which is found in smooth muscle cells. Thus, in order to facilitate an understanding of the function of MYPT2 in cardiac muscles, MYPT1 can be used as a model to make inferences about the properties of MYPT2. This review provides an overview of what is known about MYPT2 and outlines putative functions based on its similarity to MYPT1.

Gaopo Huang

Electrical and Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Saharnaz Baghdadchi, Electrical and Computer Engineering

Optical Waveguide-based Biosensor

Over the last decade, optical biosensors have found a spotlight in the biological and medical sciences. Optical Waveguide Interferometric Biosensors are one such device that has garnered interest for its sensitivity, simplicity, and efficiency. By applying the principles of waveguide propagation, Optical Waveguide Interferometric Biosensors allow for the detection of a wide range of biochemical interactions. The simplest of optical waveguides consists of a core material where propagating light is contained, using Total Internal Reflection (TIR), and a cladding material with a refractive index lower than that of the core. The refractive indices and the structure of waveguide characterize the propagation of the light in terms of the effective refractive index. The presence of biological substances at the surface of the cladding will result in a change in the refractive index of the cladding and consequently the effective index of the propagating mode. This is a consequence of the presence of the evanescent field

in the cladding created from TIR at the interface of the core and cladding of a waveguide. Using a Mach-Zehnder Interferometer setup the shift in the effective refractive index of waveguide mode can be measured and the concentration or the presence of the indicator quantified, Using the optical simulation software, Lumerical, we have designed, simulated, and optimized an Optical Waveguide Interferometer Biosensor operating based on these principles.

Sidney Huen

Mechanical Engineering, UC San Diego
STARS
Mentored by Dr. Michael Tolley, Mechanical And Aerospace Engineering

Simulation of a Soft Robot Walking Gait with Directionally Adhesive Suction Discs

Suction discs are able to cling to surfaces by imposing a partial vacuum on the affected surface. While this can create strong adhesion, a system must overcome the suction force keeping the disc adhered when it has to detach from the surface. Because of this, current disc designs are ill-suited for applications requiring frequent detachment, such as walking, despite their potential use in resisting external forces such as underwater currents. In response, we have previously designed a disc that has varying adhesive strength depending on the angle at which a load is applied onto the disc. In modeling the walking motion of a robot, our model was constrained in that the only external control was for limb extension and contraction. While having additional controls for suction force and limb rotation would make a walking gait easier to achieve, this would prove cumbersome to control when later applied to a physical system. In this work, we have simulated the gait of a walking robot with suction discs attached at the end of the robot's limbs, which has allowed us to iteratively determine the parameters required to build a physical system, such as material stiffness, weight, and damping. These parameters were found by determining which values allowed for our robot's legs to shift between angles optimized for suction disc attachment and detachment from the surface. The results of this simulation will not only help to inform the design of a physical robot, but also help to guide future work, such as simulating the motion of a robot with multiple limbs.

Hannah Hui

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

Autonomous Robot Exploration and Occupancy Mapping in a 3-D Python Simulation

Starting out in robot autonomy research can be challenging due to the hardware costs and the low-level programming languages, typically involved in state-of-the-art systems. Our work focuses on developing a simulated environment with a low-barrier

to entry that allows simulation of robots, sensors, and 3-D environments as well as implementation of core robotics algorithms on localization, mapping, planning, and control. We rely on the pyBullet physics engine to model realistic robot movement, simulate LiDAR and camera sensors, and aid testing and visualization of various environments. We implemented particle filter Simultaneous Localization and Mapping (SLAM), which relies on LiDAR data to determine the location of the robot and build a map of its environment. We also implemented a frontier-based A* search, which helps the robot plan its path to a goal in the unexplored area in the map. Both algorithms were implemented in Python and rely on occupancy grid mapping using a log-odds representation. The simulation provides intuitive ways to observe the robot and its environment, while providing plots of the estimated map and planned trajectories output from our algorithms. These results help to ease a new learner into probabilistic robotics.

Kyra Hulse

Bioengineering: Bioinformatics, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Ferhat Ay, La Jolla Institute for Immunology

Improving Resolution of HiChIP data with a Generative Adversarial Network

The 3D organization of chromatin (ie DNA plus nucleosomes and proteins bound to it) in the nucleus plays a critical role in regulating gene expression, which has major implications for cell differentiation and cancer. One of the main methods for studying the 3D organization of chromatin is a biochemical assay called Hi-C, which, when coupled with high-throughput sequencing, produces a genome-wide contact matrix. This contact matrix shows which pairs of regions of DNA are in close proximity. A more recent assay called HiChIP combines Hi-C with immunoprecipitation to generate a contact matrix that is enriched for contacts between the DNA regions associated with a specific DNA-binding protein or epigenetic tag, thus giving insight into the connection between structure and function. The sequencing of Hi-C and HiChIP samples is very expensive, even for low resolution data. I have implemented a type of machine learning model called a Generative Adversarial Network (GAN) to increase the resolution of this contact matrix data without additional sequencing costs. My preliminary results replicate prior work and show this approach is valid for Hi-C data. I am currently working on adapting this technique to apply it to Ay lab's HiChIP data from primary human immune cells to better understand the role of genetic variants in controlling immune cell genes. An overview of the approach, a summary of the Hi-C results, and results on the application of the GAN to HiChIP data will be presented.

Richard Hurtado

Psychology, CSU Northridge
STARS
Mentored by Dr. Victor Ferreira, Psychology

Do people structure sentences and words using shared mechanisms?

Structural priming paradigms have been used to study structuring mechanisms in language, such as through relative clause attachment in sentences. Studies have shown that structuring mechanisms in language may be involved in other domains, such as in arithmetic (Scheepers & Sturt, 2014; Van de Cavey & Hartsuiker, 2015). For example, the order of operations in arithmetic influences whether producers continue a fragment (e.g., "Someone warned the family of the children who…") by forming a relative clause with high- (i.e., the family) or low-attachment (i.e., the children). Based on analogously ambiguous morphological attachment in noun phrases (e.g. "French teacher" has the high-attachment reading of "someone who teaches French" or the low-attachment reading of "teacher of French descent"), we hypothesize that linguistic units of different grain sizes (i.e., clauses and morphemes) may have shared structuring mechanisms. In Experiment 1, using a structural priming model, we examined whether sentence and morphological attachment preferences affect subsequent attachment preferences in sentence production. In Experiment 2, we examined whether sentence and morphological attachment preferences affect subsequent attachment preferences in ambiguous noun phrases comprehension. If only sentence (not morphological) attachment preferences affect subsequent sentence production, and the opposite for subsequent interpretations of noun phrases, our findings would suggest that structuring mechanisms are not shared across grain sizes. In contrast, if both sentence and morphological attachment preferences affect subsequent attachment preferences in both sentence production and ambiguous noun phrase interpretations, this would suggest that structuring mechanisms are shared across grain sizes.

Lauren Ibarra

Biochemistry & Cell Biology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Eric Hekler, Public Health

Development of Digital Adherence Technology for Tuberculosis Treatment in Kampala, Uganda

Poor medication adherence is prevalent for long-term Tuberculosis treatment within developing nations. This leads to detrimental effects, such as disease relapse and drug resistance for the afflicted individuals, alongside the mental and social damage that stems from the cultural stigma around TB. Current adherence models emphasize the use of digital observational technologies (DOT), which are dependent on access to phone-technologies to contact health care workers for verification of adherence.

The phone-technology limits access to specific socioeconomic classes. To expand the reach of DOT, human-centered design research is used to develop five different form factors with novel medication adherence monitors that utilize Global Good sensor technology. The low fidelity prototypes were then reiterated with considerations of discreteness, education, customization, and cultural relevance to ensure the most holistic form models. Higher fidelity models will then be tested at two sites within Kampala, Uganda to gather feedback on form and function. Primary rounds of research emphasize the feedback and input of Ugandan health care workers to ensure forms are both economically and socially considerate. In this project, we navigate the feasibility of the use of DATs for TB treatment within Kampala, Uganda as a way to remind patients to take their medication and facilitate digital observation of pill-taking to help individualize care by TB programs for patients with varied levels of risk.

Tanish Jain

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Tara Javidi, ECE

UV-C Drone: Drone Localization / COVID

In a world trying to grapple with the impact of the Novel Coronavirus pandemic and looking for ways to return to normalcy, a key challenge is to make spaces where people live and work together safer, which includes frequently sanitizing these shared spaces. The UV-C Drone team intends to develop a cost-effective and convenient solution for the disinfection of closed spaces by using a drone to autonomously irradiate surfaces in a room with ultraviolet light to disinfect them. One of the most significant components in this process is being able to localize the drone within a room to ensure that the drone follows the optimal trajectory to disinfect every surface. We analyze several existing techniques to localize the drone and compare them to a neural network-based supervised learning approach to localization. Specifically, we analyze two Simultaneous Localization and Mapping (SLAM) algorithms for drone localization: ORB-SLAM and LSD-SLAM. We run these algorithms on a Robot Operating System (ROS) framework and test their accuracy against a "ground truth" result obtained by tracking the drone's movement against a predefined closed path.

Helen Jannke

Marine Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Richard Norris, Geosciences Research Division

A Paleoecological Record of Fish Production in the Aegean During the Rise of Early Mediterranean Civilizations

Between 14,800 and 5,500 years ago, maximum summer insolation in the northern hemisphere intensified and expanded the African monsoon season. This increased freshwater delivery into the Mediterranean Sea and contributed to the formation of sapropel S1—a dark, carbon-rich sediment deposit that represents a period of high ocean productivity—that was followed by extended oligotrophic conditions. In the URS program, we explored the fish population response to sapropel S1 by assembling an observational ichthyolith record from a deep-sea sediment core taken in the Aegean Sea. We counted fish teeth, otoliths, bones, and scales every 10cm in this core between 162 to 273cm core depth, to track changes in fish abundance between approximately 5,000 and 9,000 years ago: before, during, and after sapropel deposition. Our counts show that ichthyolith abundance increases during the sapropel phase and declines near the end of the sapropel phase, signaling a boom-bust response in fish productivity to the environmental changes associated with sapropel deposition. The observed decline in fish at the close of sapropel S1 is broadly associated with the transition from hunter-gatherer cultures to pastoralism and agriculture in mid-Holocene Eastern Mediterranean societies. Our future work will fill in the details of fish abundance and will evaluate the correlation of this fish record to climatological changes and cultural developments of the mid-Holocene Mediterranean.

Jose Jimenez

Cognitive Science, UC San Diego
McNair Scholars Program
Mentored by Dr. Sarah Creel, Cognitive Science

The Effects of Native-Accents on Cross-Language Activation in Spanish-English Bilinguals

Cross-language activation is a phenomenon in which when processing a word in either language,bilinguals search both of their languages for possible matches. For example, if a Spanish-Englishbilingual were to hear the English word "pepper", a Spanish word that sounds similar, like"pepino", would also be activated. Although cross-language activation has been shown to occurin bilinguals, little research has focused on the factors that affect the magnitude of activation. Inthis project we look at the effect of perceptual influences, specifically accented speech, oncross-language activation in Spanish/English bilinguals. In a gating task, participants were askedto identify a word from successively longer chunks of an acoustically presented

word(p...pe....pep...). The two response alternatives shared word initial sound overlap ("pepper" and"pepino") but were from two different speakers. Speakers varied in language (English orSpanish) and accent (English or Spanish accent) resulting in 4 speaker variations: Englishlanguage-English accent, English language-Spanish accent, Spanish language-English accent,Spanish language-Spanish accent. If the accent of the speaker affects language processing, wewould expect to see more early responses to the choice matching the accent regardless of whatthe word actually is

Adam Kadwory

Bioengineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Vikash Gilja, Department of Electrical and Computer Engineering

Development of an automated recording and analysis pipeline for avian song

Patients who experience disorder in their vocal system leading to a speech loss is a medical condition that to date has not been solved permanently. Speech Impairments can occur due to diseases like laryngeal cancer where it leads to a vocal removal or, locked-in syndrome where the body is no longer functioning and that includes vocalization while the brain remains functioning normally. Our main goal is to build a neural speech prosthesis using the Brain Machine Interface paradigm which can decode neural data in the brain into speech intention that can be synthesized by a computer. The Zebra Finch songbird is an optimal animal model for this research, as they are known for their stereotyped vocalization. The project includes the development of a habituation setup for birds where they can sing freely in an isolated environment with minimal acoustic noise interference. My contribution in this subproject will include the development of a sound processing pipeline that records zebra finch's song and parses, segments and automatically labels these recordings for further analysis. A birdsong vocalization library will be constructed as a result of this subproject to further be used to train machine learning-based for automatic song segmentation and labeling that can generalize across individuals and even across species.

Sean Kamano

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

Datasets for Natural World 3D Computer Vision

Our group is exploring novel approaches to the problem of 3D reconstruction. 3D reconstruction refers to the problem of producing a 3D model of an object given image(s), and optionally other information such as depth maps and camera pose data. We are interested primarily in domain adaptive frameworks which will allow us to leverage large and supervision-ready datasets such as ShapeNet. This is because 3D data on objects in the real world is not at all plentiful or easy to collect. Therefore the ability to utilize 3D rich data such as ShapeNet in order to train real world ready systems is a valuable prospect. 3D objects have been represented in a variety of different ways such as voxels, point clouds, mesh grids, and most recently implicits. Implicit functions appear promising as they allow the essential character of the 3D object to be encapsulated in a single function which, given a point in 3D space, produces a single value (sometimes a real number, other times a bit) corresponding to whether or not the point lies within this object. This appears to naturally lend itself well to currently popular deep learning architectures. We investigate how domain adaptive methodology, along with the relatively new representation form of implicits might aid in further advancing progress in the problem of 3D reconstruction.

Delina Kambo

Bioengineering, UC San Diego
Genentech Scholars Program
Mentored by Dr. Trey Ideker, Department of Medicine, Department of Bioengineering

The effect of cancer cell's genomic mutations and gene expression on cancer cell's genetic dependencies.

Cancer cells are prone to numerous genomic alterations that allow them to develop vulnerabilities that are not found in normal cells. The complex nature of such alterations has made the usage of these cancer cell vulnerabilities as potential therapeutic targets even more challenging. In order to overcome this challenge, platforms like DepMap have documented the genomic profiles of different cell line models as an attempt to build a cancer dependency map. In this study we aimed to use cancer cell data from the DepMap portal to study the effects of a cell's genomic mutations and gene expression on its genetic dependencies. First, we explored the relationships between genomic mutations and gene expression. For instance, in the MDAMB231_BREAST cell line, the expression of genes with frameshift deletions and missense mutations was significantly lower compared to the wild type genes. For the same cell line our results also show a correlation between gene expression and gene

dependency (Spearman's correlation=-0.291,p=0).Next, we compared the dependency scores of wild type and mutated common essential genes for each mutation type across 767 cell lines where most of the mutations showed no significant difference from the dependencies for the wild type genes (P> 0.1). In this study we also attempt to identify specific genes mutated as an attempt to look for genes that can be possible targets for therapeutics and that can help us better understand the vulnerabilities of cancer.

Unduwap Kandage Don

Computer Engineering, UC San Diego
McNair Scholars Program
Mentored by Dr. Vikash Gilja, ECE

Automatic Reporting on Song Data

Neurally driven speech prostheses hold the potential to restore the ability to communicate for individuals with speech disorders. Towards such systems we, at the Translational Neuroengineering Lab, are developing prototypes based on the physiology and vocalization of songbirds, specifically of Zebra Finches. Training models to effectively decode vocal behavior from neural activity requires large scale collection of neurophysiological and behavioral data. To facilitate this process we are actively developing a reporting tool that automatically reports summaries of pre-labeled song data on any given experimental session. This tool takes as input a number of segmented sound files from daily recordings of the Zebra Finch songs, and then outputs information about the distribution of vocal activity throughout the day. Statistics about the structure of the song, after its structural components (e.g. motifs, bouts, and syllables) are labeled, are reported as well. Over time, this tool will allow us to gain intuition about how often each bird sings per day and how long each period of singing is. Although currently in progress, this project has already proven to be very valuable in categorizing birds based on their daily singing rates. Due to the large amounts of data we acquire (twelve hours of data per bird from eight birds per day), this tool allows researchers on the team to easily sort through and understand the song data relatively quickly. This is essential in order to identify periods of interest where we aim to understand the relationship between neural activity and vocal behavior.

Karanjot Kaur

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

An ethnographic investigation of child begging in India

In this paper, I examine the phenomenon of child begging in Chandigarh, India. Child begging is a form of child labor and is a consequence of social inequalities. The

initiatives and laws in place focus on criminalization and forced removal of beggars from the streets. This paper aims to bring to attention the misconceptions about child beggars, which are the driving factors behind most of policy-making. Henceforth, in seeking to highlight the fundamental causes of child begging, this paper draws on ethnographic fieldwork and interviews with child beggars in Chandigarh. The research derives empirical and qualitative material from 35 interviews and fieldwork at 10 city markets and 2 temples. Some common factors recorded are; place of begging, occupation of parents, enrollment in school, size of family, number of siblings, migration, and use of money earned. After analysis of data collected, I argue that child begging in India is nuanced and multifaceted, and not just limited to criminal gangs or begging as a profession. The common problems seem to be: begging out of necessity, parents' alcoholism, lack of education, death of a parent, and access to reliable healthcare. As schools now move online due to COVID-19, there is much cause for concern. Schools not only provide low-income children with free education but also food under the mid-day meal program. Ultimately, more child-centered research is needed to find out what kind of help the children will benefit from, along with the identification of ways in which we can best deliver these solutions.

Merve Kilic

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Siavash Mirarab, Electrical and Computer Engineering

A Fast Implementation of Root-to-Tip Rooting for Virus Phylogenies

While most methods to infer phylogenetic trees from sequence data often produce unrooted trees, the root position is important in many downstream analyses. One of the most efficient rooting methods for large phylogenies is MinVar rooting, which seeks the root position that has the minimum variance root-to-tip distances. A major restriction of MinVar is the assumption that all species are sampled at the present time and therefore, it cannot be applied to phylodynamics data where the sequences are sampled at different time points. Because phylodynamic setting is common in virus datasets which can contain millions of sequences, there is a need for an efficient rooting method that is applicable to phylodynamic data. We generalized the MinVar method to work on a phylodynamics setting. Our rooting method, which we refer to as RTT, minimizes the least-square residuals of the root-to-tip distances in time and substitution units. We proved that RTT can be solved in linear-time and extended the Python-based implementation of MinVar to include RTT. In simulation, we showed that our program scales linearly with the input tree size and finishes rooting a phylogeny of 100000 species in about 4.5 seconds. Compared to the R's ape library's rtt function, our program is about 1850 times faster in rooting a tree of 5000 species. The program is open source and is available on Github at https://github.com/merve-kilic/MinVar-Rooting.

James King

Applied Mathematics, UC San Diego
McNair Scholars Program
Mentored by Dr. K. Wayne Yang, Ethnic Studies

Math Education for Black Students Juxtaposed to the Social Movements of the Past

More than any other area of the school curriculum, mathematics has been used to sort, stratify, and make ability judgments about students, particularly along lines of race and ethnic background. I will be talking about mathematics education for Black learners and how Blackness has been addressed, or not been addressed, in math. We will be looking at how math education for Black children can affect the Black community. I will be using the ideas of W. E. B. DuBois and Booker T. Washington. Though very different, both harbor the belief and notion that Black people must have a sense of self to be able to prosper in our society. But in what way does focusing on math education connect to their theories of change focused on the Black community? Modern-day Black scholars in the field of math education differ from most of the other scholars in the way they talk about Black students in math classes. Instead of focusing on the material, they focus on the student and how the student is able to best exist in a mathematical setting while still growing as a Black child. They focus on the development of Black children in math classes by taking into account their identity as a Black child. This identity in the realm of mathematics creates a prominent and very possible future for the Black community, one that DuBois and Washington envision. Therefore the appropriate answer would be to change the culture of mathematics, while also changing how they view themselves as Black individuals. It means changing the expectations and realities that people see for Black people, and what Black people see for themselves.

Dina Koes

Psychology, San Diego State University
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

Stakeholder Suggestions for Potential Intervention Approaches to Facilitate Cervical Cancer Screening among Women Living with HIV in Surat, India

Women living with HIV are recommended to have frequent cervical cancer (CC) screening, yet few interventions to promote CC screening have been developed in India. This qualitative study assessed stakeholders' (women living with HIV and their health care providers) preferences regarding CC screening intervention content, interventionists, and intervention location. We conducted semi-structured individual in-depth interviews with 25 women living with HIV and 15 health care providers using a standard interview guide. Participants were affiliated with the New Civil Hospital, a public hospital in Surat, India. Interviews were conducted in Hindi, Gujarati, or English, audio-recorded, transcribed verbatim, and translated, if necessary, into

English by multilingual study staff. The constant comparison method and content analysis were used to analyze interview data. Patients suggested an intervention should provide detailed information about CC, what will happen during CC screening, and why CC screening is important. Most study participants stressed the importance of developing an intervention that makes it easier to obtain CC screening and care, such as through improved communication. Healthcare providers and patients indicated that female physicians and counselors should deliver the intervention. Participants suggested both community and clinical settings were appropriate for providing CC screening interventions.This study is one of the first to obtain the preferences of both Indian women living with HIV and their health care providers for developing an intervention facilitating recommended CC screening. These data can be used to develop a CC screening intervention in either a clinic or community setting.

Eliana Kontokanis

Visual Arts (Media), UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dino Dinco, Visual Arts

IN HER OWN IMAGE

IN HER OWN IMAGE examines how female artists create work that subverts the conventions of Catholic representation and symbolization of women to offer a more expansive female futurity. Moreover, my research evaluates how female artists appropriate Catholic symbolism to critique the oppression of women facilitated by the Catholic Church to empower themselves. A limited number of key female figures exist within the Roman Catholic faith. A review of Catholic literature, history, ritual practices, and art reveals that conventional portrayals of Eve, the Virgin Mary, Mary Magdalene, and female saints ascribe negative and often harmful stereotypes to women. These unrealistic roles, e.g. the perpetual virgin, are conceived and controlled by the patriarchal Catholic institution to limit female power and participation in the Church. As an artist with a Catholic background, I wondered how contemporary female artists engage with these conventions when appropriating Catholic symbols in their work. Critical analysis of music videos, fine art performances, and live music performances reveals female artists utilize established symbols and rituals to subvert these stereotypes and reclaim power over and autonomy of their bodies, sexuality, and identity from the Catholic institution. The strategy of appropriation also manifests as a type of critique of the Catholic Church itself. Inspired by the art of female artists who subvert Catholic conventions in their work, IN HER OWN IMAGE culminates in a series of performance art pieces in which I physically engage with my research to advance this critical and creative lineage of artmaking.

Dalia Koujah

Physiology and Neurosciences, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

Age-Related Disparities in Outcomes for ER+ Breast Cancer: Exploring the Role of NUP210

Disparities in breast cancer morbidity and mortality rates exhibit a differential increase with age. NUP210 is a nucleoporin that has been linked to Estrogen Receptor (ER+) breast cancer metastasis. This study explores how NUP210 expression increases with age, correlating with poor prognosis in older (65+) patients. A narrative review of scientific literature indicated a link between NUP210 expression and breast cancer metastasis. Patient data were compiled from The Cancer Genome Atlas (TCGA) and cBioPortal. Data from cBioPortal were categorized into age groups (<65 and 65+), and samples were further narrowed down to select for ER+ breast cancer (N=1825), where NUP210 has been found to regulate metastasis. NUP210 expression was quantified using normalized RSEM (RNA-seq by Expectation-Maximization) values, which represent protein expression for each patient. Survival curves were generated for different age groups, and a p-value below 0.05 was used to determine statistical significance. The literature identifies NUP210 as a metastasis susceptibility gene. Data from TCGA confirms that NUP210 is highly expressed in breast cancer, relative to cancer in other tissues. Categorizing samples into age groups revealed statistically significant differences in NUP210 expression, the most significant difference among patients below 65 years old versus those 65+. This study suggests the need to consider age as a factor in clinical trials, in order to optimize age-specific treatment plans.

Lee Diego Lacasa

Biochemistry and Cell Biology B.S., Cognitive and Behavioral Neuroscience B.S., UC San Diego
Genentech Scholars Program
Mentored by Dr. Taylor Alan Doherty, Department of Medicine

The Effect of the STING Pathway on Innate Lymphoid Cell Changes During Type 2 Lung Inflammation

Asthma, a chronic respiratory disease contributes to high health care expenditure and morbidity; therefore, understanding the biological contributors to allergic airway diseases will help determine a functional treatment for severe asthma. Innate lymphoid cells (ILCs) drive lung inflammation via cytokine production, with ILC2s promoting type 2 eosinophilic responses through IL-5 and IL-13 secretion, whereas ILC1s promote neutrophilia through IFN-γ production. The STING-cGAS cellular pathway includes the synthase for the agonist, cyclic GMP-AMP (cGAS), and the cGAS receptor stimulator of interferon genes (STING), which mounts a pronounced

type-1 IFN response upon pathogenic DNA detection. However, the influence of the STING pathway on ILC-mediated allergic responses remains unknown. Using single (STING-/-, IFNAR1-/-) knockout mice, intranasal challenge with the fungal allergen Alternaria alternata combined with the STING agonist cyclic-di-GMP converted the typical mild, eosinophilic response towards a severe, neutrophilic-dominated response in a STING-dependent manner. Upon STING activation, conventional ST2+CD127+ ILC2s were reduced in the lung, and increases in ST2-CD127- ILC1s were observed. These ILC changes were prevented in STING-/- mice. In addition, we show a delineated role between STING and Type-1 IFNs on innate immunity in an Alternaria alternata model. Thus, showing the novel effect of STING activation on the lung ILC profile during innate type 2 lung inflammation.

Chunjhen Lai

Electrical and Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Pamela Cosman, Electrical & Computer Engineering

Quantifying Reading Order and Completeness Using Eye-tracking

The development of eye-tracking technology enables the quantification of page reading behavior in a fine-grained way. In this project, we study gaze locations across a page as subjects read book pages while wearing eye-tracking glasses. We algorithmically evaluate gaze patterns using data from the glasses and aim to develop an auxiliary tool in clinical assessment for children. For each page, a one-time manual step involves taking a reference high-resolution photo of the page and determining a manual ground truth on the segments, dividing the page into text, captions, and figures. After the subject reads the page and eye-tracking data is captured, the data processing consists of three major steps. We perform Kalman filtering on the raw gaze data to remove blinks and jitter in the data stream. We use image registration with a homography to map the reference photo onto each frame of the world view video. Using the homography parameters, we can calculate various metrics from the gaze data in the segmented ground truth segments. Some metrics of interest are the time spent in each segment, the percentage of each segment read, the number of visits to each segment, and the order of reading segments. The output of our metrics will be able to provide insights into reading behavior, as well as inform the design and layout of textbooks and other materials.

Shereen Lam

Biological Science, CSU Fullerton
STARS
Mentored by Dr. Stanley Lo, Division of Biological Sciences

Using mathematical graph theory to analyze student discussions in small groups

Student collaboration is essential in STEM classroom environments to further student learning. Understanding how certain factors may influence and drive student discussion is valuable to ensuring collaborative success. Typically, small student group discussions are analyzed through qualitative methods. To further understand and identify factors that affect student discussion and collaboration, also known as discourse, quantitative methods are necessary to enhance data collection and analysis. Discourse data were collected through observation of student interactions and discussions in a modified jigsaw instructional strategy. In this instructional strategy, students were first placed into groups to work on different problems. In the second phase of the jigsaw instructional strategy, one student from each group formed a new group where each individual student acted as the "expert" for the problem that they had first worked on. DiscourseGT, an R software package, uses mathematical graph theory to analyze student interactions in a quantitative way. Graph theory allows for quantitative documentation of student communication in different groups within the jigsaw instructional strategy by recording talk-turn patterns to be analyzed using mathematical parameters.

Isaias Larios

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Duygu Kuzum, ECE

Radio modulation classification with neuromorphic computing

Neuromorphic computing presents an opportunity for advances in the fields of machine learning and signal processing. Neuromorphic architecture provides greater parallel data processing at lower energy costs in comparison to the current Von Neuman architecture, making it an ideal candidate for deep learning models. Leveraging the benefits of neuromorphic computing, I am investigating the use of convolutional neural networks (CNNs) and Recurrent Neural Networks (RNNs) to classify the modulation used in radio signals. These signals are often subjected to multiple sources of wireless channel impairment such as carrier frequency offset (CFO), symbol rate offset (SRO), delay spread, and thermal noise. Current classification methodologies use expertly crafted non-trivial features that are often simplified with assumptions in conjunction with a support vector machine (SVM). However, the use of CNNs and RNNs allows for features to be learned naively and has been shown to outperform current models. Using the benchmarking tool

Neurosim, we can measure the physical properties of the device as well as simulate the classification of radio modulations.

Bolarin Lawrence

Nanoengineering, UC San Diego
California Louis Stokes Alliance for Minority Participation (CAMP) in Science, Engineering and Math
Mentored by Dr. Ester Kwon, Bioengineering

Visualization of Next-Generation Sequencing Phage Display Data for Identification of Novel Cell-Targeting Ligands After Traumatic Brain Injury

Traumatic brain injury (TBI) is a major cause of death and disability, affecting approximately two million Americans per year (CDC.gov). Beyond the primary trauma, TBI can progress to a sustained secondary injury. One disease hallmark is neuroinflammation involving microglia, macrophage-like cells in the central nervous system which activate and polarize to a pro-inflammatory state following TBI. Currently, no FDA-approved therapeutics exist to treat neuroinflammation in the clinic. Nanoparticles present a potential alternative to small molecule therapeutics because they can prolong encapsulated drug lifetime in the bloodstream and target to cells of interest. Previous work has shown that passively delivered nanoparticles can extravasate across the damaged blood-brain barrier into brain tissue. Current research is focused on utilizing nanoparticles with active targeting via short peptide affinity ligands that bind to microglia for selective delivery of anti-inflammatory drugs. In vivo phage display biopanning, a process where potential ligand sequences are iteratively screened, was utilized to enrich unique sequences that bind to microglia. These sequences have been identified through next-generation sequencing (NGS). My summer research project centered on generating a platform to display and analyze NGS data. Specifically, I created plots that displayed peptide sequence enrichment and analyzed the quality score of the data. I utilized various programs such as Python, plot.ly, and MultiQC to create visualizations and develop a graphical user interface. The peptide sequences identified will inform future active targeting strategies for treatment of TBI.

Hao Le

Global Health, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Truong Nguyen, Electrical and Computer Engineering

An Automated and Synthetic Testbed for Diverse Driving Data Generation

Motor vehicle traffic accidents appear in the world's top ten leading causes of death on an annual basis. This astounding presence is attributed to factors that inhibit human driver decision-making such as blind spots, adverse road conditions, and slow reaction times. In response, Advanced Driver Assistance Systems in cars provide

drivers with a suite of imaging and ranging sensors (RGB cameras, LiDAR, Radar, etc.) that are utilized in onboard computer systems to effectively understand the road scene and inform higher-level control algorithms. This scene-parsing is accomplished through deep neural networks (DNN) that process raw sensor data into useful formats of object detection bounding boxes (2D and 3D), segmentation masks, object egomotion, etc. However, limitations arise when dealing with supervised learning of DNNs, most notably in the form of data collection. Manual collection generally is subjected to time, financial, qualitative, and geographic constraints. In other words, vast data is expensive and human error-prone especially when its diversity is crucial to the training of robust and well-performing DNNs. To overcome such obstacles, we present a versatile and automated synthetic testbed built upon the Unity3D game engine capable of simulating and rendering photorealistic road scenarios across varying environmental conditions as well as providing pixel-accurate ground truth data. Large driving data sets of high variability are then generated to train an object detector. We show that our synthetic data when strategically coupled with real data holds the potential of improving state-of-the-art object detection performance and robustness.

Nicolette Olivia Le

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Georgia Robins Sadler, Surgery

Disparities in the Patient Pain Experience

Culture can influence people's pain-related perceptions and beliefs while racial/ethnic identities can influence people's experience at the hands of healthcare providers. This scientific literature review included articles that reported disparities in the patient pain experience across ethnic, racial, and cultural communities in the United States published from 2015 to 2020. PubMed, GoogleScholar, and ScienceDirect databases were searched. Disparities in the pain experience were found to be well-documented among patients of African, Asian, Hispanic, Jewish, and Non-Hispanic White descent. Authors identified inadequate pain assessment instruments, lack of instrument validation and norming across diverse communities, and wide variation of healthcare providers' pain management education as challenges to assessing pain-related disparities. The lack of medical guidelines related to prescribing opioids for cancer patients contributed to inconsistent practice patterns. Additionally, differences in patient care, pain self-reporting, and level of patient-provider trust based on socio-demographic characteristics created inconsistencies in oncological and non-oncological pain management. Effective pain management practices that take into account the influences of culture, ethnicity, and race, may help patients cope better with cancer. Culturally competent training programs, validated pain assessment instruments, and improved continuity of care will also advance patient care.

Tiffani Le

Global Health, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Satchidananda Panda, Biology

Time-Restricted Feeding as a Therapeutic Intervention against Cardiovascular Disorders

The circadian clock is a biological timing system that controls the timing of your daily patterns such as the time you wake up and fall asleep. Factors such as light and food consumption sync our biological clocks to the surrounding environment. However, this internal clock can be disrupted by irregular eating and sleeping schedules negatively affecting the metabolism and contributing to obesity (Zarrinpar et al., 2016). Time-restricted eating has become a popular eating pattern where people follow a defined daily period of eating and fasting. In mice, Time-restricted feeding (TRF) has been shown to be a potential preventative treatment for obesity and type 2 diabetes (Chaix et al., 2014). In humans, time-restricted eating can also set back metabolic syndrome. Set windows of feeding are strong contributors to restoring the diurnal rhythms of various metabolic pathways, thus optimizing metabolism and countering adverse effects of nutrient imbalance. It is unknown whether TRF can improve cardiovascular disorders. This study will look into the effectiveness of TRF as a therapeutic intervention in atherosclerosis. To test this, we will use low-density lipoprotein receptor (LDLR) knockout mice which are benchmark pre-clinical models for the study of atherosclerosis and subject them to TRF. Such results are important to decipher whether TRF could relieve the reliance on drugs such as statins.

Juan Andrew Leal

Human Biology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

Childhood Cancer Survivorship and Health Outcomes Among Minority Populations

Non-Hispanic white children aged zero to 19 have a higher cancer survival rate than their minority counterparts. This narrative literature review explored social factors reported to positively and negative impact childhood cancer survivorship and long-term health outcomes impacting adulthood. Evidence-based methods were explored to identify strategies to reduce those disparities. A search of scientific literature related to childhood and adolescent cancer and its impact on health later in life was conducted in the following databases: PubMed, PsycINFO, CINAL, and Web of Science. This review reconfirmed the lower childhood cancer survival rate among minority children compared to non-Hispanic white children. Low socio-economic status, increased distance from National Cancer Institute-designated cancer centers and limited access to information were negatively correlated with cancer mortality rates among minority children. Childhood cancer survivors also experience

consequential health issues later in life. This review showed that adult minority survivors suffered from poorer health outcomes in adulthood. Targeted interventions and increased surveillance must be implemented to increase cancer knowledge and promote healthy lifestyles in minority childhood cancer survivors to reduce the identified disparities. Systematic procedures supporting rural populations' access to healthcare and streamlining the dissemination of health information is crucial in increasing cancer survivorship.

Nicole Lee

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

Exploring the Association Between Higher Mortality Rates after Ductal Carcinoma in Situ (DCIS) Diagnosis

Ductal Carcinoma In-Situ (DCIS) is a non-invasive or pre-invasive stage of breast cancer. With DCIS, the cells that line the breast's milk ducts transform into cancer cells but have not yet spread to the surrounding breast tissue. Of 27,486 patients diagnosed with DCIS between 2000 and 2010, 111 subsequently died of breast cancer and 1,434 died of non-breast cancer causes. Of those 111 who died of breast cancer, 77 died of breast cancer without a documented breast recurrence and 34 died of breast cancer with a documented breast cancer recurrence. Although DCIS is considered non-invasive cancer, these breast cancer deaths subsequent to a diagnosis of DCIS may be an indicator of the need for more breast cancer-related education specifically designed for women diagnosed with DCIS. A review of the recent literature revealed limited research focused on education programs for women with DCIS. Further studies are needed to evaluate whether education programs for women with DCIS should be implemented to contribute to lower post-DCIS breast cancer deaths.

Guanqing Li

Signal and Image Processing, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Pamela Cosman, Electrical and Computer Engineering

Real-time Detection of Interruptions and Conversational Engagement Cues

Individuals on the autism spectrum often have strong cognitive abilities, offering unique strengths to the workforce, but deficits in communication skills lead to high unemployment rates exceeding 80%. This project aims to develop assistive technologies to help individuals on the spectrum improve their social communication skills, especially in the workplace. We aim to do real-time detection of interruptions as well as of conversational engagement cues such as "uh huh" and "yeah" which

are called backchannels. The system will give feedback to the speaker on how to correct their speech behavior as the conversation continues. To detect these events, we are applying deep learning and signal processing techniques to audio data. Using the audio annotation tool ELAN, we have annotated hours of audio from the CallHome English Corpus dataset of conversations to create labeled data for training a neural network. We are implementing a Long Short Term Memory (LSTM) neural network to detect backchannels and interruptions present in conversations. In order to get enough data to train the model for these conversational events, we are investigating data augmentation methods for time series data, including frequency domain and time domain augmentation methods.

James Li

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Ramsin Khoshabeh, Electrical and Computer Engineering

IOT communication API for PCB RC car

There is a great barrier of entry for students wishing to prototype an IOT PCB RC car. It requires multidisciplinary engineering aspects including hardware, machine learning, and communication, and demands a great deal of effort. This research seeks to provide the communication layer needed by a student to make a RC car IOT-capable without needing to understand the necessary technology and skills. Three primary IOT use-cases were identified: car-to-car, car-to-computer, and car-to-cloud. Considering the computation equipped on a car, different protocols were explored and compared, including MQTT, CoAP, and WebSocket. MQTT was chosen due to its popularity, lightweightedness, and reliability. A library was created containing different functions which streamlines and simplifies the MQTT process of connection, publishing, subscription, and disconnection. The library further connects the broker with a database to facilitate channel and car management, as well as security features such as channel authentication and restriction. Different database management systems were also explored and compared to reduce latency and concurrency issues. This research seeks to improve the experience currently offered in ECE 140A and ECE 140B. By reducing time needed to tinker with the communication layer, students can have more time developing more important aspects of the smart car such as ML models.

Yejun Li

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Ramsin Khoshabeh, Electrical and Computer Engineering

3D Machine Learning Training Environment for PCB RC car

Individuals with sole Machine Learning(ML) or IOT knowledge often find it difficult to build PCB-based autonomous RC cars, due to the complexity of building a system demanding both software and hardware skills. PCB Racer strives to provide an environment with sufficient tools to implement their PCB-based autonomous RC cars, without excessive requirements for hardware configuration. To accommodate the learning objectives, Unity 3d Environment with mainstream machine learning tools, like Pytorch and Tensorflow, will be used. In the simulation, there would be multiple training agents using reinforcement learning algorithms, such as proximal policy optimization(PPO). After successful training, the trained models will be used as a framework to configure the actual robocar for optimizing training with its image data. The project is aimed to improving the ECE 140 curriculum by setting up the proper a ML environment for students;thus, enabling students to spend more time learning in mechanical or hardware training

Yidong Li

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Dinesh Bharadia, Electrical and Computer Engineering

Universal IoT Gateway

In the era of Internet of Things (IoT), we see lots of devices transmitting signals in different protocols and channels, so it is useful to have radio gateways that can simultaneously receive and detect those signals. Current commercial gateways typically use different chips, each of which detects signals in one channel at a time for a single protocol. To enable cheaper and more efficient gateways, past work has suggested multi-protocol signal detection using correlation with a universal preamble. However, it does not scale well for multiple channels. More recent work proposes spectrum compression using Short-time Fourier Transform (STFT), but it performs poorly with low signal-to-noise ratio (SNR) due to the need of energy based thresholding. Our idea is to combine STFT based spectrum compression with universal preamble correlation, with inspiration from a subsampling method proposed for spectrum sensing. We suggest using correlations of subsampled data with the universal preamble. We extract the signal's time and frequency occupancies from the correlator outputs and use them to compress the spectrum. The universal preamble ensures that signals across multiple protocols can be captured. The subsampled data is able to include signals from multiple channels and the STFT based spectrum

compression ensures efficient processing of the data. This way, we can enable a robust and efficient multi-protocol and multi-channel IoT receiver.

Jianan Liang

Management Science & Cognitive Science, UC San Diego
UC Scholars
Mentored by Dr. Shannon Ellis, Cognitive Science

PeAce: Integrating AI-based Tutoring and Collaborative Learning into an Educational System

Researchers have designed systems that integrate AI-based tutoring and collaborative learning as these two methods provide individualized guidance for students to learn efficiently, help students practice collaboration skills for future careers, and minimize the teaching burden on educators. This design project explores the methodologies and current trends of Intelligent (AI-based) Tutoring Systems and Collaborative Learning Systems, finding that peer instruction and collaborative problem solving effectively enhance students' meta-cognitive skills, while modeling and improving students' meta-cognitive skills is one of the challenges in AI-based tutoring. We evaluate the merits of several systems (Stepik, Python Tutor, Codecademy, The Betty's Brain, Piazza, Carnegie Learning) and summarize the best current design solutions, including the concept maps of The Betty's Brain and the peer-involved Q&A of Piazza. Finally, we propose a new system, PeAce (Peer-oriented AI-based Collaborative Educational System). PeAce provides an educational system that enhances students' knowledge extraction by shared concept maps, minimizes student confusion time by peer-edited hints and Q&A sessions, provides tutorials and a progress monitoring tool for collaboration, and requires students to do weekly synthesis to identify recent mistakes and complete AI-generated tests to ensure mastery of past mistakes.

Dominique Lie

Molecular & Cell Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Soumita Das, Pathology

The interaction of enteric bacterial effectors with the host engulfment pathway regulates inflammatory responses

Globally, 4-6 million people die of enteric infections each year, a problem worsened by drug resistance. After invading intestinal epithelial cells, enteric bacteria infect phagocytes, but there is limited knowledge about how they interact. Previously, we found that Brain Angiogenesis Inhibitor 1 recognizes bacterial lipopolysaccharide (LPS) and binds to Engulfment and cell motility protein 1 (ELMO1), which facilitates bacteria engulfment and regulates inflammatory responses. While both pathogenic and commensal gram-negative bacteria express LPS, intestinal phagocytes can

discriminate commensals from enteric pathogens. Using Salmonella as a model organism, we hypothesized that ELMO1 interacts with bacterial effectors such as Salmonella SifA that regulate pathogenesis in enteric infections. In-silico analysis and a bacterial database search showed that SifA shares a WxxxE motif with effectors from other enteric pathogens. A previous report found that Shigella effector protein IpgB1 interacts directly with ELMO1 to advance bacterial invasion. The WxxxE motif is also essential for effector proteins, such as IpgB2 and MAP, from Shigella and E. coli, respectively. We are interested in determining how widespread the motif is among pathogenic bacteria by compiling data from BLAST searches and aligning amino acid sequences of effectors with the WxxxE motif. After in-silico analysis, we will search literature to predict the function of all pathogenic effectors with the conserved motif.

Andrea Lin

Structural Engineering, UC San Diego
McNair Scholars Program
Mentored by Dr. Shabnam Semnani, Structural Engineering

Machine Learning Data-Driven Method to solve the Mechanical Behavior of Heterogeneous Materials

This project proposes using data-driven methods using machine learning to solve the mechanical behavior of heterogeneous materials such as rocks and soils more quickly and efficiently. Mechanical behavior is commonly predicted by the Finite Element Method using Finite Element Analysis programs such as Abaqus or Solidworks. They solve smaller parts of a structural problem called finite elements and reconnect them back to solve the original problem through a series of linear algebra equations and physics laws. This method, although effective, is more computationally expensive for nonlinear behavior of heterogeneous materials and multiscale modeling. The goal of this project is to model and utilize a method that is less computationally taxing, quicker, and as accurate than the current Finite Element Method to solve heterogeneous material problems. The proposed data-driven method is equipped with classification and regression tools that can classify data points and predict them without the need of physics laws that strains computational time and power. The data-driven method utilizes deep learning to train a model with experimental data and material properties to predict mechanical behavior or stress-strain relationship of heterogeneous materials. This experimental data is obtained through compression tests simulated and analyzed by Abaqus finite element modeling software to train the Machine Learning program and be used as a reference.

Can Liu

Cognitive Science, UC San Diego
UC Scholars
Mentored by Dr. Douglas Nitz, Cognitive Science

Encoding of Task Phase Versus Environmental Location in Hippocampal CA1 Neurons During Search for Buried Rewards

Solving navigational problems is critical to the survival of most animals. Several brain structures such as the hippocampus and related regions appear to form a distributed cognitive map that enables flexibility in solving navigational problems. Across a large number of studies examining CA1 neurons during open-field foraging, CA1 neurons almost invariably exhibit place-specific firing. It has been shown that hippocampal CA1 neurons are capable of encoding non-spatial information in head-restrained animals. However, little is known as to whether this capacity extends to freely-behaving animals during an open-field foraging task. We developed a task in which rats search for three hidden food rewards whose distribution is like that of the vertices for an equilateral triangle (25 cm edges). All experimental animals exhibited knowledge of the spatial organization both in their behavior on normal trials and on individual probe trials when only the small flag was presented. Under these conditions, we recorded neuron activities in CA1, dorsal subiculum, and posterior parietal cortex. Remarkably, CA1 neurons exhibited little or no spatial tuning according to the environmental reference frame, a finding in stark contrast to finding in published work and to a population of neurons recorded in the same room under random foraging. We also examined firing activity according to task phases. Neurons in all three recorded regions did show tuning to task phase, evidencing a near complete reconstruction of the cognitive map. These findings highlight an unexpected form by which CA1, subiculum, and posterior parietal cortex activity patterns can be aligned according to task phase despite the context of navigation in a naturalistic setting.

Maxwell Liu

Computer Science, UC Berkeley
STARS
Mentored by Dr. Yi-Zhuang You, Physics

A.I. Approximation in Statistical Mechanics

The goal of equilibrium statistical mechanics is to evaluate the ensemble average of physical quantities given the energy function for microscopic configurations of a physical system. While many of these quantities can be easily calculated in systems with small amounts of configurations, as the number of configurations increases these calculations become intractable. To solve this problem, approximation techniques such as Monte Carlo simulations or transfer matrix methods are conventionally used. In this project, we explore a machine learning approach to solve

these kinds of statistical mechanics problems. We plan to investigate the viability of this novel approach by using an autoregressive generative model, which is a deep learning model developed to generate images. By treating each image as a spin configuration in statistical mechanics systems, the generative model can be trained to capture the Boltzmann distribution of a physical system, based on which various physical quantities can be evaluated. We will develop the approach and test it on Ising models, where the result can be compared with known exact solutions. The success of this project will provide novel machine-learning methods for the study of statistical physics.

Zack Liu

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Ramsin Khoshabeh, Electrical and Computer Engineering

Brushed DC Motor Driver Printed Circuit Board (PCB) & Battery Management System (BMS) For Autonomous Remote Control (RC) Car

Our primary objective was to create an affordable and versatile robotics platform to lower the hardware expertise students need to start experimenting with autonomous vehicles. Our team was tasked with creating a driver circuit to control the speed and direction of a brushed DC motor as well as creating a system to charge and manage the lithium-ion battery used to power the RC car. Existing solutions on the market were either too expensive, lacked availability, or did not meet our safety and ease of use requirements. We selected the DRV8873-Q1 integrated chip from Texas Instruments to design our motor driver circuit around as it was widely available and can be used with a wide range of brushed DC motors. The motor driver circuit is controlled from the computer on the car allowing fine control of the motor speed. Lithium batteries offer superior energy density over other battery chemistries, however, lithium-based batteries can ignite if heavily abused from physical damage or from exceeding the maximum specifications listed by the manufacturer. The BMS was designed to protect against scenarios which risk irreversibly damaging the batteries by reducing their life span. Additionally, a buck topology charging circuit was included to convert voltages of up to 28V down to 12.6V to safely charge the battery. This allows laptop battery chargers to be used as an inexpensive charger. Our solution provides a cost-effective and adaptable solution for the motor control and battery management hardware that can be mass-produced as an educational platform.

Samantha Long

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr/ Dinesh Bharadia, Electrical and Computer Engineering (ECE)

Programming ScatterMIMO Surfaces via BLE Links

As WiFi protocols evolve to accommodate exponential increases in data, a constant goal for wireless networks is to provide increased data throughput or rates. Simply deploying more WiFi AP (Access Points) is not always effective, especially when the environment that communication occurs over does not provide for rich signal scattering. Signals lose power when they come into contact with objects (via absorptions/reflections), so typically there is only one dominant path for the signal to reach a user. ScatterMIMO addresses this issue by using a smart surface, placed near an active WiFi AP, to create a secondary reflected signal path directed towards the user that is as strong as the direct path, thus doubling the throughput. The goal of the project is to support multiple ScatterMIMO surfaces via connecting to them with low-latency BLE (Bluetooth Low Energy) links. Using these links, the master-controller is able to send commands wirelessly to a select ScatterMIMO board; each is placed at a different location and equipped with a BLE receiver. This project explores the UART interface between the board's central microcontroller and BLE module, from the most efficient way to handle received serial data (using polling, interrupt, or DMA [Direct Memory Access] modes) to routing it to the appropriate antenna. By using BLE links, multiple ScatterMIMO surfaces can be used in the environment, potentially increasing the throughput by order of magnitude equal to the amount of surfaces.

Carolina Lopez

Biochemistry/Chemistry, UC San Diego
STARS
Mentored by Dr. Amy Non, Anthropology

The influence of genetic ancestry data on clinician's treatment choice for white and mixed race patients with hypertension

The increasing availability of genetic ancestry data has presented clinicians with a potential new factor to consider when developing treatment plans for patients with hypertension. Racial disparities in hypertension contribute to disproportionate deaths among these two communities, and race-specific guidelines- that have yet to be comprehensively validated- may contribute to this disparity. The American College of Cardiology JNC8 race-specific guidelines for management of high blood pressure generally states that black patients should initiate a thiazide or a calcium channel blocker, but nonblack patients should be given additional options for an ACE inhibitor or ARBs. The goal of this ongoing observational study is to explore how clinicians utilize genetic ancestry data in their clinical practice when developing treatment plans

for hypertensive patients. In this study, we examine data from 21 interviews with clinicians regarding treatment plans for mixed race and white patients with hypertension. Preliminary results indicate that while clinicians were generally aware of race-specific guidelines for choice of drug treatment, most did not follow them closely. Instead, they tended to rely on clinical experience which prioritized factors such as potential side effects and lifestyle over genetic ancestry data or race when justifying their reasons for medication choice. Understanding how clinicians use and value ancestry data will be valuable to advance investigations of the contentious topic of race-specific treatment of hypertension between Black and White Americans.

Research Team: Carolina Lopez, Chantal Rabay, Cassidy Tomlinson, Samantha Streuli, Dr. Non

Gabriel Lopez

Molecular and Cell Biology, UC San Diego
California Louis Stokes Alliance for Minority Participation (CAMP) in Science, Engineering and Math
Mentored by Dr. Lidija Vukovic, Molecular Biology

The H3-like region of SARS-CoV-2 protein E is acetylated by p300 HAT

The structure of SARS-CoV-2 was elucidated shortly after the global COVID-19 outbreak: spike protein, membrane protein, nucleocapsid protein, and envelope (E) protein were revealed as the major structural components of the virus. The amino-acid sequence of SARS-CoV-2 E protein reveals a highly conserved region in its C-terminus that resembles the N-terminal domain of histone H3, part of the histone octamer that DNA binds to form structured chromatin. In addition, this H3-like region is similar to the C-terminal region of non-structural protein 1 (NS1) of influenza A subtype H3N2, which has been shown to inhibit anti-viral response by binding transcription regulators that would normally bind to histone H3. Taken together, these observations point to the possible role of SARS-CoV-2 E protein as an H3 mimic that hijacks the infected cell's machinery by binding to transcriptional regulators. Histone H3 is a known binding partner of bromodomain-containing protein 2 (BRD2), an epigenetic reader that binds to acetylated histones in order to regulate transcription. Additionally, a proteomic screen revealed BRD2 as a possible binding target for protein E. In order to elucidate this proposition, we sought to establish lysine acetylation in the H3-like domain of protein E through a p300 histone acetyltransferase (HAT) assay. The results of this assay point to acetylation of protein E by p300 HAT. Furthermore, we plan to express different versions of mutant protein E (where different lysines are replaced by arginines singly or in combination) to determine the specific acetylation site of protein E.

Livier Lopez Canela

Public Health, CSU Northridge
STARS
Mentored by Dr. Drew Walker, Cognitive Science

Seductive details: How do they affect learning outcomes?

Seductive details are additional text in learning material that can steer the reader but are not relevant to the intended learning outcomes. Seductive details are often used in textbooks, lectures, slideshows, and other forms of educational content to make a course more interesting or interactive. Previous research has found negative effects on learning outcomes when seductive details are presented in the learning material. Our learning task will consist of presenting participants with two passages. One of them will contain seductive details and the other will not. Participants will then take a quiz to determine how much of the material they retained. Previous research has shown that seductive details lead to illusions of understanding revealed by students' judgment of learning ratings (Wiley et al., 2018). Based on this theory, we anticipate that students exposed to seductive details will exhibit worse scores compared to students who were not exposed to seductive details.

Songyu Lu

Computing Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Truong, Nguyen, Electrical Computing Enginnering

Spatial Audio Demonstration

As of now, there are not many online tools available to learn about spatial audio, and almost no demos that experiment with personalization of head-related transfer function (HRTF). HRTF describes how a sound wave is affected by the head and body as it travels through space, so personalizing it to an individual's anthropometric measurements can improve sound localization. The CIPIC database contains ear measurements and corresponding HRTFs of 45 people that can be used by researchers to find an individual's closest HRTF match. Previous HRTF matching techniques have extracted distances from ear pictures, relying mostly on ear size. Our Matlab application offers three algorithms that provide a match based on ear shape. The user can select from block segmentation with Hu moment invariants, principal component analysis, and Q-vector analysis. After the closest ear shape match from the CIPIC database is identified, the corresponding HRTF is used in our demo (instead of the standard MIT KEMAR model HRTF). The demo was created by building on a Github program of a sound moving 360 degrees horizontally. We used C language with Simple DirectMedia Layer 2 libraries, creating a layout for the user to specify the azimuth of the sound that they are hearing. We are creating an easily accessible, streamlined educational module for users to learn about spatial audio, and test for themselves whether the localization of the audio is improved.

Yang Lu

Psychology/Clinical Psychology, UC San Diego
McNair Scholars Program
Mentored by Dr. Susan Tapert, Psychiatry

Adolescents' Perceptions of Substance Use Harms are Contingent on Mode of Administration

Vaping emerged in the past decade as a popular mode of administration for adolescent substance use. Early research investigated vaping as a monolithic category of substance use, without specifying the types of substances that were consumed. In studies that examined harm perceptions related to nicotine, adolescents consistently reported perceiving vaped nicotine to be less harmful than cigarettes. The aim of the current study is to replicate and extend these findings by including comparisons of vaped nicotine with vaped cannabis and vaped cannabis with traditional cannabis. An attempted census of 7th graders, sophomores, and juniors was taken from a southern California secondary school district, yielding 604 responses to the 2020 California Healthy Kids Survey, which assesses health behaviors, including substance use and related harms perceptions. Multilevel mixed-effects ordered logistic regressions were employed to evaluate the differences in harm perceptions between the substances consumed (cannabis vs. nicotine) and the modes of administration (traditional vs. vape). Among participants who were substance-naive, the odds ratio associated with higher risk perception was 1.76 (95% CI [1.19, 2.61]) for occasional use of traditional cannabis as compared to occasional use of vaped cannabis. These results indicate that differences in harm perceptions may need to be addressed when designing public health interventions to reduce adolescent substance use behavior.

Mia Lucio

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

Radio Collar Telemetry

Tracking wildlife with radio telemetry is significant to conservation efforts, which utilize knowledge of animal movements for management planning. Our efforts of integrating radio techniques utilize unmanned aerial vehicles(UAVs), which allow for more efficient tracking over large distances and uneven terrain as opposed to on foot. However, UAVs' limited battery life and payload size make it imperative to find an efficient method of tracking to maximize resource use. Previous flight methods include having a UAV fly in a lawnmower pattern over an area to detect a transmitter, and then using collected data to make a post flight location estimate. In order to evaluate the effectiveness of various search patterns, we are building a simulator that allows us to visualize the effect of flight patterns on the accuracy of location

estimates in real time. For example, our simulator's current results suggest that while tracking a single target with a lawnmower pattern, the estimate point does not change significantly after the vehicle travels a few rows on its path, indicating that this may not be the most efficient method in terms of time and battery life. Additionally, flight paths are likely to affect the tracking of multiple targets, which our simulator allows us to study. In order to make tracking with a UAV more efficient, we need to optimize the search pattern. We will do so by describing the effect of various search patterns, noise sources, and other uncertainties on estimates.

Jiachen Luo

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr/ Tina, Ng, electrical engineering

Electronic harness to assist elbow movement

The goal of this project was to design a brace allowing a five years old patient, who suffered from Acute Flaccid Myelitis, to fully utilize his right hand by allowing him to control motion of his elbow. This project was originally designed by an ECE191 group, but there are many issues that require further improvements. The micro controller and the associating codes for the robotic control are missing. Thus, I am responsible for rearranging the circuits of the micro controller with Arduino mega-2560 as a substitution during this summer. I also need to use new wiring methods for reconnection.The final orthosis will be composed of two major components. The first is a harness designed by previous ECE191 group, the harness deign is highly functional and working great. This is because that the material (Dracon) of the harness is highly resisted toward stretching. The second part was a 3D printed arm shell with a flex sensor and a linear actuator attached on it.
When the patient stretches his wrist, the change in resistance of flex sensor could be read by the Arduino board, and it will control the linear actuator which shortens to lift patient's arm. The board and the batteries charging for the actuator will all be put in a bag attached to the harness. Thus, it will distribute the weight of the devices to reduces the pulling force on patient's shoulders.

Jiayi Luo

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Cheolhong An, Electrical and Computer Engineering

Lensless camera: Simultaneous Depth and Scene reconstruction

A camera is ubiquitous nowadays for machine vision as well as human vision. Meanwhile, a lensless camera arises and becomes more important since it take photos and videos without a lens. This improvement will enable people to build a

camera as thin as possible to fit on small real-world applications such as smart phones and robots. This project aims to apply machine learning and deep learning algorithms to retrieve both scene and depth image at the same time from captured complex signal of the sensor from lensless camera.

Rachel Luu

Mechanical Engineering, UC San Diego
Mentored by Dr. Marc Meyers, Mechanical and Aerospace Engineering

Bioinspired Horse Hoof Model

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 a large resistance to high speed impact and compression. Thus, we study the hoof for its great potential in designing new impact resistant 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 micro-mechanisms, we create bioinspired models using computer aided design and additive manufacturing methods, thereby enlarging this structure from the microscopic to macroscopic scale. In order to characterize and differentiate properties of the horse hoof, we develop models that isolate the variables in the structure. Using drop tower tests, we analyze impact resistance, deformation behavior, and mechanical properties present in these models. As an intersection point of materials science, biology, and mechanical engineering, our research both catalogues property findings and cultivates design guidelines for new synthetic materials. Our study on the microstructure of the horse hoof will provide novel insights in the burgeoning field of bioinspiration and will contribute to the next generation of impact-resistant materials.

Anastasiia Makhniaieva

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Michael Yip, ECE

Surgical Robotic System Tracking within an MRI Scanner

Minimally invasive surgery (MIS) provides numerous advantages, including reduced perioperative pain and shorter postoperative recovery time; however, perception and state estimation are primary challenges of MIS. Magnetic Resonance Imaging (MRI) provides real-time non-line-of-sight imaging, enhancing the Interventional Radiologist's ability to precisely diagnose and operate on the patient. Procedures that could greatly benefit from improved perception within an MRI scanner include needle lung biopsy, renal biopsy, and lower back pain management. These procedures all require precise needle access deep within the body while compensating for

anatomical motion. However, MRI scanners have greatly limited space, a high magnetic field, and a slow refresh rate which limits tracking options and speed. We propose a hybrid approach to tracking through the fusion of the low refresh rate MRI images with a properly shielded CMOS camera. This will provide a fused image with the high accuracy and contrast non-line of sight volumetric images of the MRI scanner while retaining the high spatial and temporal resolution of the video camera. This is an initial first-work proof of concept to demonstrate the feasibility of this approach both for tissue and robotic platform tracking. The camera is mounted to the robotic system and has the software ability to track objects inside that would be used for the visualization of the patient inside the MRI using ArUco Markers. This work aims to produce a camera system that will provide real-time tracking for operation and diagnosis, providing direct MRI image-guided procedures.

Greg Maki

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Hanh-Phuc Le, ECE

Extremely High Voltage Power Converter for Soft Robots

As robots become increasingly common in everyday life, the need for polymer-based soft robots capable of performing delicate work grows. These machines are well suited to tasks involving humans, such as surgery, prosthesis, and biomimicry, but often require extremely high voltages (4-10 kV) for their actuators that are difficult to efficiently produce from battery power (2.8- 4.5 V). Consequently, there is rising demand for an efficient DC-DC converter with a large conversion ratio that can bridge this tremendous voltage gap. To address that demand, the Dual-Transformer Hybrid Converter is proposed as on-going research in our group. The goal of this study is to understand the converter operation and improve its efficiency by performing a multivariate optimization of the converter losses using MATLAB and verifications with circuit simulations. We identified the five main sources of loss resulting from non-idealities in the switches, capacitors, and transformers, and then grouped them into conduction loss (related to output currents) and switching loss (related to switching frequency) for better analysis and mitigation. In terms of magnetizing inductance and duty cycle in the flyback stage, capacitance in the switched-capacitor stage, and switching frequency, all the losses were parametrically calculated in an optimization flow to achieve optimal performance in the converter. To confirm the accuracy of our analysis, circuit simulations using PSIM and PLECS were carried out.

Kate Mallari

Sociology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. April Sutton, Sociology

All Bark, No Bite

There is a difference between universities producing a diverse freshman class and universities ensuring that those diverse students graduate. A body of literature shows that first generation college students struggle across academic, social and financial domains; and makes policy recommendations for universities directed at mitigating these common challenges. However, few studies have examined how first-generation college students may be impacted during times of crisis or analyzed how marginalized students may be best supported during crises. I analyze how the events that unfolded during the Spring of 2020- including the COVID-19 pandemic and series of murders of Black men and women- impacted the academic, social and financial lives of first- generation students. I also examined to which extent students felt supported by various factors at UCSD. Interviews from 10 first-generation college students at a large Southern California University, many expressed that the crises faced during spring quarter put a strain on them academically, socially, mentally and financially. Data also revealed that students were frustrated with UCSD's response and level of support offered but- at the same time- were not surprised by UCSD's shortcomings. Overall, this research suggests that the crises over the last several months often exacerbated existing challenges and created new obstacles for first-generation students. Based on students' own experiences and suggestions, I conclude by offering a set of policy recommendations for UCSD aimed at ameliorating these students' ongoing problems and preventing the unique difficulties these students faced during the recent crises.

Steve Anthony Maravillo

Public Health, Education Sciences, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Paula Saravia, Global Health Program

Examining Vulnerability in Troubling Health Outcomes and Disparities Amidst the COVID-19 Pandemic: Black Homelessness in Los Angeles County, California.

In light of the novel Coronavirus pandemic, there is an immense surplus of positive COVID-19 cases projected on individuals that identify with the Black and Homeless populations, two highly vulnerable groups within the United States. Regarding the demographics of Los Angeles County, California, vulnerability is inclusive of a social scientific perspective in which traditionally BIPOC (Black, Indigenous, People of Color) encounter the most complications amidst the current pandemic; nonetheless, populations such as the Homeless, LGBTQIA+, and disabled communities also experience a severe degree of vulnerability. According to the California State

Department of Public Health, the Black population in L.A. County represents approximately 8.16% of the county-wide population, yet suffers roughly 33% of hospitalizations and attribute to nearly 35% of deaths. Meanwhile, the county-wide homeless population represents approximately 20% of positive cases countywide yet accounts for nearly 40% of the mortality fate. In this research project, I am assessing pre-existing data related to the severity of the pandemic and examining varying degrees of health outcomes in the form of demographic, health-related, and social vulnerability experienced by the Black Homeless community of L.A. County. Nonetheless, I am incorporating data collected from the following: World Health Organization, Center for Disease Control, Los Angeles County: COVID-19, and California State Department of Public Health.

Chad Marks

Theatre, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Eva Barnes, Theatre

Take Two: Drama Therapy From An Actor's Point Of View

This project offers a comparative analysis between acting methods used in film & theatre and methods used in the field of Drama Therapy, with an emphasis on exercises, instruction, and techniques used in both fields. Exercises involving puppetry, role playing, character masks, and improvisation along with physical and psychological methods are readily found within the acting educational curriculum. Similarly, techniques, created to better equip actors with a creative skillset, are also employed within the sphere of Drama Therapy. Drama Therapy is a form of psychodramatic therapy used by professionally trained therapists to treat a variety of mental and mood disorders that interfere with an individual's ability to fully recognize, understand, and operate at their true potential. Drama Therapy attempts to help individuals who may be experiencing issues related to depression, anxiety, loss of parent/sibling/relative, body image, self-esteem, or who may have experienced emotional, psychological, physical, or sexual trauma. Due to its similarity to acting instruction, Drama Therapy differs from the typical one-on-one individual interface or pharmaceutical approach. Drama Therapy is group-based and requires the participants to engage, confront, and artistically express while creatively surrounded by one another, similar to certain acting instruction. A cardinal connecting point, is how acting instruction and Drama Therapy, serve to expand our consciousness by providing a better understanding of ourselves in relation to others and society through creative expression.

Josselyn Marroquin

Psychology, CSU Fullerton
McNair Scholars Program
Mentored by Dr. John Wixted, Psychology

Applying Basic Models to Eyewitness Identification

Applying basic science concepts can help address real world social problems. Since 1990, 365 wrongful convictions have been overturned by DNA evidence. In 70% of those cases, eyewitness misidentification has played an important role. In an effort to address this problem, scientists have argued for decades that changing the way police do lineups from showing six photos simultaneously to showing them sequentially helps to address this problem. They also concluded that confidence in an eyewitness identification tells the police little or nothing about how accurate they are. In other words, simply because an eyewitness is confident does not mean they are accurate; thus, judges and jurors should disregard how confident an eyewitness is when making an identification from a lineup. These two ideas were extremely influential, literally across the globe, for decades. However, in 2014, a committee of the National Academy of Sciences suggested that much of this work, which had been conducted mainly by applied psychologists, was problematic. What was needed was basic-science researchers with expertise in formal mechanisms of how we remember, see, and make decisions (Albright & Rakoff, 2014). In recent years, applications of formal models like signal detection theory have overturned both of these longstanding ideas. It turns out that simultaneous lineups are superior to sequential lineups, and confidence in an initial identification is highly predictive of accuracy. The overarching lesson is that basic and applied science need to work together to find effective solutions to problems in our criminal justice system.

Ivette Martinez

Sociology and Education Studies, UC San Diego
UC Scholars
Mentored by Dr. Luz Chung, Education Studies

We Do Not All Have A Traditional College Experience

This paper examines undergraduate students' sense of community and overall involvement at a public university in Southern California prior to, and during, Spring Quarter 2020, when the instruction was remote due to the coronavirus pandemic. I compare the experiences of folks who have lived on campus since their first year and students who were admitted to the university as freshmen, but commute from their family home, more than 20 miles away from campus. Testimonials from both groups are used to raise consciousness on the struggles faced by commuters at four-year institutions. Many commuters describe their time as limited to the classroom, failing to immerse themselves in extracurriculars and supportive networks. Due to the pandemic, various folks who were used to living on campus are now feeling a similar

detachment from the university, although it is only temporary. Commuters are always subject to a less than traditional college experience and it is time for universities to provide the necessary support and services. I am not able to make generalizations about all commuters, but this does bring attention to the experiences of some of these students.

Stephanie Martinez

History, Southwestern College/ UCLA
STARS
Mentored by Dr. Frances Contreras, Education Studies

Puente: Crossing the Bridge of Education

The Puente project utilizes an inter-disciplinary approach and is open to all students in over four middle schools, 38 high schools, and 65 community colleges in California. Although Puente has provided evidence of its success, many community colleges cannot or are not provided adequate funding to support the needs and reach of Puente for their campus population. To understand the impact provided by Puente on college students, data will be collected through secondary data provided by community college reports for student demographic, graduation and transfer rates, as well as annual budgeting. Primary data collection, in the form of interviews, were also conducted to understand firsthand experiences of students and coordinators that participate in Puente. In addition, this study also seeks to understand the unquestionable impact of COVID-19 on the Latinx community and Puente's educational efforts. The success of this study provides empowerment to community colleges in requesting grants and other funding to build upon the framework for student support provided by Puente.

Samuel Mayfield

Environmental Economics and Policy, UC San Diego
STARS
Mentored by Dr. Richard Carson, Economics

Implications of Temporal Misalignment of Reported COVID-19 Statistics for Forecasting the Pandemic's Progression

Each day U.S. states report the grim toll of COVID-19 in the form of death counts, new positive cases, and the number of tests conducted. Unfortunately, what is not widely acknowledged is that a death a state reports on one day may have occurred over a month ago or that today's positive case may have been identified by a test administered weeks earlier. In modeling a pandemic's progression, when an event such as a death actually occurs can be just as important as the event itself. This discrepancy in state-level COVID-19 reporting is exacerbated by differential reporting on weekends and by large out of temporal sequence data dumps of deaths from

nursing homes and negative tests results, which are subject to weaker reporting requirements. By reconstructing the correct temporal sequences for key COVID-19 statistics via death certificates and other auxiliary accounts maintained by some states, I show there are substantive differences in future death counts and positive case forecasts relative to the standard state reported data currently being used by the pandemic modelling community. Specifically, the use of event data with correct temporal sequencing results in short-term statistical forecasting models able to detect earlier movements, both upward and downward, in deaths and positive cases. Forecast confidence intervals, which are quite large using the standard state reported data, are dramatically smaller in models built using data with the correct event temporal sequencing.

Kevin Mazo

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Karl Wahlin, Ophthalmology

The role of miRNA in late morphogenesis of retinal organoids

Cell fate during differentiation is influenced by differential gene expression. MicroRNAs (miRNA) constitute a class of small non-coding RNAs that 'fine tune' cell function by inhibiting mRNA translation and have been shown to participate in neuronal development. In a human stem cell model of eye development, miRNA levels are dynamically and differentially expressed during key stages in ocular development from the uncommitted stem cell stage through retinal development, including the transition from retinal progenitor cells (RPCs) to post-mitotic retinal neurons, including retinal ganglion cell (RGC). To identify differential miRNA expression, a 3D Retinal Organoid (RO) model was differentiated to recapitulate spatial and temporal development of the retina, and small RNAseq was performed to determine the miRNA profile of the RO. Simultaneously, RNAseq was performed to determine the mRNA composition of the RO. Bioinformatic analysis of this process identified that between days 20 (D20) and 45 (D45) of differentiation, 26 different miRNAs are upregulated to inhibit expression of LRP5, CRB2, DLL1, and HIPK2, genes putatively involved in retinal morphogenesis in camera-type eyes. In the initial stages of retinal development, these genes are essential for the proper development of the retina. As an RO differentiates from RPCs to RGCs, however, the retinal morphogenetic pathway must be downregulated as the retina has already been developed, and further expression of this pathway would lead to a loss of stratuous structure in the retina, potentially resulting in retinal degeneration and loss of vision.

Sapna Mehta

Global Health, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Dennis Kuo, Pediatric Hematology Oncology

Universal Cancer Predisposition Screening Protocol within the Pediatric Hematology Oncology Population

The growing availability of large gene sequencing panels available has caused cancer predisposition syndromes in the pediatric oncology population to be increasingly identified due to higher testing availability resulting in an increased amount of positive results. This study seeks for scientists to understand the facilitators and barriers involved with the genetic cancer predisposition screening plan within the pediatric oncology population at Rady Children's Hospital San Diego, while enabling these at-risk individuals with the opportunity to be tested and receive genetic counseling. This clinical trial conducts three surveys on parents and >15-year-old patients before, during and after optional genetic predisposition testing through the Invitae™ Multi-Cancer Panel or clinically indicated cancer predisposition testing along with genetic counseling. These surveys intend to examine knowledge, attitudes, behaviors, and satisfaction regarding genetic cancer predisposition screening along with health literacy, demographic characteristics, and cancer diagnosis. This will allow us to conduct genetic mapping and enable first degree relative cascade testing. 32 patients have completed the entire study with 11 patients that only need to complete the final survey and of these, 2 patients have tested positive for likely pathogenic cancer predisposition mutations. This study may provide clarity on pediatric oncology patient and family knowledge, attitudes and behaviors while providing the opportunity to preemptively inform patients of predisposition syndromes to receive life-saving measures.

Jorge Mendoza

Neurobiology, UC Irvine
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Mentored by Dr. Thomas Hnasko, Neurosciences

Using chemogenetics to manipulate Lateral Habenula activity

Abnormal activity in the Lateral habenula (LHb) is associated with a variety of neuropsychiatric disorders. For example, LHb hyperactivity is observed in patients with depression, while chronic hypoactivity may precipitate the onset of manic episodes in bipolar disorder. In rodents, pharmacological or optogenetic stimulation of LHb is aversive, and causes depressive-like behaviors. Thus, balance of LHb activity may be important for normalized motivation. The LHb receives GABA/glutamate co-release from several inputs, including ventral tegmental area (VTA) and entopeduncular nucleus of basal ganglia, both of which may play a role in balancing LHb activity. Here we sought to validate the use of chemogenetics in

altering LHb activity to cause hyper- or hypo-activity. We injected either excitatory (hM3dq) or inhibitory (hM4di) DREADD (designer receptors exclusively activated by designer drugs) constructs into the lateral habenula of female and male mice. After systemic intraperitoneal injections of clozapine n-oxide (CNO; 1mg/kg) to activate DREADD receptors, Fos protein expression was quantified in LHb using ImageJ software. Our results support the hypothesis that DREADD stimulation can alter LHb activity. Thus, a chemogenetic approach towards manipulating LHb activity can be a useful tool in understanding how imbalanced LHb activity leads to pathological motivations, and allow for future experiments to probe the effect of VTA inputs on balancing motivation.

Zahra Mesrizadeh

Bioengineering, UC San Diego
STARS
Mentored by Dr. Liangfang Zhang, Nanoengineering

Engineered cell membrane-coated nanoparticles functionalized with MECA-79 to target high endothelial venules for enhanced T cell activation

Lymph nodes play an important role in the accumulation, activation, and proliferation of lymphocytes. High endothelial venules (HEV) within the lymph nodes are post-capillary structures in which naive T cells are recruited and presented with antigens. Upon activation, the T cells then return to the bloodstream and can migrate to infected, damaged, or cancerous tissue. Targeting lymphocytes within lymph nodes has been challenging; however, focusing on the T cells in the HEVs can have potential therapeutic applications. Peripheral node addressin (PNAd) is an extracellular protein expressed by endothelial cells in the HEV and is recognized by MECA-79 monoclonal antibodies. The specificity of MECA-79 to PNAds provides opportunities to deliver therapeutic nanoparticles to the HEV, thus improving immune responses. Our lab has explored the advantages of T cell activation using biomimetic nanoparticles fabricated by coating PLGA polymeric cores with the membrane from cancer cells engineered to express CD80, which enables them to present tumor-associated antigens in a stimulatory context. Herein, we propose to design an engineered antigen-presenting cell-mimicking nanoparticle coupled with MECA-79 mAb (MECA-79-APC-NP) capable of enhanced accumulation in the HEV and improved stimulation of naive T cells. MECA-79 mAb will be engineered onto the nanoformulation using chemical bonding. Once the formulation for the nanoparticles is confirmed, their interaction with the HEV and their ability to elicit potent immune responses will be assessed. It is expected that the final MECA-79-APC-NP formulation will effectively accumulate in the HEV to stimulate and activate the naive T cells that are present.

Jonathan Mi

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Truong Nguyen, Electrical Engineering

A New Camera Platform for Computer Vision Application

Thus far, highly accurate computer vision systems have had to rely on expensive non-traditional camera based technologies, such as 3D LIDAR, for depth perception, so it would be desired if a new computer vision system that is both cheap and highly accurate can be developed. There are three phases to this project: first, we need to theorize a model that this new computer vision system is going to use, second, we need to verify that such model can be an improvement to the existing models, and third, we must develop a computer vision algorithm to detect objects and depth and make sure it is optimized for the aforementioned system. During the first phase, we worked out a hypothesis on an improvement for the current camera systems, and now during the second and third phase, we are collecting data using test stands as well as software application we have developed to verify the model's improvement on the accuracy of depth perception and develop a computer vision algorithm that is tailored for the new proposed system of ours.

Jake Millhiser

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Piya Pal, Electrical and Computer Engineering

Overcoming Diffraction Limits with Correlation-based Super-Resolution Algorithms

Historically, Abbe's diffraction limit restricted spatial resolutions to be proportional to the wavelength of incident light. However recent super-resolution techniques have enabled resolution beyond physical diffraction by use of correlation between frames of fluorescence sequences. A technique like SOFI, under a Gaussian point-spread function, is able to increase resolution by reducing the spread width. Further resolution can be gained by use of higher-order statistics (HOS), but this requires a large number of measurements, and causes suppression of weak emitters, known as dynamic range expansion. Sparsity-based super-resolution correlation microscopy algorithms such as SPARCOM attempt to improve upon SOFI by avoiding use of HOS, and instead imposing a sparsity assumption that allows use of correlation-aware LASSO (namely Co-LASSO, which was proposed by our research group) to recover emitter positions and variances. However, SPARCOM forces emitters to lie on a fixed high-resolution grid, and forces the point-spread function to be windowed to the size of a low-resolution grid to allow for efficient computation. Our research seeks to overcome these limitations of correlation-based super-resolution techniques by (i) replacing the emitter recovery step with grid-less non-convex super resolution algorithms such as MUltiple SIgnal Classification (MUSIC), and (ii) improving existing

methods of correlation estimation so that we require fewer frames for emitter recovery.

John Minihan

Data Science, San Diego City College
STARS
Mentored by Dr. Tsung-Ting Kuo, Department of Biological Informatics

Health Insurance Claims on Blockchain for Efficiency, Security, and Privacy

The health insurance claiming process can be lengthy, and manual checking of the disseminated data can be error-prone. This can cause potential time and monetary loss of the patients, providers, and insurance companies. Perhaps intuitively, a data center can be built to collect and exchange data automatically, to increase the efficiency and reduce the potential error rate of the claiming process. However, storing all data in one location makes the entire system vulnerable to malicious actors. For example, if the data center is compromised, all information can be altered, leading to a potential risk of "single-point-of-failure". Firstly, to circumvent this weakness, we plan to adopt blockchain, a distributed data storage platform. In a peer-to-peer blockchain network, each node records all the data, and also alterations to that data. If any node is compromised, the blockchain network can still override the manipulated data. We will also set up private blockchain networks which allow more power over and visibility of the access control at all levels of the system with granular configuration, to further protect patient privacy and conform to Health Insurance Portability and Accountability Act (HIPAA) or other health information regulations. Finally, we plan to develop smart contracts, the code running on blockchain, to automate the claiming process. Smart contracts can further provide benefits such as ensuring the immutability of the protocol agreed between the stakeholders. Using these state-of-the-art technologies, we aim at improving the claiming process to be more efficient and secure while protecting patient privacy.

Jesi Miranda-Santos

Electrical Engineering, UC San Diego
California Louis Stokes Alliance for Minority Participation (CAMP) in Science, Engineering and Math
Mentored by Dr. Frank Talke, Center for Memory and Recording Research/ MAE

Portable Ophthalmic Instruments

The portable ophthalmic instruments project aims to create a portable eye examination system device for the convenience of both the client and doctor. It is a series of basic eye tests that can be taken at home that will determine if there is a need for further examination in person. The two sub-projects focused on were the slit lamp and the acuity test devices. The slit lamp works by taking pictures (via a mobile phone) at different places of the back of the eye using a slit light. Improvements were

made for the printed circuit board (PCB) design by updating individual components to the latest versions available on the market, fixing software and hardware issues, and testing the new design. Keeping replicability in mind, the PCB was designed with surface mount devices for the manufacturers, which would allow for faster production of the board and reduce the assembly time of the entire system. On the other hand, the acuity test device minimizes the size needed for one to do the Snells test examination and then send the result to the doctor. For this device we are in the process of designing an android application that will fit the device to show the different image sizes for the test.

Dawnielle Mitchell

Sociology, Spelman College
STARS
Mentored by Dr. Lane Kenworthy, Sociology

To What Extent is the Mass Medias' Use of Negative Black Stereotypes Affecting Black Adolescents Perception of Self?

Throughout history, the portrayal of the Black community within the media has primarily been far from positive. Television stations and movie producers are moving away from presenting racist caricatures on screen, but the media continues to perpetuate negative stereotypes of Black people while simultaneously highlighting very few positive narratives. While consensus has grown in regards to the lack of positive representation of Black people, this study will examine the extent to which the media's negative depictions of Black people directly affects Black adolescents' perception of self. With the help of extant research I hope to provide a better understanding of how the media participates in the process of identity development for Black youth.

Cameron Moffett-Smith

Physics, California State Polytechnic University, Pomona
STARS
Mentored by Dr. Liang Yang, Department of Physics

Barium Tagging

For my summer project, I used the GEANT simulation package to study how efficient detections of radioactive barium ions are, when using a Germanium detector. The motivation of the project is to tag barium ions that are produced in the double beta decay of Xe-136 in such a way that eliminates background noise in searching for neutrinoless double beta decay. Such a decay process is rare and if it is found, implies that the neutrino is its own antiparticle and physics beyond the Standard Model. As part of the Ba tagging R&D team, we are using a radioactive ion beam at the Argonne National Lab to study the transportation properties of Ba. For example, studying how Ba leaves the surface of metals such as Rhenium, Tantalum, and

Platinum. The Geant simulation will be used to correct measurements for the efficiency of gamma ray detection that cannot actually be measured in the experimental setup. This will also allow us to study the surface desorption of Ba as well as its ionization rate on these surfaces. Detection via the radioactive ion beam technique can be extended in the future for demonstrating the barium tagging process.

Animesh Mohapatra

Nanoengineering, UC San Diego
UC Scholars
Mentored by Dr. Liangfang Zhang, Nanoengineering

Long-Circulating Nanoparticles Inspired by Nature

In recent decades, nanoparticles have improved the prevention, diagnosis, and treatment of diseases. However, efficient therapeutic applications are hindered by the short circulation times of nanoparticles in the body. Organ clearance, opsonization, and phagocytic uptake prevent prolonged circulation. A longer circulation time allows for improved drug delivery and localization. Although, (poly)ethylene-glycol (PEG) is a benchmark for increasing circulation times, research indicates significant shortcomings with this material. Recently, membrane-coated, biomimetic nanoparticles which utilize cellular membranes for immune camouflage have garnered great interest. Membrane-coated particles are further functionalized to improve desired properties. Nonetheless, membrane-coated nanoparticles have not entirely solved short circulation times. On the other hand, some of the body's cells such as red blood cells and cancer cells are equipped with a variety of surface molecules to better circulate. Similar strategies are used by some viruses, protozoa, bacteria, and fungi to avoid clearance and circulate effectively. It is important to be knowledgeable of the methods used by these long-circulating organisms since relevant molecules can inspire modifications to increase nanoparticle circulation times. This review analyzes surface molecules used by diverse organisms to circulate effectively and evaluates the possibility of incorporating these molecules into membrane-coated nanoparticles.

Asim Mohiuddin

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Maripat Corr, Rheumatology, Allergy, Immunology

Regulation of Bone Erosion in Arthritis

String DB is used to outline the consolidating pathway that may lead to the critical path for treatments. Existing knowledge is used and ongoing research is done to identify target genes for future experiments. Project includes data entry from existing experiments using the Von Frey up/down calculator to determine the 50% withdrawal

threshold. Our lab utilizes cloud space where our extensive data files on existing and past projects exist. I will combine my data with the extensive data set that the following strains: 3d, Ifnar1, ikke, ikkeIfnar1, IL10, Irf3, Irf7, Md2, Tlr2, Tlr3, tlr4, Tlr5, Tlr7 Tlr9, MyD88, Ticam1, MyD88/Ticam1, Rag1, Sting, Ticam2, Tirap, Ifnar1CD11c , Ifnar1LysM, Ifnar1GFAP, Ifnar1cx3cr and C57Bl/6 WT mice. The data sets will be sorted for by gender to determine if there are any gender related discrepancies in the onset and resolution of tactile allodynia as they are all collected from the same model with standardized time points. The area under the curve for the inflammatory phase (day 3-10) and the post inflammatory phase (day 18-28) will be calculated for comparisons of the early and late phases. Statistical significance will be tested using analysis of variance (ANOVA) for von Frey and ankle swelling curves compared to WT. Additional statistical tests will be done to analyze between strain and sex comparisons for "q" which will be graphed relative to the normalized areas.

Matthew Moldthan

Manufacturing Systems Engineering, CSU Northridge
STARS
Mentored by Dr. Shaochen Chen, Nanoengineering

3D Bioprinting Approaches for Biomimetically-Patterned Tissue Constructs: A Comparative Overview

Recent advances in additive biomanufacturing-based tissue engineering methodologies, specifically 3D bioprinting, now permit researchers to produce increasingly accurate and complex, biomimetically-patterned extracellular matrices and tissue constructs. Many of these techniques hold great promise, not only as means of generating viable, biocompatible tissues and organs, but also as means to address various ethical dilemma and other technical challenges facing the international scientific community. Advanced photocrosslinkable and chemically-crosslinkable biomaterials have become increasingly prevalent in this field due to the experimental necessity to impart specific material properties, at specific times, for specific applications, during the tissue growth, 3D bioprinting, and biodevelopment processes. This study uses information/data gathered from previous 3D bioprinting studies to summarize the studies' progression/results, weigh the costs/benefits of each approach from a materials science and additive manufacturing-based perspective, and provide a comparative overview of the most promising methods currently available. The findings in this case reflect that the best method is highly contingent on the experimental context. For example, sodium alginate and Pluronic F-127-based bioinks, in conjunction with microextrusion 3D bioprinting, show great promise and for studying biomechanotransductive properties of various carcinoma in biomimetically-patterned extracellular matrices and tissue constructs; however, stereolithography (SLA) based methods, particularly Digital Light Projection (DLP) 3D bioprinting along with photocrosslinkable hydrogels, are a powerful tool for creating complex 3D biological constructs with high throughput for disease modeling and drug discovery.

Mariaelena Montanez

Psychology with a Minor in Biology, Chaffey Community College
STARS
Mentored by Dr. Frances Contreras, Equity, Diversity and Inclusion

"Once a Puentista, always a Puentista."

In the last four decades, The PUENTE Project has been an instrumental program in the California public education system for students of the Latinx community, which are often underrepresented and educationally disadvantaged. The program supports transfer success, academic counseling, and community mentorship; serving students an opportunity to develop effective skills for a brighter future in their academic and career goals. Under Dr. Frances Contreras mentorship, our mission is to evaluate and understand the complexities of the learning outcomes that the program enables the students to achieve. As stated in Dr. Contreras' six projects overview, "The Community College PUENTE Project has never been formally evaluated by a third party, thus many [significant] questions remain unanswered." By exploring the literature provided, research methods and secondary data analysis; our team's ambition is to collect adequate data to propose and implement towards The PUENTE Project, ultimately transcending the Latinx students' journeys and outcomes.

Morgan Montoya

Cognitive Behavioral Neuroscience, UC San Diego
McNair Scholars Program
Mentored by Dr. Jyoti Mishra, Psychiatry

Investigating Cognitive Function in Individuals from Different Racial and Ethnic Backgrounds & its Interactions with Resilience

Neuro-cognition is the ability of the brain to perform appropriate cognitive functions, such as paying attention and working memory, which are associated with specific neural pathways in humans. The ability to neuro-cognitively respond to everyday life demands is a shared experience across all races and ethnicities. Additionally, the ability to overcome hardship, defined as resilience, is needed for daily life. We studied how race and ethnicity influence neuro-cognitive abilities and how these relationships are in-turn, shaped by self-reported resilience. To bridge this gap in knowledge, we used the Brain Engagement (BrainE) digital platform developed at NEATLabs, UC San Diego, which comprised of a suite of game-like assays to study attention, working memory, and conflict processing in and outside of emotional context. We collected demographics (age, gender, socio-economic status) from all participants as well as acquired ratings of resilience measured by the Brief Resilience Scale (BRS). The 248 adult participants reported as Caucasian (53.2%), Asian (27.4%), and Other (19.4%), which also composed of Hispanic (15%), Non-Hispanic (83%), and Unknown (2%) ethnicities. Using generalized linear mixed models, we found that race and ethnicity were important for predicting working memory

efficiency. Resilience alone was not significant in these models; however, we found that resilience interacted with race/ethnicity variables. Understanding how race/ethnicity, resilience, and neuro-cognition are indispensable to mental health outcomes will improve the quality of care given to diverse Americans, and consequently decrease mental health care disparities.

Joseph Morales

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

Assessing Factors Associated with Trust in Physicians among Caregivers of Children with Newly-Diagnosed Cancer

Caregivers' trust in physicians can help achieve optimal outcomes in pediatric cancer. Information on physician trust among minority communities' caregivers with cancer is lacking. This study explored factors associated with trust among Hispanic caregivers of children with cancer. The Pediatric Trust in Physician Scale (Pedi-TIPS) was completed by 140 caregivers of children with newly diagnosed cancer at Rady Children's Hospital-San Diego; Half (69 (49%)) were Hispanic and half (71 (51%)) non-Hispanic Whites (NHW). Multiple surveys were given in order to measure the contextual and socio-demographic factors associated with trust in physicians. The participants in this study were the children's primary caregiver; 67% were the children's mother. The mean difference of the Pedi-TIPS scores between Hispanics and NHW was 0.081 (p = 0.934). Disparate levels of trust in physicians among caregivers were only correlated with caregivers' number of children, with caregivers with one child scoring higher in trust than among those who had two or more children (p = 0.006). Trust in physicians was comparable for Hispanic and NHW caregivers. While this study showed no correlation between trust and ethnicity, the sample size was small and limited to one geographic region. Further research is needed in larger geographically and ethnically diverse Hispanic communities to confirm the reproducibility of these results.

Xelestial Moreno-Luz

Media, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Marian Wardwell, Visual Arts

Transgender Movements of Color and Audio-Visual Culture: Insisting Till Our Last Breath

Gender as a colonial construct has enabled centuries of Black-Indigenous genocide across the Americas and beyond. The will to resist oppression can be observed through contemporary transgender & non-binary movements – connecting a transcultural transgender community that mobilizes for the right to self-determination

and collective autonomy. In 2015, the LGBTQIA+ media advocacy organization GLAAD reported that 84% of Americans do not personally know someone who is transgender. Since the 1800's mass media has communicated dehumanizing attitudes that inform the public on how we should engage with transgender people. The Human Rights Campaign released a statement that at least 27 transgender people have been murdered in 2020, mostly Black transgender women. Where can we observe the nuances of gender-expansive bodies chartering social movements and mass media in the last 200 years? What strategies are transgender artists and organizers utilizing to challenge the social ramifications of heterosexuality, cissexism, capitalism, and white supremacy? By creating discursive sites, transgender movements are crafting new ways of contesting violence – and designing innovative worlds to exist as interconnected beings of multiple experiences. How do transgender movements prioritize what immediate needs their communities require in order to live equitably, and exist in their right towards gender self-determination?

Jason Morris

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Ramsin Khoshabeh, Electrical and Computer Engineering

Brushed DC Motor Driver Printed Circuit Board (PCB) & Battery Management System (BMS) For Autonomous Remote Control (RC) Car

Our primary objective was to create an affordable and versatile robotics platform to lower the hardware expertise students need to start experimenting with autonomous vehicles. Our team was tasked with creating a driver circuit to control the speed and direction of a brushed DC motor as well as creating a system to charge and manage the lithium-ion battery used to power the RC car. Existing solutions on the market were either too expensive, lacked availability, or did not meet our safety and ease of use requirements. We selected the DRV8873-Q1 integrated chip from Texas Instruments to design our motor driver circuit around as it was widely available and can be used with a wide range of brushed DC motors. The motor driver circuit is controlled from the computer on the car allowing fine control of the motor speed. Lithium batteries offer superior energy density over other battery chemistries, however, lithium-based batteries can ignite if heavily abused from physical damage or from exceeding the maximum specifications listed by the manufacturer. The BMS was designed to protect against scenarios which risk irreversibly damaging the batteries by reducing their life span. Additionally, a buck topology charging circuit was included to convert voltages of up to 28V down to 12.6V to safely charge the battery. This allows laptop battery chargers to be used as an inexpensive charger. Our solution provides a cost-effective and adaptable solution for the motor control and battery management hardware that can be mass-produced as an educational platform.

Ameen Muhammad

Mechanical Engineering, Howard University
STARS
Mentored by Dr. Jinhye Bae, Department of NanoEngineering

Solute Diffusion in Hydrogels

Throughout the years, the number of applications of hydrogels has steadily increased due to their distinctive structure and vast mechanical properties. Oftentimes, modeling this type of diffusion can present challenges due to the special makeup of hydrogels.There are currently three basic theories that model the diffusivity of solutes in hydrogels that include: Free Volume Theory, Hydrodynamic Theory, and Obstruction Theory. Although these models have provided much data, these studies still lack a predictive model. In this study, we have looked into a more efficient model for understanding the diffusivity of solutes in hydrogels. In this study, we have analyzed new ways of modeling the diffusivity of solutes in hydrogels by studying the three basic theoretical methods.

Jaqueline Munive

Education Studies and Sociology, UC San Diego
McNair Scholars Program
Mentored by Dr. Makeba Jones, Education Studies

Understanding the Educational Journey of Undergraduate Latinx Students: Latinx Womxn Perspective

The Latinx population is the fastest-growing population in California as it is expected that by 2060, 45% of CA's population will be Latinx. Therefore, it is pivotal to provide Latinx students with an equitable education where they will be able to attain their degrees in a timely manner. In the last 14 years, college Latinx enrollment has increased by 12 percent. However, Latinx students continue to have one of the lowest retention rates in comparison to other ethnicities. The purpose of this study was to gain an understanding of how Latinx students are navigating higher education institutions to learn what these institutions can do to increase Latinx retention and 4-year degree attainment rates. The following questions guided the study: 1. How can higher education institutions increase Latinx retention? 2. How do Latinx college students describe their experiences in higher education? 3. What can higher education institutions do to ease Latinx students' transition from high school to a 4-year college? The focus for this research was on undergraduate Latinx identified women at the University of California, San Diego. The study was a combination of quantitative and qualitative research methodologies where 30
undergrad Latinx women completed a survey and 6 interviews were conducted. By highlighting Latinx students' voices and experiences, this study includes recommendations on what higher education institutions can do so Latinx students feel supported during their journey in college.

Nicholas Munoz

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

Burrowing Owl Classification

Behavioral ecologists rely on a variety of technologies to study animal population and their behaviors in order to help certain species. The burrowing owl population has been declining in the Southern California area and researchers are using camera trap images to develop science-based solutions to reverse this decline. Unfortunately, a significant amount of time is used to label and filter their data manually. With the use of machine learning techniques, we are developing a pipeline to automate the labeling, ultimately saving time for researchers. Our pipeline uses detection and classification to extract information from the images and label interesting events. This allows us to get to our ultimate goal of behavior classification. To design this pipeline, we integrated an open sourced software(Microsoft MegaDetector) with our pre-trained owl classifier model. With this pipeline researchers will be able to save time by filtering and classifying their data, bringing them closer to their goal of protecting these burrowing owls.

Ryan Myers

Marine Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Martin Tresguerres, Marine Biology Research Division

Unique strategies for life at hydrothermal vents in the giant tubeworm Riftia pachyptila

Deep-sea hydrothermal vents boast extreme conditions, making them hospitable to only a handful of specialized organisms. A vent at 2500m deep can have pressures 250X higher than atmospheric pressure at sea level, high magnitude temperature fluctuations from the mixing of 2°C ambient bottom water with the superheated (up to 464°C) vent fluid, and nutrient-poor water that ranges from hypoxic to anoxic, all while in a state of continuous darkness. The tubeworm Riftia pachyptila is one of the most studied organisms found in these communities. For my research project, I am writing a comprehensive literature review on the physiology of the giant tubeworm R. pachyptila. Adaptations of the tubeworm are to be mouthless and gutless, and overcome the nutrient challenges of vent living in a symbiotic concert with the bacterium Candidatus Endoriftia persephone, which are retained in their trophosome. R. pachyptila take up hydrogen sulfide emitted from the vents using their sizable gill plumes which on average have a specific branchial surface area of 22 cm2 · g-1(~9X of that of the rest of their body). Once absorbed, the sulfide bonds to specialized hemoglobin which can concurrently bind sulfide and oxygen by blocking sulfide-oxygen interactions with zinc and subsequently binding sulfide to free cysteine

residues and disulfide groups in the globin chains. Candidatus then chemosynthesize through sulfur oxidation to meet energetic demands producing ATP and organic carbons which R. pachyptila capitalize on for its energy requirements. My review will consolidate recent research on R. pachyptila and provide context to its current relevance in the field of cellular physiology as well as suggest novel questions to be investigated through future studies.

Nay Chi Naing

Molecular and Cell Biology, UC San Diego
McNair Scholars Program
Mentored by Dr. Pamela Mellon, Obstetrics, Gynecology and Reproductive Sciences

In vitro regulation of the Kiss1 promoter by VAX1

Kisspeptin neurons in the hypothalamus are critical regulators of the hypothalamic-pituitary-gonadal (HPG) axis. Dysregulation of the neuropeptide kisspeptin, produced by the Kiss1 gene, can cause negative effects in reproduction, such as delayed or absent puberty, altered gonadotropin and sex steroid secretion, and partial or complete loss of fertility. The homeodomain transcription factor, VAX1 is necessary for reproduction in mice and could play a role in the regulation of Kiss1 transcription. The heterozygous loss of the Vax1 allele results in increased Kiss1 mRNA in female mice, despite decreased Gnrh1 mRNA expression and various degrees of subfertility. We investigated the role of VAX1 in regulating mouse and human Kiss1 promoters in immortalized kisspeptin neurons derived from the anteroventral periventricular nucleus (AVPV) or the arcuate nucleus (ARC) of a female mouse. We found that overexpression of VAX1 represses the mouse and human Kiss1 promoter in both AVPV and ARC cell lines. The optimal concentrations of VAX1 in mediating this repression in AVPV and ARC cell lines with the mouse Kiss1 promoter were 200 ng and 50 ng respectively and the optimal doses of the human Kiss1 promoter were 100 ng and 50 ng respectively. These experiments demonstrate that VAX1 is capable of regulating the Kiss1 promoter and will further our understanding of Kiss1 gene regulation and the roles of homeodomain transcription factors within the HPG axis.

Ali Nekouei

Chemical Engineering, UC San Diego
STARS
Mentored by Dr. Thomas Bussey, Biochemistry

BioChemAR in the Classroom

Understanding the relationship between macromolecular structure and function is a core learning outcome in nearly all biochemistry courses; however, instructors are largely limited to using two-dimensional images in order to teach students about three-dimensional biomolecules. This can limit the ability of students to grasp key visuospatial elements such as scale, the impact of conformational change, and the

spatial and temporal relationship and interactions between and within a macromolecule. To address the current gap in instructional tools available for teaching macromolecular structure, an augmented reality (AR) tool, BiochemAR, has been developed for and piloted in a college-level biochemistry course. To study the impact of the use of this technology, we are using an equity framework to explore how the technology and classroom instruction impact students' access and engagement. In this presentation, I will discuss the preliminary analysis using the Equity QUantified In Participation (EQUIP) tool and potential implications.

Katherine Ngo

Cognitive Science, UC San Diego
Converge Incubator
Mentored by Jacques Chirazi, Office of Innovation and Commercialization - Basement / Blackstone Launchpad Program

Municipal Microgrid Planning

Cities are at the forefront of the national conversation about climate change. Increasingly, elected officials and city residents are finding ways to deploy more clean energy and reduce their carbon footprints. Our team was tasked by the city of San Diego to establish a methodology for identifying ideal municipal microgrid locations. The City is interested in installing renewable microgrids (both campus-style and single building) to increase resiliency in response to climate-driven energy disruptions. Our solution was a detailed ranking system that took into account of several criteria including: cost benefits, GHG (greenhouse gases) emissions, resilience value, and community impact.

Lucia Nishizawa-Rodriguez

International Studies- Literature, UC San Diego
McNair Scholars Program
Mentored by Dr. Carol Arcos Herrera, Literature

El performance, la mujer, el ser y la (r)evolución

Esta investigación tiene como propósito analizar el performance Un Violador En Tu Camino con enfoque en su impacto en México. Es en los movimientos feministas descoloniales, que vemos el uso del performance como acción política paravisibilizar demandas frente a las grandes mayorías. Con ello, también, es posible ver el impacto de las realidades creadas por los medios tecnológicos de hoy, mostrando el rol de la permanencia. El uso de los medios digitales de comunicación nos ofrece realidades diferentes para los movimientos políticos que demandan justicia o derechos, en el caso de esta investigación importa cómo el movimiento feminista se levanta contra la recurrencia de los feminicidios y la violencia contra la mujer en México. Intento analizar los espacios creados por elperformance, su impacto social, político, e histórico, por medio del uso de un performance feminista en un país como

México. Para ello documento brevemente las tres olas de feminicidio en México, la historia del performance, y las cuestiones digitales del activismo que se presentan hoy día.

Syreeta Nolan

Psychology/Human Health, UC San Diego
McNair Scholars Program
Mentored by Dr. Francesca Telese, Medicine

A Systematic Review of Methamphetamine Use Disorder Considering Syndemic Factors in HIV

Methamphetamine (METH) addiction is a psychiatric disorder that affects millions of Americans that are left without effective pharmaceutical treatments. In addition, METH abuse is widespread among the HIV positive population. However, the effects of this syndemic are poorly understood. Here we are using a systematic review approach to answer the following questions: (1) Are pharmaceutical treatments successful in methamphetamine user's ability to maintain abstinence? (2) Does HIV status in methamphetamine users impact their ability to maintain abstinence? METH is pharmacokinetically distinct from other psychostimulants with longer lasting highs compared to other psychostimulants. Long lasting effects of METH abuse include Methamphetamine Associated Psychosis in a third of METH users and a similar pattern of necrotic cell death as seen in traumatic brain injuries (TBI). Among HIV positive patients, a leading hypothesis is that METH is used to self-treat HIV-related pain. This research will take one step forward towards helping patients affected by METH addiction to have the pharmaceutical support that they need to sustain abstinence into a full recovery.

Naama Nunez

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

Across Borders: The Role of Education in Transnational Students' Career Trajectory

Living near the U.S.-Mexican border has had heavy influence on the lives of both American and Mexican communities. While the ability to cross from one country to another becomes facilitated, their close proximity to the border also creates a larger possibility for dangerous and criminal activity, at times causing its residents to experience traumatizing events. These, and many more factors, are what influence students from both La Jolla High School in San Diego, California (pseudonym) and Casa de Revolucion Middle School in Tijuana, Mexico. This project studies how effective and useful resources for these transnational students are in both U.S. and Mexican schools. This is done by following transnational students who have self identified as having lived, crossed or been born in the U.S., while going to school in

Mexico, and vice versa, and conducting both group and individual interviews. In addition, a series of surveys conducted on ninth grade students in the U.S. and Mexico further help depict the reality for transnational students on both sides of the border.

Dora Ogbonna

Chemical Engineering, UC San Diego
McNair Scholars Program
Mentored by Dr. Nisarg Shah, Chemical Engineering

Literature Review on Cytokine Release Syndrome in Autoimmune Diseases

Cytokine Release Syndrome (CRS) is a systemic inflammatory response that involves the continuous and uncontrolled release of proinflammatory cytokines. It is a characteristic that is prevalent in many diseases. The presence of this symptom spans different time periods from hours to years. It can induce death quickly or can be prevalent for an extended amount of time slowly leading to destruction of the organs like in the case of Autoimmune DIseases. Autoimmune diseases are diseases where the body defends against itself due to various factors and events. I will be discussing the characteristics of CRS in long term illnesses more specifically Autoimmune Diseases and its effects of CRS in select autoimmune diseases, the cytokines involved, the treatments tested and the hopes for future uses. Some autoimmune diseases discussed are Rheumatoid Arthritis and Chronic Graft Versus Host Disease. I conducted this review by reading articles published with regard to the latest developments in the area of CRS and Autoimmune diseases. The sites used to conduct this search were google scholar and PubMed. I reviewed about 30 articles published within the last five years, which contains information regarding Cytokine Release Syndrome in different Autoimmune diseases. From my initial findings, there are multiple advancements with regards to CRS in long term autoimmune diseases, this includes several new approaches to treating and regulating CRS in patients. I expect this project to help inform and guide research on CRS in autoimmune diseases.

Shawn Ogden

Biology, San Diego State University
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

Researchers Need a Well-Developed Method to Increase African American Participation in Clinical Trials

African Americans (AA) suffer disproportionately high burdens of pancreatic cancer. Discovering non-invasive screening methods will be of limited value if AA are underrepresented in these clinical trials. Scientists need innovative recruitment strategies and focus on communities that will most benefit from research. This

literature review identified AAs' barriers to clinical trial participation and socio-culturally aligned ways to help AA evaluate appropriate participation. Articles published since 2015 were found in PubMed, CINAHL, and Google Scholar. American Cancer Society and National Cancer Institute pancreatic cancer statistics were used. Over forty articles identified key tasks. First, researchers must know where to find eligible participants. Then, socio-culturally aligned approaches are needed for disseminating study information, snowball contacting methods, community outreach, one-on-one conversations, and meaningful relationships with the community. Researchers must also communicate all expectations of participants and be aware of past unethical research towards AA. Outreach education/recruitment programs require staff, participant incentives and adequate budget planning. Increasing AAs' representation in clinical trials begins with a well-developed, culturally aligned recruitment plan and budget. Encouraging study participants to share their positive clinical trial experiences could also help increase community-wide interest in clinical trials participation.

Ethan Olson

international studies - political science, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Alexander Gershunov, Climate, Atmospheric Science and Physical Oceanography (CASPO)

Getting Real: Accounting for Domestic Factors in International Climate Agreements

International climate cooperation has the potential to experience increased participation among individual states by being conscious of domestic factors that restrict and determine policy change and action. These main factors are simplified into three categories — endowments of factors of production, interests, and institutions. The current research on international climate agreements is rich in debate on the architectures of policy regimes. However, the success of all climate change agreements hinges on domestic policy implementation and climate action. As we have seen in countries such as the United States, the adoption of policy measures and cooperative action to mitigate climate change can be stifled by domestic friction. For international climate agreements to be more successful, they must be shaped with a keener understanding of the relationship between factor endowments, interests, and institutions in determining climate performance. Using this framework provides a more holistic explanation of countries' cooperation with international agreements, as it details the role diverse factors play at multiple scales, ranging from individual citizens to national governments.

Cameron Ormiston

Global Health, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Pam Taub, Division of Cardiovascular Disease, School of Medicine

Influence of time-restricted eating (TRE) on circadian regulation of glucose homeostasis and mitochondrial function

Metabolic syndrome is defined by the WHO as having high fasting blood sugar, increased waist circumference, abnormal cholesterol levels, and elevated blood pressure, and is a multiplex risk factor for cardiovascular disease and Type 2 diabetes. Despite over 34% of US adults having metabolic syndrome, current courses of treatment do not meet patient needs; most clinical approaches employ calorie restriction-based diets, which is effective in the short-term but fails beyond six months since most can't adhere to such a program for long. Using Time Restricted Eating (TRE)—consuming all calories within a 10-hour window each day—to address metabolic syndrome, however, may resolve this unmet patient need. By utilizing our circadian rhythm's interaction with diet and lifestyle rather than caloric restriction, TRE is a novel approach to metabolic syndrome and lifestyle nutritional therapy. This study is a randomized controlled trial where patients are randomly assigned to a control group of behavioral nutrition counseling (standard of care/SOC) or an intervention group of behavioral nutrition counseling with the addition of adopting a ten-hour eating window for 12 weeks (TRE). The effects of TRE will be evaluated based on blood glucose levels, metabolic biomarkers, body composition, and mitochondrial function. We hypothesize adhering to a consistent feeding-fasting cycle will restore and stabilize our circadian rhythm, improving glucose homeostasis and cardiometabolic biomarkers, decrease abdominal fat, and enhance mitochondrial function.

Jacquelyn Ortegon

Neuropsychology, San Diego Mesa College
STARS
Mentored by Dr. Maho Takahashi, rady School of Management

"Only" vs "Exactly"

As the linguistic knowledge of humans matures, they develop an array of pragmatic expectations that limit a possible range of interpretations denoted by a word (e.g., "some-but-not-all" implicature, disjunctive interpretation of "or"). Previous research has found the number of words appear to be an exception to this pattern, since children as well as adults prefer the exact interpretation for them. However, an imprecise interpretation of numerals is also prevalent, even among adults. The interpretation of numerals is highly sensitive to context, which results in the possibility of "non-exact" interpretation, as demonstrated by examples such as: He can have 2,000 calories without putting on weight [he can eat at most 2,000 calories] and If you

score five points, you get a teddy bear [a teddy is earned if scoring at least five points]. Numerals can appear either by themselves, or with determiners such as only and exactly. For our study, we will examine if the non-exact interpretation persists with such determiners, and if it is possible to experimentally observe an interpretational difference between only + numeral and exactly + numeral. In particular, we test English-speaking adults on cases where the numeral in a sentence does not match a corresponding visual stimulus (group of objects with a target or non-target color) in two possible ways: (i) There are more target-color objects than specified by the numeral, and (ii) There are fewer target-color objects than specified by the numeral. We will observe in which scenario, (i) or (ii), the non-exact interpretation is more likely to emerge for sentences with only + numeral and exactly + numeral.

Weifan Ou

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Nikolay Atanasov, Department of Electrical and Computer Engineering

Autonomous Robot Exploration and Occupancy Mapping in a 3-D Python Simulation

Starting out in robot autonomy research can be challenging due to the hardware costs and the low-level programming languages, typically involved in state-of-the-art systems. Our work focuses on developing a simulated environment with a low-barrier to entry that allows simulation of robots, sensors, and 3-D environments as well as implementation of core robotics algorithms on localization, mapping, planning, and control. We rely on the pyBullet physics engine to model realistic robot movement, simulate LiDAR and camera sensors, and aid testing and visualization of various environments. We implemented particle filter Simultaneous Localization and Mapping (SLAM), which relies on LiDAR data to determine the location of the robot and build a map of its environment. We also implemented a frontier-based A* search, which helps the robot plan its path to a goal in the unexplored area in the map. Both algorithms were implemented in Python and rely on occupancy grid mapping using a log-odds representation. The simulation provides intuitive ways to observe the robot and its environment, while providing plots of the estimated map and planned trajectories output from our algorithms. These results help to ease a new learner into probabilistic robotics.

Jessica Pacheco

Cell and Molecular Biology, CSU Northridge
STARS
Mentored by Sr. Stanley Lo, Biological Sciences

Transfer student experiences and identity formation in STEM

Studies have shown that transfer students have a high interest in majoring in science, technology, engineering, and math (STEM) disciplines. However, due to limited opportunities, transfer students tend to have decreased academic involvement and continuation within STEM majors in comparison to non-transfer students. Academic experiences may allow for students to have a positive or negative perspective in their persistence in STEM, thus potentially changing their science identity. Through this study, we have identified academic experiences, outcomes, and identity trajectories within nine transfer students to understand the possibilities that lead to positive science identities. STEM transfer students were interviewed on meaningful academic experiences. Interviews were transcribed and were qualitatively coded (Saldana, 2009). Compared to previous coded data, new codes were identified to capture different experiences that students had. The science identity model by Carlone and Johnson is used to classify what students' priorities are for persistence in a major. (Carlone & Johnson, 2007). The results found in the data thus far have indicated that students have had both positive and negative experiences within their time as STEM majors. Experiences that were positive helped further provide tenacity in students' education and continuation in STEM. The experiences that were negative had provided some students a peripheral trajectory that did not increase nor decrease their trajectory in their majors. Further coding and findings need to be made in order to help guide faculty and staff to provide support for transfer students in their success and persistence in STEM.

Andrea Padilla

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

Additional Barriers to End-of-Life Care among Hispanics with Advanced Cancer: Negative Connotations and Financial Limitations

The scientific literature reports that Hispanics face cultural and linguistic barriers to accessing end-of-life care (EoLC). This narrative review examines whether economic barriers and the terms "end of life care" and "hospice" impede Hispanics' use of EoLC. Peer-reviewed research articles published from 2006 to May 2020 were eligible for inclusion. PubMed, CINAHL, PsycINFO, and Google Scholar databases were searched and the reference lists of identified articles were reviewed for additional eligible articles. Few articles were found that focused on if the potentially negative connotations of the terms EoLC and Hospice impacted Hispanics' use of

EoLC and few explored Hispanics' knowledge of the costs associated with EoLC and the degree to which this would influence their use of EoLC. Although the real/perceived cost of EoLC is often overlooked, since it is covered by health insurance, Hispanics have the highest uninsured rates within the United States, creating a potential barrier to utilizing EoLC. Researchers' limited focus on these barriers to Hispanics' use of EoLC makes it impossible to assess the degree to which those two factors impact Hispanic's use of EoLC services. While the scientific literature endorses cultural and linguistic barriers, it is also important to emphasize the economic barriers which limit the use of EoLC and the distressing stigma associated with the terms "end of life care" and "hospice" which may negatively affect cancer patients' experiences.

Ryan Park

Microbiology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Jing Yang, Pharmacology

Tumor Micro-environment effects on Breast Cancer Development

The tumor microenvironment (TME) is a key regulator of tumor progression, metastasis, and therapeutic response. Here, we examine the cell state and transcriptomic changes within the TME at a single cell level to elucidate the immune regulation of tumor survival and metastasis. We use a mouse model of HER2+ and triple negative breast cancer where each step of tumor progression and metastasis is traceable. We dissect the contribution of CD8+ T cells in breast tumor progression and metastasis. Then, we isolate breast tumor cells and the cellular components of the TME for transcriptomic analysis with single cell RNA sequencing. We examine differences in the composition of resident cell types within the TME using marker databases, as well as differential gene expression within important oncogenic pathways and anti-tumor response. We found that CD8+ T cells play a major role in primary tumor cell initiation, proliferation, and metastasis. In addition, CD8 T cells regulate major cell state and transcriptomic changes in the TME leading to increased tumor cell dissemination and metastasis. Our data yield insights into the interactions between cancer cells, CD8+ T cells, and other proximal immune cells that results in an environment that fosters tumor growth and metastasis. Understanding the mechanisms underlying this crosstalk will allow for novel therapeutics that target multiple components of the TME, improving prognosis and survival in women with breast cancer.

Salma Michelle Parra Pulgarin

Public Health, UC San Diego
STARS
Mentored by Dr. Hemal H. Patel, Anesthesiology

Caveolin-3 Modulation of Heart Function in Type 2 Diabetes

More than 34 million Americans have been diagnosed with diabetes, the majority of whom are suffering from type 2 diabetes (T2D). Coronary artery disease is the leading cause of death in T2D. Diabetic cardiomyopathy is defined as abnormal structure and performance of the heart in individuals with T2D. In order to get a better look at T2D, the disease can be modeled in mice using a single injection of 75mg/kg of streptozotocin (a pancreatic beta cells toxin) and a 60% fat diet for three months. The project aims to comprehend the complexities of diabetes and the impact on heart energy and function. The laboratory studies caveolins, structural proteins that are essential in the formation of caveolae, that regulate intracellular signaling. Caveolin-3 (Cav-3) is expressed in the heart and may be beneficial in limiting heart dysfunction in a number of diseases. Limited data exist in linking Cav-3 and the diabetic heart. The mice were designed to overexpress Cav-3 only in the heart. The induced T2D resulted in altered mitochondrial structure and function and mild changes in heart function in female mice. Male mice had mitochondrial structural changes but normal function. Cav-3 overexpression protected both male and female mice from mitochondrial and heart function changes. The lab concluded that Cav-3 overexpression protects the heart from diabetic cardiomyopathy and Cav-3 may lend itself to be a promising therapy for those suffering from diabetes in the U.S.

Eamon Patamasing

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Dinesh Bharadia, Electrical and Computer Engineering

Large-scale Retrodirective mm-Wave Tags for Traffic Sign Identification

One of the current problems in the development of autonomous cars is detecting and recognizing traffic signs under all weather conditions. Automotive radar systems have robust performance in environments with reduced visibility but lack the ability to collect color and texture information useful for traffic sign identification. Furthermore, object-detection algorithms in camera systems can be easily fooled by small modifications on traffic signs. A proposed solution is to utilize millimeter wave tags attached to traffic roadside signs each coded with a unique identifier for oncoming automotive vehicles to detect. These millimeter wave tags can be created by employing a retrodirective passive Van Atta array architecture that is excited by an incoming radar signal and reflects the signal back in the same direction. By attaching RF switches, an On-Off keying mechanism can be used to modulate the reflected signal, giving it a unique identifier. This array architecture is designed at a center

frequency of 24.125GHz and is implemented with inset-fed microstrip patch antenna pairs. Designs were optimized to improve detectability at wider angles and distances and to reduce loss from signals scattered by the antenna and ground plane.

Xavier Perez

Electrical Engineering, UC San Diego
STARS
Mentored by Dr. Vikash Gilja, ECE

Low-Cost Home-Made Recording Chambers for Zebra Finch Birds

The Songbird Project seeks to develop a neural prosthesis able to decode birdsong from the activity of individual and groups of neurons recorded in different nuclei of the bird's brain. Specifically, we aim to collect simultaneous neural and vocal recordings from freely behaving zebra finch birds, with the purpose of reconstructing a synthetic version of their original song informed by neural activity. The goal of this specific project is to build and develop effective methods for capturing freely occurring birdsong. Here we build a low-cost system of home-made recording chambers using isolated coolers. Creating a comfortable environment for the birds involves the inclusion of a light and a ventilation system. Additionally, we include a USB array of 8 PDM MEMS microphones. This array of microphones will allow us to direct virtual sound beams that will detect the real time position of the source of sound. By applying mathematical algorithms to signals recorded from the microphone array we will block or filter out undesired noise and record only the one source of interest: the vocalizations of the bird. The end goal of this project is to build a "clean" library of birdsong data that will expand our ability to understand and characterize song production. With the end goal of clinical translation, our findings will bring us one step closer to understanding the mechanisms of vocal production, and to the development of robust, reliable speech prosthesis for individuals with brain injuries, speech impairments, and/or locked-in syndrome.

Ilya Petrov

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Xinyu Zhang, Electrical Engineering

mmWave Software Defined Radio

Millimeter-wavelength (mmWave) RF technologies represent a cornerstone for emerging wireless network infrastructure, and for RF sensing systems in security, health, and automotive domains. By using hundreds of antenna elements, mmWave can boost wireless bit rates to 100+ Gbps, and potentially achieve near-vision sensing resolution. However, the lack of an experimental platform has been impeding research in this field. M-Cube is the first mmWave massive multiple-input multiple-output (MIMO) software radio. We extend M-Cube to enable real-time processing on

a Field Programmable Gate Array (FPGA), which bypasses the relatively slow processing previously performed on commodity PC hardware. This will allow us to achieve near real-time processing of multiple 48 Gbit/s RF data streams, and near real-time radar imaging and communications performance evaluation.

Hao Pham

Biochemistry, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Christina Jamieson., Urology Moores Cancer Center

Promising Strategies to improve Prostate Cancer death rate among Native Americans and Alaska Natives

The ratio between prostate cancer incidence and death rates was higher for Native Americans and Alaska Natives compared to other races. Multiple causes have been reported for this disparity. The next step is to identify various intervention strategies applicable to these communities. A narrative review of scientific literature was conducted to identify and evaluate strategies that have been reported for improving prostate cancer survival rate among NA/AN or may apply for these communities. Articles were found from PubMed, CINAHL, SAGE journals, and Google Scholar between 2010 to 2020. Related websites like Cancer Institution, American Cancer Society, and the Centers for Disease Control and Prevention were also searched. This review identified three promising new strategies. First, the Prostate Urine Risk Test, a preliminary self-administered prostate cancer detection test that may overcome modesty, cost, discomfort, and geographic barriers to office screening. Second is the Patient-Reported Information Multi-dimensional Exploration framework that helps doctors evaluate patients' emotional fluctuations through online screening and offers referral to online cancer support groups to help patients become better informed and cope better with intense negative emotions. Third, Native American Cancer survivors can help newly diagnosed cancer patients to restore quality of life. These three strategies offer a chance for reducing prostate cancer deaths among NA/AN. It is imperative that researchers specifically evaluate their benefits for those communities. Cultural humility in participant recruitment strategies and trusted community leaders' endorsement will be essential to evaluate these strategies.

Peter Pham

Biochemistry/Chemistry, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Maripat Corr, Medicine

Cell Specific Type I Interferon Receptor Signaling is Critical for Arthritis Pain in Mice

Inflammation often contributes to acute pain, therefore the inflammation in arthritis can be used to study tactile allodynia. Tactile allodynia is abnormal hypersensitivity to mechanical stimuli. Although acute pain and chronic pain is largely recognized as two

different types of pain, the transition from acute to chronic has an unclear cause; this condition is considered neuropathic pain. The Yaksh and Corr Labs utilize the K/BxN serum transfer as a model of murine arthritis. This model is often characterized by persistent allodynia after the resolution of paw swelling and paw inflammation. In addition to these findings, the Corr lab has identified that mice deficient in type I interferon receptor experience little to no pain. The Corr Lab has collected a substantial amount of data from mouse strains that relate to the type I interferon cell types and signaling pathways. Analysis of this data holds promising elucidation of the transition to a chronic neuropathic pain in the post-inflammatory state of the murine arthritis model. Findings in this experiment aspire to discover which interferon pathways lead to the initiation of allodynia, or the conversion to neuropathic pain.

Jason Pham

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Truong Nguyen, ECE

Generating Depth Maps for Autonomous Driving Applications

Detecting objects such as vehicles, bicycles, and pedestrians for autonomous driving applications requires many hours of videos in a variety of environmental conditions (snow, rain, night-time, etc.). To reduce the cost and the time requirement in the data collection process, one possible solution is generating synthetic images through Unity, a game development engine. I focused primarily on generating real images and their corresponding depth maps and comparing the differences between the synthetic image depth and a Monodepth2's pre-trained image depth. By creating a conversion factor by setting up a calibration image, mapping from synthetic depth to the model's depth can achieve low relative standard and absolute errors.

Minh Pham

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

Autonomous Quadrotor Robots

Hobbyist drones are now widely used in today's world. With advances in embedded computation and sensing technology, hobby-level drones become readily available to the public. However, there is yet to be an open-source and expandable drone platform for different kinds of research purposes. In order to close this gap, our project aims at building a quadcopter drone platform which is able to do autonomous mapping and 3D environment reconstruction. It includes a powerful Intel NUC computer, high-performance networking device, and various reliable sensing devices like global-shutter camera, high-precision IMU and GPS, facing down LiDAR, etc. To

support those devices, a major component of the project is designing a power distribution PCB board. To build the drone, frame, motors and propeller are carefully selected according to project requirements. Hardware construction of the robot involves skills such as CAD design, laser cutting, and 3D printing. Furthermore, once the hardware is in place you need to install sensor drivers so that they can communicate properly to the flight controller and companion computer. Next we set up a network using Ubiquiti devices so the drone can communicate with the ground station reliably over a long-range. Basic PID controller theory will be learned, in order to tune parameters of the flight controller to achieve stable hovering. Finally, we would like to achieve a waypoint following task. Detailed development guides will be written along the way to make the project more valuable and beneficial to future researchers.

Thuy Trang Sabrina Pham Vu

Ethnic Studies & Clinical Psychology, UC San Diego
McNair Scholars Program
Mentored by Dr. Yen Le Espiritu, Ethnic Studies

Intergenerationality & Identity-Building within the Oakland Vietnamese Community

The effect of the COVID-19 pandemic on Vietnamese refugee communities remains largely undiscussed despite its significant impact, especially when considering Vietnamese small businesses. This study examines the Oakland Vietnamese community to draw attention to the structural and societal inequalities affecting them as revealed by COVID-19. Using an ethnographic approach, the research evaluates Vietnamese identity and intergenerational dynamics between first and second generation Vietnamese in order to identify the community's positionality in the context of Oakland and the United States, as well as to explore avenues of intergenerational collaboration to engage against systemic inequalities. Participant observation was used to gather data while working with the Oakland Vietnamese Chamber of Commerce to aid Vietnamese small businesses, as well as while working with second generation Vietnamese Americans to help primarily first generation business owners. Analysis revealed that language is a significant factor in maintaining the intergenerational gap between first and second-generation Vietnamese Americans in terms of what communities, cultures, and parts of society they have access to. Additionally, efforts to develop an independent Vietnamese identity and Little Saigon in Oakland from the established pan-Asian identity reflected in Chinatown re-conceptualizes the pan-Asian narrative in Oakland to acknowledge the particular experience of Vietnamese refugees. As such, COVID-19 provided an opportunity to create dialogue around the needs of the Vietnamese community by recognizing their unique struggles, and through bringing attention to their experience, offers possibilities to address and engage against the systemic inequalities they currently face.

Naomi Pineda

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

Genetics may put Hispanic Americans at Higher Risk of Liver Cancer and Science may not be Able to Help due to Lack of Participation.

Liver cancer (LC) is prevalent among Hispanic Americans (HA). Enough is known about prevention and early intervention strategies to create an education program to help reduce LC mortality among HA. This review of a scientific literature will facilitate the development of a liver cancer education program. To explore these risk factors, the peer-reviewed scientific literature was explored using PubMed, Ebsco, and Google Scholar. UC San Diego's Roger catalog was also explored for relevant evidence-based information. Access to full text and publication from 2000-2020 were the eligibilities. Risk factors of liver disease increase among HA and the efficiency of treatments against them is low. Genetic variation in PNPLA3 are being researched to understand if there is a genetic triggered disparity linked to LC. Hepatitis B can be prevented, while hepatitis C cannot, but effective treatment is available. Risk factors become more prominent when accompanied with a diet high in carbohydrates. HA participation in clinical trials is low, linked to a fear of discrimination, fear of deportation, and language barriers. High LC incidence among HA is due to an increase liver disease risk factors in this community, attributed to genetics and lack of research on HA and LC. Increased education on clinical trials, treatment cost coverage and treatment options among the HA community may improve LC rates.

Jacob Pollard

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Nuno Vasconcelos, ECE

Exploring Methods for 3D Reconstruction

Our group is exploring novel approaches to the problem of 3D reconstruction. 3D reconstruction refers to the problem of producing a 3D model of an object given image(s), and optionally other information such as depth maps and camera pose data. We are interested primarily in domain adaptive frameworks which will allow us to leverage large and supervision-ready datasets such as ShapeNet. This is because 3D data on objects in the real world is not at all plentiful or easy to collect. Therefore the ability to utilize 3D rich data such as ShapeNet in order to train real world ready systems is a valuable prospect. 3D objects have been represented in a variety of different ways such as voxels, point clouds, mesh grids, and most recently implicits. Implicit functions appear promising as they allow the essential character of the 3D object to be encapsulated in a single function which, given a point in 3D space, produces a single value (sometimes a real number, other times a bit)

corresponding to whether or not the point lies within this object. This appears to naturally lend itself well to currently popular deep learning architectures. We investigate how domain adaptive methodology, along with the relatively new representation form of implicits might aid in further advancing progress in the problem of 3D reconstruction.

Alisha Poudel

Neuroscience and Physiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Alan Hargens, Dr. Alan Hargens/ Orthopedics Department

Ground Reaction Force Distribution and Gait Patterns during Lower Body Positive Pressure Treadmill Exercise

Objective: Early mobilization following surgery is essential to improve patient outcomes. A Lower Body Positive Pressure (LBPP) device allows patients to perform treadmill exercise over a range of fractional body weights. We tested the hypothesis that increasing levels of LBPP would shift the habitual rearfoot strike to a forefoot strike and that increasing speed during ambulation would normalize the strike pattern to rearfoot strike.

Methods: Ten healthy volunteers (age range of 18-55 years with 5 females and 5 males walked at 0.89 m/s and jogged at 2.68 m/s at five different levels of LBPP corresponding to 100%, 80%, 60%, 40%, and 20% of their total bodyweight. Ground reaction force distributions under both feet were measured continuously by pressure sensitive insoles using Tekscan F-Scan technology and analyzed for gait patterns as a function of LBPP and velocity. Gait data were supplemented by video analyses.

Results: Strike pattern shifted from rearfoot strike to forefoot strike with increasing LBPP levels and returned to normal rearfoot strike as velocity increased. The 0.89 m/s and 2.68 m/s speed results were significantly different for force times bodyweight between 18% and 50% of stance which represents the peaks of rearfoot strike and forefoot strike.

Conclusion: Increasing levels of LBPP shift the normal strike pattern to forefoot strike which returns to rearfoot strike at greater speed.

Briana Prado

Earth Science and Chemistry double major, UC Santa Cruz
UC LEADS
Mentored by Dr. Lihini Aluwihare, Scripps Institute of Oceanography

Lihini Aluwihare

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.

Samantha Pulido

Applied Mathematics, UC Berkeley
STARS
Mentored by Dr. Angela Yu, Cognitive Science

Human Decision-Making in Social Scenarios

Humans readily form social impressions of faces at a glance. Whether those social impressions affect decision making in the social context is not yet explored. Previously, we observed that people's decisions in hypothetical social scenarios (e.g. which job applicant would you be more willing to talk to?) or economic games (e.g. Prisoner's Dilemma) are correlated with facial features of the face they are viewing. In this project, we want to tackle the following question: whether a subject's demographic background influences their face-based decision making? 500 college students from diverse racial and gender groups were recruited. We obtained the

mean population response for each demographic group and performed a paired t-test for in-between group comparison on their response.

Christina Puzzanghera

Marine Biology, UC San Diego
STARS
Mentored by Dr. Rennison, evolution, behavior and ecology

Determining the role of predation in the evolution of sexual dimorphism in threespine stickleback

The Three-spine stickleback has been known to exhibit sexual dimorphism in a verity of traits in the wild. Our research is focused on decoding what mechanisms contribute to this dimorphism. We used a controlled experiment, that manipulated environmental factors including predation to determine the effect of said factors on dimorphism. We hypotheses that sexual dimorphism in the three spine stickleback could be caused because male and female stickleback interact differently with their environment and in particular, predators.

Yana Pyryalina

Cognitive Science: Machine Learning and Neural Computation, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Douglas Nitz, Cognitive Science

Role of Axis-Tuned Neural Activity and Head Direction Encodings in Construction of Neural Maps of Space

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. Unlike "place cells" found in CA1, subicular neurons do not reveal their function through conspicuous encodings, and therefore require much more complex computational analysis. One of the most intriguing subiculum phenomena is Axis-Tuning, meaning that subiculum neurons respond to specific horizontal, vertical, and diagonal axes of an environment. This finding is important, as it suggests the subiculum's function of processing relative orientations of paths and angles between them. Expanding upon this finding, we are now attempting to reproduce the subiculum's encoding methods by creating a model that will show how a rodent brain uses internal and environmental variables to track location. This research presents and discusses the simulation of a neural ensemble, as well as a correlation matrix

model that reveals the role of combining head direction encodings and axis-tuned neural activity to construct a neural "map" of space.

Tian Qiu

Electrical and computer engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Pamela Cosman, Electrical and computer engineering

Viewport-adaptive 360-degree video streaming

A key component of immersive virtual reality (VR) content, 360° video contains content in every direction with each frame. Traditional VR headsets utilize a wired connection to deliver this high quality content with minimal latency. However, wires limit mobility and cannot be scaled to large areas. To enable delivery of high quality content over a wireless link, some optimization must be performed. Unlike traditional videos, only a small fraction of 360° video is visible at any one time. State-of-the-art approaches to delivery of 360° video utilize viewport-adaptive streaming, which adapts delivered content based on the visible portion. Current methods of viewport-adaptive streaming project 360° video to equirectangular projection (ERP), which is then segmented into tiled regions. A subset of the tiled regions is delivered, allowing for bandwidth savings. However, the tiled approach to viewport-adaptive streaming has several fundamental limitations. In our work, we explore a novel system of viewport-adaptive streaming based on the truncated square pyramidal (TSP) projection which removes these inadequacies of tiled viewport-adaptive systems. In TSP projection, the quality of the video is uniformly reduced, allowing for less jarring boundaries relative to a tiled implementation while allowing for similar bandwidth savings. Experimental results show improvements over existing viewport-adaptive systems, with no additional client-side overhead relative to a tiled ERP baseline.

Jocelyn Quiroz

Bioengineering, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

Cancer risk among victims of human trafficking

Forty million people are modern-day slaves, trafficked for sexual, drug, and labor exploitation. The prevalence of mental, sexual, and physical health issues present among human trafficking victims make this cohort of grave concern. Yet, their relation to cancer risk has received little attention. PubMed, CINAHL, PsycInfo, and Google Scholar were searched for relevant, accessible articles published since 2010. No studies linking cancer risk and human trafficking were found. One article investigated the likelihood of a relationship between human trafficking and cancer development through a literature search and identified the possibility of adulthood cancer resulting from human trafficking or behavior that developed in response to being trafficked. A

multitude of health implications associated with human trafficking (often simultaneously experienced), including substance abuse, learned helplessness, immune system suppression, inadequate hygiene, anal abuse, and oral abuse, could potentially increase cancer risk. Minorities and immigrants experience more extreme forms of exploitation, likely further raising cancer risk. The literature supports the likelihood of finding a correlation between elevated cancer risk and being a human trafficking victim with all of its associated cancer-inducing negative consequences, but direct causative studies are needed to evaluate this possible correlation and, if found, to develop appropriate interventions to reduce survivors' cancer risk.

Chantal Rabay

Biological Anthropology, UC San Diego
McNair Scholars Program
Mentored by Dr. Amy Non, Anthropology

Analyzing Clinician Views on Race and Genetic Ancestry

The scientific community has long concluded that there is no biological basis to race, yet racial categorization is still used in medicine to guide diagnosis and treatment plans for certain diseases. Additionally, the rise of genetic ancestry data has presented a new potential means for racial categorization in healthcare. The use of race in a clinical setting is of interest because there is a lack of consensus among clinicians over how to define race and what value should be placed on genetic ancestry data. This study analyzes interview data from 21 clinicians using qualitative data analysis of open ended questions about use of race-related information in clinical decision making, how they defined race, and general perspectives about the role of race and ancestry in medicine. We presented clinicians with video cases of mixed race individuals with signs of hypertension along with their genetic ancestry results. We also collected data on clinicians age, race, and training specialties and locations. The goal of this ongoing empirical study is to understand how clinicians value and use genetic ancestry data and racial classifications when practicing medicine. Preliminary results indicate that clinician's definitions of race are variable, from purely socially constructed to a strict biological construct. Further, clinicians did not often prioritize genetic ancestry data over other race-related variables in classifying race or treating patients. These results may be relevant for the ethical implications around the role of genetic ancestry data and race in medical practice and may serve to shape future medical training.

Marina Ramsey

Molecular Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Ellen Lee, Psychiatry

Link Between Compassion and Health in People with Schizophrenia

Schizophrenia is a serious mental illness characterized by positive symptoms (psychosis) and negative symptoms (apathy). People with schizophrenia (PwS) experience worse health outcomes and premature mortality compared to non-psychiatric comparison participants (NCs), due to psychiatric symptoms, antipsychotics side-effects, and health behaviors. Compassion training offers a novel mechanism to improve health outcomes in PwS because compassion is both modifiable and linked to health. We hypothesize that lower compassion towards others (CTO) and compassion towards self (CTS) are associated with worse health outcomes in PwS in a cross-sectional analysis (n = 189 PwS, 166 NCs). Independent T-tests were used to compare diagnostic groups. General linear models (GLMs), controlling for age, gender, smoking, and antipsychotic dosage, were used to examine the relationship of compassion (CTS and CTO) with physical wellbeing, a subjective marker of overall health; and CRP, a blood-based inflammatory biomarker. PwS have lower compassion and worse health outcomes than NCs. Among the PwS, physical wellbeing was significantly related to CTS, such that higher CTS is associated with better physical wellbeing. CRP level was significantly related to CTS such that higher CTS is associated with lower CRP. These relationships remain true when controlling for positive and negative symptoms. The health outcomes were not related to CTO. This preliminary analysis showed that CTS was related to health and, thus, could potentially be used in health interventions specific to PwS. Future analysis will use mediation analyses to examine the impact of CTS on health and will examine these data longitudinally over about 4-years.

Sophia Reyes

Geography, CSU Northridge
STARS
Mentored by Dr. Prashant Bharadwaj, Economics

Examining the Legacy of Residential Security Maps in San Diego County

In this paper, we examine the legacy of Residential Security Maps (Redlining) in San Diego County, California. In the 1930s the Home Owners Loan Corporation (HOLC) created residential security maps to identify areas with high lending risks. These maps were divided into 4 grades, which considered a neighborhood's quality of housing, the recent history of sale and rent values, the racial and ethnic identity and class of residents. These maps were used for approximately 4 decades until the passage of the 1968 Fair Housing Act that prohibits housing discrimination. These maps have been hypothesized to have played a major role in segregation and

contributed to limited social mobility within the U.S. Using the latest census tract data from 2018, we will examine outcomes such as income, education, crime, etc. across the four HOLC grades. Doing so will provide insight into the long-term impacts of redlining at a census tract level. This study is still in its initial stages, but future results can be utilized towards the understanding of redlining and the major implications it still has for racial wealth gaps. Further research will include examining other redlined cities and comparing housing values right on the borders of different neighborhood grades to get closer to a causal link between HOLC grades and current outcomes.

Nayeli Rincon

Psychology (Social), UC San Diego
McNair Scholars Program
Mentored by Dr. Pamela Smith, Rady School of Management

Exploring Pathways to Power for Individuals in Consensually Non-monogamous Relationships

Given recent research documenting high levels of stigma and prejudice surrounding consensually non-monogamous (CNM) romantic relationships, my research investigated how this stigma might be affecting pathways to power for individuals in these non-normative relationships. More specifically, I investigated how stigma towards individuals in CNM relationships affects how much power others perceive them to have and how willing others are to put them in positions of power, as well as if the way they disclose their CNM relationship to others has an effect on power. In my first study, participants provided their impressions of two job candidates who were both in romantic relationships, one implicitly monogamous and one CNM. The individuals in CNM relationships were perceived as having less power and were given less power than the individuals in implicitly monogamous relationships. In my second study, participants provided their impressions of a person who was either in a monogamous relationship or in a CNM relationship and chose to either intentionally disclose, unintentionally disclose, or intentionally conceal the CNM nature of their relationship. Though there was no difference in power between the individuals in monogamous relationships and those who intentionally disclosed that their relationship was CNM, individuals who appeared to be most comfortable disclosing their CNM relationship were given more power than those who appeared the least comfortable disclosing it. These findings provide insight on how power operates around CNM individuals as well as those with other kinds of concealable stigmatized identities and warrant further investigation into potential mechanisms behind the effects found.

Gonzalo Rocha-Vazquez

Political Science, Bakersfield College
STARS
Mentored by Dr. Erik Gartzke, Department of Political Science

Closing the Gap: The Influence of Conflict and Distance on Nuclear Platforms Development

Current scholarship largely centers around how countries use their nuclear platforms to deter conflict and countries seeking nuclear capabilities for global hegemony; the focus is on how they will use the threat of nuclear warfare to meet their needs. However, very little scholarship focuses on what fields—mobility, accuracy, yield, etc.—of nuclear platforms a country will choose to invest in to increase its effectiveness and what influences these decisions. It is expected that countries will build their nuclear platforms to reach their adversaries, this work seeks to affirm that expectation. By looking at the development of range capabilities in nuclear countries, aligning them with periods of conflict, and noting the distance between the country and their new adversary, this study will examine whether or not countries are designing nuclear platforms in response to the distance of their adversary. This will be done by plotting out a time-series graph of the development of range capabilities for each country. We should see distinct curves for each country and increased investment in range capabilities as a response to periods of conflict with enemies out of their reach at that time; they will want to close the gap in distance between their weapons' range and their new adversary. If my hypothesis is correct, this could lead to further research into what fields of nuclear platforms these countries will begin investing in after having reached their adversaries, eg., focusing more on yield or accuracy.

Persephonie Rodriguez

Cognitive Science with Specialization in Machine Learning, UC San Diego
Converge Incubator
Mentored by Jacques Chirazi, Office of Innovation and Commercialization-Basement/Blackstone

Novel Building Materials

Due to an unrelenting increase in population, the world is currently experiencing the largest wave of urban growth in human history. To accommodate this growth, trillions of square feet of infrastructure must be built in an environmentally friendly manner to be both sustainable for many decades and to meet zero-net-carbon standards. The Living Building Challenge (LBC), a reputable program designed to create a universal green building standard, has procured a list of the worst chemicals and materials prevalent within the building Industry called the Red List. Our research focuses specifically on three materials from the Red List and addresses the history of their use, how they are used today, and reasons behind their ubiquitous presence. More

importantly, our research focuses on possible novel materials that could serve as replacements to the three Red List materials, and how these disruptive alternatives may alleviate the environmental burden and/or dangers to human health that current materials pose. The end goal of this research is to generate a list of alternative materials and present it as a tool that building contractors, architects, and industry professionals may utilize to source or identify sustainable options for their infrastructure projects. The three Red List materials we focus on are Polyvinyl Chloride (PVC), Halogenated Flame Retardants, and Lead, which were chosen due to their prevalence in the building industry as well as their immense environmental and human health dangers. The study was implemented by gathering anecdotal evidence from industry professionals through interviews, researching information from the websites of environmentally proactive organizations, and reviewing academic papers or material safety data sheets (MSDS).

Mariah Romero

Sociology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

Cervical Cancer Screening, Practices, and Barriers among the LGBTQ+ Community: A Literature Review

The Centers for Disease Control and Prevention ranks cervical cancer as one of the most preventable cancers. LGBTQ+ people have disproportionately higher rates of being diagnosed and at a later stage. This literature-review explored remediable factors contributing to this excess disease burden. The scientific literature was examined to evaluate the barriers that LGBTQ+ community members encounter that compromise the community's attainment of optimal cervical cancer control. Databases such as PubMed and Google Scholar were used. Terms used for this search were: LGBTQ+, screening, and health disparities. Articles published since 2010 were included. Limited access to quality healthcare is a major contributor to cervical cancer disparities within the LGBTQ+ community. Many LGBTQ+ adults delay or don't seek healthcare services, lack a regular provider, and have a higher rate of participating in behaviors that increase the risk of cervical cancer. There's a higher risk of poverty, lack of insurance coverage, and a lack of trust and understanding when disclosing sexual orientation or gender identity to a provider. Discriminatory feelings can occur when providers don't use correct pronouns. Research shows that clinician-patient interactions strongly-impact whether LGBTQ+ members seek routine healthcare. Research specific to sexual minorities is limited, optional collection of sexual orientation in patients' charts and health registries could improve patient care and research.

Erin Rosales

Human Biology and Global Health, UC San Diego
Genentech Scholars Program
Mentored by Dr. Leonardo Noguiera, UC San Diego Department of Medicine, Division of Physiology

Effects of the lung treatment of SARS-CoV-2 spike proteins in mice on lung and diaphragm ACE2 expression and plasma Ang II levels

It has been recently detected that patients infected with SARS-CoV-2, who develop COVID-19, have higher plasma levels of Ang II compared to healthy subjects. It has been suggested that this occurs due to an interaction between spike proteins (S-proteins) with lung ACE2 and inhibition of Ang II proteolysis. Prolonged Ang II signaling in the diaphragm leads to atrophy and weakness. We hypothesize that SARS-CoV-2 infection leads to diaphragm weakness due to S-protein-induced lung ACE2 degradation and Ang II-dependent diaphragm protein degradation and dysfunction. C57BL6J mice were divided into five treatment groups: recombinant S-proteins S1 or S2, S1+S2, lipopolysaccharide (LPS), or by 0.9% NaCl (saline) via intratracheal instillation. 48 hours after instillation, initial results showed LPS and S1 treatments decreased lung ACE2 and increased diaphragm ACE2, while S2 treatment was unchanged. However, a second group of mice showed higher lung ACE2 by LPS and S1 treatments, and decreased diaphragm ACE2 in S1 treatment. A third group of mice will be treated with the same methods and groups described above (saline, LPS, S1, S2 or S1+S2) using intratracheal injection via tracheostomy in deeply anesthetized mice, to ensure lung delivery. We anticipate that our findings will yield similar results to the first trial, resulting in a decrease in lung ACE2. We will test whether plasma Ang II levels and diaphragm contractile proteins are changed by the treatments.

Reed Rouland

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Ramsin Khoshabeh, Electrical and Computer Engineering

Optical Blood Pressure Sensing

The use of photoplethysmography (PPG) and electrocardiography (ECG) in wearable, consumer grade electronics is now commonplace with the development and distribution of devices such as the Apple Watch and the Fitbit. PPG and ECG methods are employed to acquire important health information using continuous heart rate monitoring, but consumer devices remain unable to produce blood pressure information. While viable in a clinical setting, the measurement of blood pressure with an inflatable cuff is not a practical methodology for portable devices, and can cause stress in patients resulting in misleading measurements. For this reason, we are investigating the use of PPG and ECG methods to develop wearable

blood pressure sensing devices. Because errors from a user's movement are exacerbated by the nature of wearable devices, the investigation includes filtering and algorithmic techniques to reduce the impact of motion artifacts and other sources of noise from our data.

Erica Ruiz

Ethnic Studies & Education, Southwestern Community College
STARS
Mentored by Dr. Frances Contreras, Education Studies

Bridging Classrooms & Communities: An Examination of The PUENTE Project Throughout California's Community Colleges

The PUENTE Community College Program is an academic preparation program, designed to support first-generation students, by providing academic counseling, mentorship, and culturally relevant coursework. The project's mission is to successfully transfer students to four-year colleges or universities, earn college degrees, and have students return to their communities as mentors. PUENTE currently impacts 4 middle schools, 38 high schools, and 65 community colleges throughout the state. While studies demonstrate the success of the PUENTE model, the demand for PUENTE far exceeds its capacity. This research seeks to gain a deeper understanding of the PUENTE model, its outcomes, retention, and success. While over 50% of California's students in K-12 and 40% of all undergrad students are Latinx, only 18% of Latinx adults have college degrees. By identifying the program's successful model, PUENTE and similar learning communities can expand and support the outcomes of underserved communities throughout the state.

Keshav Rungta

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Dinesh Bharadia, Electrical and Computer Engineering

SensorFusion: Imaging for Autonomous Driving

Detecting objects in the scene, accurately and consistently, is crucial for autonomous vehicles. These detections are realised in the form of placing bounding boxes around objects in the scene. Over the years, systems based on individual sensors, like Cameras, LiDARs and Radars, have been improving. However, they haven't gotten to a point where they can be used reliably in any situation, irrespective of weather conditions or scenarios being imaged: cityscapes or highways or dense populations. In this endeavour we attempt to combine two unique sensors in our sensor array: a camera and a set of spatially separated radars. We introduce fusion techniques to leverage the advantages of each modality in the various stages of the system and a network that is able to accurately detect the objects in the scene. We use our own dataset to train and test the network and will be comparing it with other datasets

publicly available like NuScenes and Astyx. The fusion techniques implemented in this project would improve the autonomous driving industry vastly and also allow for improvements in numerous other fields.

Neha Sahota

Human Biology, UC San Diego
Converge Incubator
Mentored by Jacques Chirazi, Office of Innovation and Commercialization - Basement

Flybility — Improving Airport Accessibility at SAN

Even when accessibility regulations are met by the San Diego International Airport (SAN), the airport experience for passengers with disabilities still has room for improvement. SAN is not the only airport to face these challenges; 36,930 airport accessibility complaints were filed in 2018. Recent ACRP reports suggest that accessibility tends to be an afterthought in airport design, which results in passengers bearing the burden of self-advocacy. However, airports are complex institutions, and with information constantly changing, it is difficult to implement lasting solutions and divide responsibilities appropriately. Our research has highlighted a multifaceted gap in communication between SAN, 3rd-parties, and passengers with disabilities. After consulting with passengers, airline and airport staff, and relevant experts, we have created a guide to shift SAN's approach from reactive to proactive by leveraging technology and addressing social causes of accessibility gaps. In addition, training and disability councils will improve awareness and prioritize opportunities for improving airport experiences. Increasing involvement and decision-making power of people with disabilities is a necessary step to sustainably improve accessibility. Because this approach goes hand in hand with universal design, these changes will not only benefit the 61 million disabled adults across the country as they travel, but it will also ensure that all passengers have a more positive journey.

Julie Salazar

Psychology, CSU Northridge
STARS
Mentored by Dr. Melinda Owens, Division of Biological Sciences

Co-Teaching vs. Single Teaching: Comparing Active Learning Practices within a Course

Compared to traditional classrooms, active learning classrooms have shown to increase student learning in science, technology, engineering, and mathematics (STEM) fields. Also, qualitative studies have shown that students are more engaged in co-taught courses and benefit from experiencing critical thinking from multiple perspectives. Co-teaching might also affect the frequency of active learning. Here,

we compare the frequency and type of active learning in co-taught and single-taught sections of the same course. I hypothesize that active learning frequency will be higher in co-taught sections. Data was collected from a large-enrollment introductory biology course at a large public R1 university. We use Decibel Analysis for Research in Training (DART), a machine-learning tool that analyzes classroom audio recordings to categorize whether time is spent in Single Voice, Multiple Voice, or No Voice modes. Multiple Voice and No Voice modes are thought to correspond to active learning. I estimate the proportion of total class time spent in active learning. The recordings are further analyzed using hand annotation to examine what types of active learning activity occur. Understanding the differences in the amount of active learning in single-taught rather than co-taught settings will be beneficial for professors and programs to consider when offering more co-taught courses at universities.

Daniel Sandoval

Cognitive Science – Neuroscience, UC San Diego
Mentored by Dr. Bonnie Kaiser, Anthropology

Depression: Psychopathology as Defined By Underrepresented Adolescents

How do adolescents define depression and how does that compare to the standard definition used in Psychology? Because not all suffering is equal, it is better to understand the narratives underrepresented people have by listening to them. This project is insightful by nature because it dives into the perspective adolescents have regarding depression. This project is a collaboration on an ongoing project in Oceanside which has collected qualitative data regarding mental health experiences of underrepresented adolescents. The setting where the interviews have taken place is a culturally diverse school in which students there are classified as socioeconomically disadvantaged. Within the interviews, participants were asked to define depression, where they heard this name from, and if they had it or knew someone that did.

Mark Schara

Mechanical Engineering, Rice University
STARS
Mentored by Dr. Nicholas Boechler, Mechanical and Aerospace Engineering

Optimized Human Robot Interface for Wearable Technology

With increased applications in the fields of prosthetic, orthotic, and exoskeleton technologies, the design of an effective physical human robot interaction (pHRI) interface to comfortably distribute force onto the human body is an important challenge. Current applications of prosthetic, orthotic, and exoskeleton technologies many times face the problem of high pressure concentrations on the human body

thus causing pain and discomfort while the technology is in use. However, using pentamode metamaterials, an optimized human to robot interface can be created with variable bulk moduli to effectively distribute force on the human body. This will in turn decrease the pain and discomfort associated with the use of wearable technologies. In this presentation, the human-interface system is characterized, and finite element analysis software coupled with gradient based optimization is used to design the best possible variable moduli interface to be used for pHRI technologies.

Caleb Schimke

General Biology, UC San Diego
Lo Lab
Mentored by Dr. Stanley Lo, Biological Sciences

Assessment of the Validity and Reliability of Data Gathered by Undergraduate Students in Course-Based Undergraduate Research Experiences (CUREs)

Course-based undergraduate research experiences (CUREs) are designed to engage students in authentic scientific research. In recent years, many CUREs in biological sciences have been developed and studied both empirically and theoretically. They represent a democratization of the research experience by providing the opportunity for a much larger number of students to participate in research, including students who belong to minoritized groups that have been historically underrepresented in science. In addition, one study found that 61% of faculty teaching CUREs believed that the large amount of data collected and analyzed by students could be used in peer-reviewed scientific publications. If data gathered by students through CUREs were to be used in peer-reviewed scientific publications, it is paramount that the data is of sufficiently high quality. To address the lack of a methodology for assessing CURE data quality, we developed an approach to assessing reliability and validity of student-gathered data. We propose that experiments should be performed in parallel by a set of experts such as trained teaching and instructional assistants with research experience to which the distribution of student-gathered data can be compared for each experiment. We demonstrate the utility of this approach for reliability and validity using data from an introductory biology CURE at UC San Diego

Reeya Shah

Neurobiology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Varykina Thackray, Reproductive Medicine

Effects of increased fiber diets on PCOS metabolic phenotype

The purpose of my project is to determine if changes in dietary fiber intake can improve metabolic dysregulation associated with polycystic ovary syndrome (PCOS).

PCOS can cause hormone imbalances, problems with infertility and pregnancy. Despite being a common endocrine disorder among premenopausal women, there is not much understanding about the metabolic phenotype in PCOS, which increases the risk of developing type 2 diabetes, gestational diabetes, and cardiovascular disease. This metabolic phenotype may be linked to the gut microbiome, a complex system of bacteria which has been implicated to play a causal role in metabolic disorders like obesity and diabetes. Current treatments for PCOS patients do not fully address the metabolic aspect of PCOS due to lack of relevant research, and so further research into the relationship of the gut microbiome with PCOS is imperative to develop novel treatments for patients. In the Thackray lab, a PCOS mouse model has been developed to simulate PCOS metabolic and reproductive phenotypes. My project will use this mouse model to test whether treatment with dietary fiber improves the PCOS metabolic phenotype compared to treatment with an insoluble fiber control.

Alina Shahin

Biology, CSU Northridge
STARS
Mentored by Dr. Melinda Owens, Biology

The Frequency and Type of Active Learning Techniques utilized by Professors changes within a Quarter, and the effects of Co-teaching on these Changes

Active learning is an approach to teaching in which students are involved in the learning process, unlike traditional lecturing where they passively receive information. Studies testing various active-learning approaches have shown these techniques promote greater learning. In this study, we ask how the type and frequency of active learning techniques changes throughout a quarter and how that is affected by co-teaching. This study will analyze data from two introductory biology courses at a large public R1 university. Audio recordings of classes will be analyzed with DART (Decibel Analysis for Research in Teaching), a tool that estimates the time active learning takes place based on classroom noise. I use DART to compare the percent of time spent in active learning in the beginning and end halves of the quarters. Hand-annotation of classroom audio is used to determine which specific active learning techniques are used. We predict that use of active learning techniques will be greater in the second halves of the quarters, as professors are made aware of the benefits of active learning, while the type of active learning techniques used will remain consistent. Furthermore, the frequency of active learning in co-taught rather than individually taught classes will be analyzed. This study will provide insight into the frequency of active learning used within a quarter. Lastly, it allows for insight into whether co-teaching has an effect on the amount of active learning used.

Prem Shelat

Computer Engineering, UC San Diego
Converge Incubator
Mentored by Jacques Chirazi, Office of Innovation and Commercialization - Basement / Blackstone Launchpad Program

Novel Building Materials

Due to an unrelenting increase in population, the world is currently experiencing the largest wave of urban growth in human history. To accommodate this growth, trillions of square feet of infrastructure must be built in an environmentally friendly manner to be both sustainable for many decades and to meet zero-net-carbon standards. The Living Building Challenge (LBC), a reputable program designed to create a universal green building standard, has procured a list of the worst chemicals and materials prevalent within the building Industry called the Red List. Our research focuses specifically on three materials from the Red List and addresses the history of their use, how they are used today, and reasons behind their ubiquitous presence. More importantly, our research focuses on possible novel materials that could serve as replacements to the three Red List materials, and how these disruptive alternatives may alleviate the environmental burden and/or dangers to human health that current materials pose. The end goal of this research is to generate a list of alternative materials and present it as a tool that building contractors, architects, and industry professionals may utilize to source or identify sustainable options for their infrastructure projects. The three Red List materials we focus on are Polyvinyl Chloride (PVC), Halogenated Flame Retardants, and Lead, which were chosen due to their prevalence in the building industry as well as their immense environmental and human health dangers. The study was implemented by gathering anecdotal evidence from industry professionals through interviews, researching information from the websites of environmentally proactive organizations, and reviewing academic papers or material safety data sheets (MSDS).

Eman Sherif

Computer Science, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Christine Alvarado, Computer Science

Exploring Equitable Pathways to Computer Science

Demographically, the computer science field has always been predominantly Asian and White men. As technology starts to become a greater part of society, it is important that the people creating these technologies are representative of the people using them. However, with the lack of access to computers and computer science classes in high school many underrepresented students do not consider computer science when pursuing higher education. To combat this, I have created an educational program for underrepresented students that focuses on creating

equitable, diverse, and inclusive pathways to computer science. Throughout this program I would teach students basic computer science principles and ways that computer science is discriminatory against underrepresented groups. Some of these discriminatory practices include racism within facial recognition software and the apparent gender gap that causes women to feel like outcasts in the field. Within this program students are able to understand the many faults within the current computer science fields and start thinking of solutions to these problems. Throughout this program, I found that many students are unaware of the current discriminatory practices within computer science and higher education. Additionally, many students expressed how they hoped to see change and what actions they would take to change the current faults.

Soyoung Shin

Chemical Engineering, UC San Diego
Genentech Scholars Program
Mentored by Dr. Jinhye Bae, NanoEngineering

Diffusivity of water in homogeneous polyacrylamide (PAAm) hydrogels

Understanding the solute diffusion in hydrogels is essential for not only fundamental science but also industrial applications such as drug delivery and absorbents. To experimentally examine the diffusivity of a solute in hydrogels, it is required to prepare homogeneous hydrogels to ensure the diffusivity of solute is uniform throughout a certain hydrogel specimen. In this project, we use water as a solute and polyacrylamide (PAAm) as a hydrogel as a model system. Our effort focuses on synthesizing PAAm hydrogels by changing concentrations of the monomer, the crosslinker, and the initiator, respectively, to reduce spatial inhomogeneity due to nonuniform crosslink density. Improvement of homogeneity of PAAm is characterized by dynamic light scattering (DLS) method, the degree of transparency , swelling ratio, and Young's modulus. Furthermore, we use theoretical diffusion model to study the solute diffusivity in hydrogels. The diffusion model is based on obstruction theory that hydrogel network works as an obstacle preventing solute from diffusing. Rather than defining the sieving factor (D/D_0) as the probability of the number of polymer meshes larger than solute, the diffusion model we choose defines sieving factor as the probability of solute passing the meshes in any direction of movement to ensure the consideration of the interaction between solute and hydrogel. Such theoretical model and experimental data allow us to obtain the diffusivity of water in the homogeneous PAAm hydrogels. We also compare our result with previous reported diffusivities with PAAm hydrogels.

David Sibrian

Spanish Literature, UC San Diego
McNair Scholars Program
Mentored by Dr. Carol Arcos-Herrera, Literature

La disidencia homosexual en Desde Allá (2015) de Lorenzo Vigas: Un análisis de la sexualidad disidente venezolana y sudamericana

This article proposes an approximation to the study of dissident sexualities in Venezuela through an analysis of Desde allá (From Afar) by Lorenzo Vigas. Considering the problem of addressing LGBTIQ+ literature and topics from a standardized queer theory imported from the United States, this investigation centralizes Néstor Perlongher and Pedro Lemebel's theories as a non-hegemonic alternative to queer North American theory.

Narinderbir Singh

Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Sonya Neal, Biological Sciecnes

Characterizing Dfm1's Features in ERAD Retrotranslocation of Integral Membrane Proteins

ERAD (Endoplasmic Reticulum Associated Protein Degradation) is a process that gets rid of misfolded protein from the lumen (ERAD-L) or the membrane (ERAM-M) of the ER. A buildup of these misfolded proteins could otherwise be toxic to the cells. For degradation, these proteins are shuttled from the lumen of the ER to the cytosol where they are degraded by cytosolic proteasomes. The process of moving misfolded proteins from the lumen to the cytosol is called retrotranslocation. Dr. Neal has discovered that a protein called Dfm1 is required for retrotranslocation. In my preliminary work, I have built several Dfm1 chimeras using mutagenesis to understand what motifs of Dfm1 are required for its function of retrotranslocation. Due to remote learning, I am now taking a molecular dynamics approach to further characterize Dfm1's features for retrotranslocation. Using softwares such as PyMol and Phyre 2 I have developed a model of Dfm1 based on information published in related papers. Working with a fellow lab member who has characterized different mutations on Dfm1 that result in loss of function, I have mapped those mutations on my Dfm1 model. Next using molecular dynamics, I will analyze different residues and observe how mutating different regions impacts the structure and function of the protein. This will include analyzing structural stabilization and enzymatic activity of Dfm1. A better understanding of functional residues of Dfm1 and protein quality control pathway can lead to therapeutic interventions to deal with diseases related to misfolded proteins.

Morgan Sinkfield

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

Infrared Thermal Imaging Screen for Mutant Plants with an Impaired Response to Elevated CO2

Plants use their stomata for the exchange of carbon dioxide and water to enable CO_2 to enter leaves for photosynthesis. Stomata are tiny pores in the leaves of plants which close to save water or open to increase CO_2 uptake. The stomata are surrounded by guard cells which control the function of opening or closing the stomata depending on environmental conditions, including abiotic stresses. Wild type (WT) plant leaves are warmer when exposed to high levels of CO_2 (900 ppm), as they close their stomata, decreasing leaf transpiration. Mutants in the grass Brachypodium distachyon were analyzed to observe the effects of high CO_2 levels on the stomatal movement responses. Using this approach, a high-CO_2 insensitive mutant was found, denominated "chill1". In order to obtain an F2 mapping population, chill1 mutants and WT plants were crossed and the F2 generation offspring ratio was examined using infra-red thermal imaging of leaf temperatures. The mutant plants may be recessive and would be expected to make up 25% of the offspring or if the mutation is dominant 75% of the offspring would be expected to show the cool leaf phenotype. Thermal images of the plants were inspected and the putative mutant plants were labelled. 114 plants out of the 561 plants (~20%) were assumed to be mutants, as they had cooler leaves. This segregation of possible F2 cross mutants, can be used to rough map the responsible mutated gene. It is important to be aware of how global warming is negatively affecting plant health. Plants are responsible for our oxygen supply, as well as our food supply. It is necessary to have a deeper understanding of the CO_2–triggered gas exchange that occurs in plants so future science can help plants adapt to climate change.

Justin Skaggs

Chemical Engineering, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. David Fenning, Nanoengineering

Accelerating the Characterization of Perovskite Solar Cells Via Automated IV Testing and Efficiency Loss Analysis

Perovskite solar cells (PSC's) are currently the fastest growing solar technology with record efficiencies reaching 25.2% and have a promising future as an extension to the existing silicon market. Perovskite structures can be synthesized by a large variety of elemental compositions which modify its material properties, such as optical band gap, and are compatible with many device architectures making them a versatile solar absorbing material. Every perovskite solar cell study requires several

iterations of device fabrication with corresponding testing and analysis which, overall, is a time-consuming process. In this project, a fully automated current-voltage (IV) measurement stage was engineered to perform dark and illuminated IV scans on a tray of solar devices, collecting valuable information about device performance and diode behavior with minimal operator supervision. The automated nature of the IV measurement tool enables high throughput device analysis, accelerating the development and discovery of new perovskite materials. Using the collected data, an extensive loss analysis can be performed in order to deepen our understanding of deficiencies that limit the performance of PSC's. Specific regions that significantly limit the device can swiftly be identified and used to guide future device improvements to increase both power conversion efficiencies and device stability.

Kyle Skelil

NanoEngineering, UC San Diego
Initiative for Maximizing Student Development (IMSD)
Mentored by Dr. Tod Pascal, NanoEngineering

Molecular Dynamics Simulations of Binding Energy Between Single Strand DNA and Silver Nanoparticles

Large-scale Atomic/Molecular Massively Parallel Simulator (LAMMPS) molecular dynamics (MD) software was used to study binding energies of silver nanoparticle (AgNP) and DNA complexes after heating the system to 298K. Two silver nanoparticles were each bonded to the 5' end of an 11-nucleotide complementary single-strand DNA (ssDNA). These AgNP-ssDNA complexes were each then solvated in their respective neutral water box to calculate their potential energies. The two AgNP-ssDNA complexes were then combined in their own water box to calculate this total system's binding energy. Molecular motion is approximated classically by using the AMBER force field to describe forces experienced by the DNA atoms, and the EAM potential designed by Finnis and Sinclair (1) to describe the Ag atomic forces. Binding energy was found to be +0.83 kcal/mol for the combined AgNP-ssDNA complex, which is within 78.3% error of experiment. This model effectively simulates the hydrogen bonding energy that helps stabilize the DNA strands together, as well as the overall binding energy of the combined AgNP-ssDNA complexes in solution. The computational environment used is understood as a predictive model for studying the conformation and binding energy of our nanoparticle/DNA systems.

Michael Skipworth

Cognitive Psychology, University of San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

Tobacco Marketing Evolution and Influence in African American Youth Smoking

African Americans have the highest lung cancer morbidity and mortality rate. Ascending tobacco rates and younger initiation ages continue to extend the tobacco consumption timeframe through marketing efforts toward youth, thereby increasing morbidity and mortality. This literature review explores the evolution of African American focused tobacco marketing targeting youth. A search of the scientific literature focusing on African American youth smoking behaviors and the development of tobacco marketing's influence was conducted. PubMed, CINHAL, PsycINFO, and ERIC databases were searched. Twenty-six articles reported methods in which tobacco companies explicitly target African American youth following the Master Settlement Agreement (MSA) in 1998 (an accord concerning direct or indirect advertisement targeting), including marketing in proximity to candy, promotions for candy and fruit-flavored products, storefront ads in African American and youth centralized neighborhoods, and targeted product themes. Studies also reported the higher prevalence of focused marketing in neighborhoods with more African American youth, with more specialty products and variety in visited venues. Counter to the MSA, tobacco marketing continues to disproportionately influence African American youth. Investigating focal trends of current youth tobacco marketing and the combined relationship among African Americans, youth, and tobacco marketing's progression may provide deeper disparity analysis.

Jesse Soto

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Ramsin Khoshabeh, ECE

RC Car Chassis

There are a great number of machine learning and/or IoT projects that need an RC car as a base to start with. There are many kits available online for such purposes but each seems to be lacking in a separate category such as cost or performance. The goal of this project is to create a car chassis that can be hooked up to any single board computer and provide the necessary performance with the least amount of complexity and cost. This starts with sourcing cheap and replaceable parts to construct the car itself. This way the car will be more cost-effective and users are not dependent on a single vendor. From there, the car construction is made to be as simple as possible so that users who are not comfortable with hardware are not overwhelmed with complicated instructions. Finally, there is a STM32 board that will receive any instructions from the onboard computer and manipulate the motor and

steering servo accordingly. Additionally it will send all information collected from any sensors back to the onboard computer. Having a micro-controller onboard leaves this chassis open to further modifications according to the user's purpose. This research is aimed towards improving upon the performance of the current vehicle used in ECE 140AB. Improving performance, flexibility, and cost-effectiveness, students can attempt a wider array of project ideas than previously possible with the original kit.

Gregory Stocker

General Biology, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Stanley Lo, Biology and Biology Education Studies

Transitioning Sophomore Experiences and the Perceived Usefulness in Supporting their Academic, Social, Personal, and Professional Development

The academic and social experiences of sophomore students are commonly ignored in undergraduate education. Utilization of an academic sophomore summer-bridge program at a large, public university in the western United States, serving primarily first-generation college students and underrepresented minorities, sought to dispel this gap in literature on sophomore experiences. Through weekly reflections from over 130 transitioning sophomore students in the 10-week summer program, student experiences and perceived outcomes were analyzed and summarized as codes. These codes demonstrated the linkage between various actions and outcomes and the students' overall perception in supporting their academic, social, personal, and professional development. These codes represent the actions and outcomes of the students within the program, encompassing the students' perceptions of academic coursework, community engagement, career readiness, and general life-long learning. Based on the experiences, students reported across all categories an enhanced perspective. Individually, academic coursework led to enhanced understanding while general learning resulted in enhanced preparation and community engagement developed social bonds. These analyses give insight into the second year transition and perceived usefulness of these experiences. It appears this program has the basis to develop impactful experiences that will assist rising sophomores in both their academic and other collegiate pursuits.

Justin Sun

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

Development of Educational Technologies for Flipped Classrooms

Classroom technologies such as student response systems can help create a rich learning environment for students through feedback and interaction. While student response systems such as iClickers enable this sort of student participation in class,

they need to be purchased by the students at a non-negligible cost to them. The goal of our research is to explore and expand upon these student response systems by utilizing what nearly every student has on hand at all times – a smartphone – to create an experience that best caters to both students and instructors. We have created a web-based student response system that not only mitigates the financial costs for these technologies, but also provides the instructor with additional real-time formative feedback through student categories. These categories provide more detailed information on how certain groups of students respond, which instructors can then utilize to better cater to these students on the fly.

William Sun

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
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Quantifying Reading Order and Completeness Using Eye-tracking

The development of eye-tracking technology enables the quantification of page reading behavior in a fine-grained way. In this project, we study gaze locations across a page as subjects read book pages while wearing eye-tracking glasses. We algorithmically evaluate gaze patterns using data from the glasses and aim to develop an auxiliary tool in clinical assessment for children. The algorithm consists of three major processing steps in order to calculate metrics effectively. One of these steps is to perform Kalman filtering on the raw gaze data for blink removal. Another step is to take a reference, high-resolution photo for each page and perform a manual ground truth on the segments. In this project, we seek to separate segments into text, captions, and figures. Finally, we use image registration to map the reference photo onto each frame in the world view video. Thus, we can calculate metrics after these steps are completed by calculating the corresponding coordinates from the gaze data in the world view video onto our reference frame using a homography matrix. Metrics are necessary to evaluate reading order and completeness such as time spent in each segment, percentage of each segment read, and the number of visits to each segment. The output of our metrics will be able to provide key insight into reading behavior.

Callie Suppa

Communications, UC San Diego
Converge Incubator
Mentored by Jacques Chirazi, Office of Innovation and Commercialization - Basement / Blackstone Launchpad Program

Team Rush Hour

Team Rush Hour is working on improving sanitation at transportation hubs and transit vehicles in order to provide a safe return to public transportation. We have partnered

with SANDAG to understand how their visionary 2021 regional plan, that hopes to reinvigorate public transportation around San Diego, will be affected in the age of COVID. We are also working closely with SD MTS to understand current safety measures, gauge their effectiveness, and propose updated strategies.

Steven Swee

Chemical Engineering, UC San Diego
Converge Incubator
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Novel Building Materials

Due to an unrelenting increase in population, the world is currently experiencing the largest wave of urban growth in human history. To accommodate this growth, trillions of square feet of infrastructure must be built in an environmentally friendly manner to be both sustainable for many decades and to meet zero-net-carbon standards. The Living Building Challenge (LBC), a reputable program designed to create a universal green building standard, has procured a list of the worst chemicals and materials prevalent within the building Industry called the Red List. Our research focuses specifically on three materials from the Red List and addresses the history of their use, how they are used today, and reasons behind their ubiquitous presence. More importantly, our research focuses on possible novel materials that could serve as replacements to the three Red List materials, and how these disruptive alternatives may alleviate the environmental burden and/or dangers to human health that current materials pose. The end goal of this research is to generate a list of alternative materials and present it as a tool that building contractors, architects, and industry professionals may utilize to source or identify sustainable options for their infrastructure projects. The three Red List materials we focus on are Polyvinyl Chloride (PVC), Halogenated Flame Retardants, and Lead, which were chosen due to their prevalence in the building industry as well as their immense environmental and human health dangers. The study was implemented by gathering anecdotal evidence from industry professionals through interviews, researching information from the websites of environmentally proactive organizations, and reviewing academic papers or material safety data sheets (MSDS).

Rabia Syed

Public Health, UC San Diego
McNair Scholars Program
Mentored by Dr. Leslie Lewis, Urban Studies and Planning (USP)

Somali Refugees: Access to Healthcare

Background: In the midst of all the current health issues unfolding, it is unequivocal that the US healthcare system is not equal or equitable. The purpose of this research

is to bring to light the challenges and barriers that the Somali refugee community faces when trying to access health care. This research project is driven by three main questions: What are the primary barriers Somali refugees face when accessing and utilizing healthcare in San Diego? What resources do refugees find helpful in relieving any burdens they may face in utilizing care? What policies and resources are available that Somali refugees (and other refugee communities) might find to be helpful to to maintaining health and wellbeing?

Methods: This study utilized a mixed methods approach. The first part of the study consisted of literature review which was further utilized to create a quantitative data based survey on a web application called Qualtrics. After disseminating the survey, the plan was to conduct a personal interview by phone to participants that want to further their involvement in the study. Using all the data collected, a short paper summarizing results will be completed, and a small resource guide created and made available to community members in City Heights.

Results: Currently, the survey is still underway and therefore, no results have been collected yet.

Conclusions: Currently, no conclusive results have been constructed.

Key Words: Somali, Refugee, Health

Amer Tabban

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Myze

Myze aims to create a confident shopping experience for the everyday online shopper. Where we will recommend users the correct size for the shirt/clothing that they are purchasing from an online retailer by using Big Data and machine learning.

Kirollos Tadrousse

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Kellie Breen Church, OB/GYN and Reproductive Medicine

Investigating neuronal activation during the response to psychosocial stress in female mice

Stress is one of the leading causes of infertility and reduced reproductive function in females, although the neurobiological mechanisms are not well understood. Females

are exposed to a variety of stress types, including metabolic or psychosocial stress, that may also differ in intensity (acute vs. chronic). The goal of this project is to map specific neuronal populations activated by stress and to investigate whether these cell populations represent common cellular pathways activated by different stress types. One brain area the Breen Church Lab has become interested in is the brainstem and the unique populations of catecholamine neurons that have been implicated in responding to stress. The goal of this summer research experience was to investigate neuronal activation of a norepinephrine-containing cell population within the brainstem, termed the A2 region, as a mediator of impairment of reproductive function during psychosocial stress, modeled by isolation and restraint. Female mice were exposed to either an acute restraint stress paradigm (~3 hours, once), a chronic restraint stress paradigm (~3 hours, daily for one week), or no stress control treatment. Immunohistochemistry was conducted on cryostat-sectioned brain tissue to label dopamine beta-hydroxylase (DBH), a marker for norepinephrine cells, and cFos, a marker for cell activation. Stained neuronal tissue in the brainstem was visualized utilizing microscopy, and the specific brain regions activated due to stress treatment were quantified and will be compared among treatment groups. Data analysis is currently ongoing.

Donovan Tamkin

Psychology, Minor: Computational Social Science, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Michael McCullough, Psychology

Measures of Morality

The structure and organization of moral values, beliefs, and judgement has been debated by researchers for decades, leading to many different theories that offer explanations of human morality. To date, few studies have examined the common overlap across different measures of morality, and we know of no study that has simultaneously examined all existing measures of morality. The goal of the current study is to better understand the common core of morality across divergent measures of moral cognition by examining responses to a comprehensive battery of moral measurement instruments using Structural Equation Modeling (SEM). SEM is a statistical technique used to compare statistical models that explain common variance across measures (e.g., correlated factor models, bifactor models) and aids in selecting the model(s) that provide best fits based on the data. We hypothesize that existing measures of morality can be summarized by a few items that comprehensively measure the psychological foundations of moral cognition. By identifying the set of items that map onto the core of moral cognition and their correlations with known measures of moral outcomes, other researchers will be able to make more informed decisions when selecting measures of morality. Understanding the common variance across measures will contribute to moral theory by identifying which components of morality generalize across measures, explain unique conceptual domains, and are most predictive of moral outcomes.

Hong Tang

EE, UC San Diego
Electrical and Computer Engineering SRIP
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3D Machine Learning Training Environment for PCB RC car

Individuals with sole Machine Learning(ML) or IOT knowledge often find it difficult to build PCB-based autonomous RC cars, due to the complexity of building a system demanding both software and hardware skills.
PCB Racer strives to provide an environment with sufficient tools to implement their PCB-based autonomous RC cars, without excessive requirements for hardware configuration. To accommodate the learning objectives, Unity 3d Environment with mainstream machine learning tools, like Pytorch and Tensorflow, will be used. In the simulation, there would be multiple training agents using reinforcement learning algorithms, such as proximal policy optimization(PPO). After successful training, the trained models will be used as a framework to configure the actual robocar for optimizing training with its image data. The project is aimed to improving the ECE 140 curriculum by setting up the proper a ML environment for students;thus, enabling students to spend more time learning in mechanical or hardware training

Yordanos Tesfai

Public Health, UC San Diego
McNair Scholars Program
Mentored by Dr. Laramie Smith, Division of Infectious Diseases and Global Public Health

Socio Structural Impacts: A Focus on the Relationship between Respect, Trust, and Healthcare Service Engagement among HIV MSM in Tijuana, Mexico

Background: Globally, research has supported the relationship between stigma and negative health outcomes due to the lack of access to appropriate care services for HIV positive men who sex with men (MSM). However, few studies have examined the influence of respect and trust with regards to HIV MSM engagement with health services.

Methods: From 2015-2016, 24 interviews were conducted with study participants in Tijuana, Mexico. Inclusion criteria for participants included: previously unaware of their HIV status, biologically male (pre-op transgender women will be included), have had sex with a man in the past 2 months, ≥18 years of age, and consented to the study were recruited.

Results: Gender identity of participants included 17 MSM and 7 transgender women (TGW). Analysis of in-depth interviews revealed (1) a positive relationship between respect and trust as it relates to healthcare providers and adherence to medication

and treatment; (2) an expected level of credibility of providers from patients impacts patient-provider relationships; (3) lack of maturity and professionalism of health care providers towards patients negatively impacts patient's willingness to continue treatment; (4) increased saliency of HIV positive and MSM identities arise when providers project fears due to the HIV status of patients.

Conclusions: HIV MSM in Tijuana are met with discrimination due the socio structural impacts of stigma in social and healthcare settings, and the need for more research, outreach and centering of care for vulnerable communities needs to be executed to support accessible and safe spaces for communities to access care services.

Megan Tjuanta

Bioengineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Karsten Zengler, Livia Zaramela, Pediatrics

synDNA: A Standardization Approach for Metagenomics

A common drawback in many microbiome metagenomic studies is the inability to draw conclusions about absolute abundances in a microbial community. While relative abundances provide insightful information, absolute abundance data will add to a more complete understanding of the community dynamics. In this study, we seek to develop a standardized method for quantifying absolute abundance in metagenomic studies. We propose to design multiple syntheticDNAs (synDNA) with GC contents, and to spike in a defined microbial mock community. . Currently, our in silico simulations predict that the synDNA will not add significant biases to measured abundance values. We will continue conducting in vivo experiments with synDNA, as the protocol needs to be developed and refined further to yield improved results that more closely reflect the in silico simulations. We will then cross-compare our synDNA results with other existing methods for measuring absolute abundance to validate our method. Our final step will be to use mouse stool samples and analyze the varying effects of different synDNA spike-in concentrations and compositions in natural samples. Development of a reliable and unbiased quantitative method for metagenomic studies will allow researchers to gain greater insight into absolute abundance and structure of microbial communities.

Charlie Tran

Data Science, UC San Diego
Converge Incubator
Mentored by Jacques Chirazi, Office of Innovation and Commercialization - Basement / Blackstone Launchpad Program

Municipal Microgrid Planning

Cities are at the forefront of the national conversation about climate change. Increasingly, elected officials and city residents are finding ways to deploy more clean energy and reduce their carbon footprints. Our team was tasked by the city of San Diego to establish a methodology for identifying ideal municipal microgrid locations. The City is interested in installing renewable microgrids (both campus-style and single building) to increase resiliency in response to climate-driven energy disruptions. Our solution was a detailed ranking system that took into account of several criteria including: cost benefits, GHG (greenhouse gases) emissions, resilience value, and community impact.

Tiffany Tran

Economics, UC San Diego
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Using Pupil Services Spending and Resources to Predict Student Performance: Understanding the Role of District Leadership and Analyzing Student Performance in California School Districts

Student's mental health and access to basic needs are strong predictors of their academic achievement. School districts are at the forefront of making well-informed decisions to meet the needs of their students and prepare them for excellence in all aspects of life. This research qualitatively examines the challenges and criteria considered by district leadership in evaluating and implementing appropriate services for students' mental health and basic needs - commonly referred to as pupil services. It also uses time and entity-fixed regression models to analyze student performance on the California Assessment of Student Performance and Progress Exam (CAASPP Exam). The focus of the analysis is on funding and access to pupil service resources, however, there are also controls in place for students' socioeconomic status, instruction quality, and community characteristics. Though results are unclear among districts with greater proportions of students meeting and/or exceeding CAASPP Exam standards, there is evidence which suggests that districts with a higher proportion of students failing to meet math and reading standards are spending relatively less on pupil services.

Sally Trinh

Biochemistry and Cell Biology, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

What Is Contributing to HPV Oral Cancer and What Can We Do About It

Human papillomavirus (HPV) oral cancer is predicted to surpass the annual rates of cervical cancer in 2020. It is found more often in 45-60 year old white men who are non-smokers, non-drinkers, and those who have a high number of lifetime oral sexual partners. This narrative review of the scientific literature explores what is contributing to the increasing rates of HPV oral cancer and how it can be reduced. This exploration of the evidence-based literature used such terms: oral cancer, HPV, risk, vaccine, prevention, incidence, race, and sexual behavior. The databases used were PubMed, CINAHL, and PsycInfo. HPV oral cancer is caused by HPV infection. The biggest risk factor for infection is unprotected oral sex, possibly due to changes in sexual behavior, suggesting that HPV oral cancer is a sexually-acquired disease. Out of all the strains, HPV16 increases the risk of developing HPV oral cancer the most and is used often as a marker in research settings. Currently, no FDA approved screening method for HPV infection exists which may possibly contribute to increasing rates. Thus, methods of preventing HPV infection is a large focus in the literature. The HPV vaccine, approved by the FDA in 2006, is the only vaccine proven to prevent cervical cancer. It is possible that the HPV vaccine may also prevent HPV oral cancer, but it is predicted that until 2040 we will be unable to determine whether the vaccine fulfills that hope for reducing HPV oral cancer.

Joey Truong

Molecular Cell Biology, UC San Diego
Undergraduate Research Scholarships
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Quantifying the Motile Properties of Dynein in the Presence of a Cargo Adaptor Complex

Cytoplasmic dynein-1 (dynein) is a molecular motor that moves diverse cellular cargoes, including vesicles, viruses and protein aggregates along the polarized microtubule cytoskeleton. Proper cellular cargo transport is vital for function of all eukaryotic cells, as disturbances to the function of dynein or its interacting partners lead to neurodegenerative diseases and cancer. Dynein forms a large complex with dynactin and an activating adaptor protein that activate dynein for movement, as well as link it to cargoes. In general, activating adaptors are dimeric coiled-coil proteins that link to dynein and dynactin via their N-terminus and cargo via their C-terminal region. The Hook3 activating adaptor forms a tripartite cargo adaptor complex, known as the FHF complex that links dynein to early endosomes. The FHF complex is composed of FTS, Hook3 and FHIP proteins. While the mechanism of dynein

movement has been extensively explored using in vitro approaches, the molecular details of dynein's interaction with physiological cargoes are poorly understood. To understand how cargo transport is accomplished by the dynein complex, I will measure dynein's motile properties in a single molecule motility assays after activation of movement by the FHF complex components. Some of these motile properties will include velocity, run length and landing rates. My analysis will shed light onto how cargo recruitment is achieved for the dynein complex and how these interactions with cargo affect dynein's movement in vitro.

Tai Truong

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Electrical and Computer Engineering SRIP
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Renewable Power Supply System for Remote Area

Complex geography and remote locations are still an obstacle to electrification of a vast area of the world, Sub-Saharan Africa, residing around 1.2 billion people. Major portions of such areas are countries in this region, i.e, Nigeria, Cameroon, Congo etc. sharing a significant amount of people not having access to electricity. According to our research on a range of appliances used by rural households in Nigeria, low powered devices such as regular mobile phones, radio and lighting can significantly improve one's quality of life. As a goal to improve the living conditions for these people, a renewable power supply and storage system has been designed to provide enough energy required by these households for nightly activities. The solution comprises a small DC nano-grid within a household powered by a Photovoltaic (PV) system. Without any intermediate DC/AC and AC/DC conversion, this approach is targeted to a simpler solution with reduced conversion stages, lower complexities, and thus higher efficiencies and compactness.

Joseph Tsai

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Undergraduate Research Scholarships
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Characterization of the age-associated intratumoral microbiome in pancreatic adenocarcinoma

Pancreatic adenocarcinoma (PAAD) is the third leading cause of cancer deaths in the USA and seventh worldwide. Older individuals are at a significantly higher risk of developing PAAD, with 80% of PAAD tumors developing in patients between the ages of 60 and 80 years. Since patients seldom exhibit symptoms until advanced stages of the disease, the most significant challenge in combating PAAD is detecting the disease in its early stages. There are currently no proven markers for PAAD, making early diagnosis virtually impossible. Recent studies have shown that

the intratumoral microbiome may play a role in the development of PAAD. We aim to identify dysbiotic microbes between PAAD and normal samples and characterize their effects on immune signaling that may alter PAAD carcinogenesis. This will be accomplished through the mining and analysis of patient RNA-sequencing data using various computational analyses that correlate between microbial abundance, host gene expression, and clinical outcomes. We hypothesize that changes to the microbiome over time as the host ages may lead to deleterious signaling that leads to PAAD, and therefore may explain why age is such a significant risk factor. We hope that our findings may eventually contribute to the development of better immunotherapy strategies and diagnostic tools for patients with PAAD, thereby improving the prognosis of these patients.

Steven Tsan

Computer Science, UC San Diego
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Autoencoders for Anomaly Detection

As the search for beyond the standard model (BSM) particles has been met with limited success at the CERN Large Hadron Collider, there has been a growing interest in employing unsupervised deep learning models that can search for new physics independent of the conventional assumptions of what signatures BSM particles may exhibit. In this work we explore the use of graph-based autoencoders, which can better exploit the interdependencies among the particles within jets, or showers of particles arising from proton-proton collisions, relative to the more widely studied traditional autoencoder architectures. Autoencoders trained to efficiently compress and reconstruct background events with minimal error can be used to distinguish anomalous signals by isolating input with high reconstruction error. Initial results based on traditional and graph-based autoencoders affirm that these models can be used to efficiently compress the background, and thus isolate anomalous signals, and more work is being done to improve the efficiency of these models.

Alexandria Tso

Global Health, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Ju Chen, Medicine

The Role of Neuronal Precursor Cell-expressed Developmentally Downregulated 4 (Nedd4) in Cardiac Development

Heart disease is a leading cause of morbidity and mortality worldwide. Proper protein turnover is required for normal cardiac development and function, and E3 ubiquitin ligases play key roles in marking proteins for degradation, regulating protein activity, and changing protein subcellular location. Neuronal precursor cell-expressed

developmentally downregulated 4 (Nedd4) is a HECT-type E3 ubiquitin ligase. Nedd4 is highly expressed in cardiomyocytes; embryonic studies revealed that cardiac-specific Nedd4-cKO mice embryos display enlarged right ventricles, abnormal heart shapes, and decreased cardiac function. These observations imply that Nedd4 is essential for cardiac development; however, both Nedd4's substrate and specific role in cardiac development remains unknown. Grb10 is a signal adapter protein that regulates cell growth, metabolism, and apoptosis. Proteomic analysis suggests that Grb10 may be Nedd4's substrate in developing cardiomyocytes. To gain further insight into Nedd4's specific role in developing cardiomyocytes, we identified Nedd4 amino acid sites that are predicted to be critical for the interaction between Nedd4 and Grb10. Our experiments revealed that the T116F and Q119F double mutation disrupted the interaction between Nedd4 and Grb10. This study will contribute to our molecular understanding of protein ubiquitination in cardiac development and function, and may ultimately suggest potential therapeutic approaches for treatment of cardiomyopathies relating to protein quality control.

Rowan Ustoy

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

The underrepresentation of HIV+ participants in cancer clinical trials and the barriers faced involving cancer treatment

Anti-retroviral therapy has extended the life of HIV+ people and decreased the risk of AIDS. While the number of AIDS-associated cancers has decreased, the number of non-AIDS-associated cancers has increased. Consequently, those with HIV are less likely to receive proper treatment and experience higher mortality rates. A literature review of PubMed, Google Scholar, and CINAHL was conducted regarding cancer treatment for those with HIV, and disparities present in treatment and mortality. HIV cancer patients were often diagnosed in later stages and received treatment later or not at all, which contributed to higher mortality. These disparities are thought to be a mixture of patient, physician, health care, and socioeconomic barriers. Patients struggle with the dual burden of lifelong treatments mentally, physically, and financially. Physicians do not receive sufficient education regarding treatment for HIV+ cancer patients. Clinical trials previously excluded HIV+ participants and still are not representative. Programs, like the AIDS Malignancy Consortium, are currently working on decreasing these disparities through inclusive HIV+ clinical trial research. It is pertinent that there are more HIV/cancer-specific clinical trials as well as the inclusion of HIV+ people into general clinical trials. With more programs like AMC, physicians will be better informed when treating their HIV+ patients. HIV+ people still face health challenges and must not be forgotten in research.

Carson Valdez

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
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Integrated Optical Phased Arrays for Optical Trapping

Optical phased arrays apply the principles of constructive and destructive interference of the light fields emitted from an array of radiating elements in order to engineer an arbitrary intensity pattern in free space. By controlling the amplitude and phase profile at the input to each radiating element any desired field pattern can be achieved. Integrated optical phased arrays have become popular in a variety of applications for their ability to form and dynamically steer an emitted beam without the need for any mechanical devices. Optical trapping or optical tweezers employ highly focused beams to manipulate sub-micron scale objects. The intensity gradient of a gaussian beam creates a microscopic restorative force that effectively holds an object in place. Optical tweezers are used in biology and medicine as a means to investigate the force mechanisms of single cell systems, the construction of artificial cell structures, and the field of cell sorting. We use the optical simulation software, Lumerical, in order to design and test the capabilities of an integrated optical phased array for the goal of optical trapping. Using standard Silicon on Insulator wafers and Complementary Metal-Oxide-Semiconductor (CMOS) processes we design a hybrid silicon photonic device that can achieve beam forming and dynamic beam steering at the focus through control of the input phase profile. Furthermore, we investigate the possibility of dynamic polarization control in order to further manipulate the targets.

Swan Van

Biochemistry/Chemistry, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Alexis Komor, Chemistry and Biochemistry

Atomistic insights into the nucleic acid binding activity of the Trm10 enzyme

To incorporate a mutation of interest into the genome of living cells, conventional CRISPR-Cas9 genome editing relies on the introduction of cytotoxic DNA double-strand breaks (DSBs), resulting in random insertions/deletions (indels) and low efficiencies. In contrast, base editors introduce a point mutation at a specific site without first generating DSB. A base editor consists of a catalytically inactive Cas9 fused with a base-modifying enzyme that acts on ssDNA. Base editors thus enable the direct, irreversible conversions of C•G base pairs to T•A (by cytosine base editor, CBE) and A•T to G•C (by adenine base editor, ABE) with high efficiency and precision. While this technology is a revolutionary genome editing tool, the two existing base editors can only mediate four transition mutations ($C \rightarrow T, A \rightarrow G, T \rightarrow C$, and $G \rightarrow A$) but not other combinations. To address this limitation, we work to develop novel base editor that can convert G•C base pairs to T•A by repurposing the

nucleic acid modifying enzyme Trm10 to work cooperatively with Cas9. Wild-type Trm10 catalyzes the methylation of guanine base in tRNA during post-translational modification, but does not show any measurable activity on single stranded DNA (ssDNA) so it cannot be used directly as a base editor. Therefore, we aim to generate evolved Trm10 enzymes that are capable of performing $G \rightarrow T$ editing on ssDNA, and use these proteins to develop the first GTBE. We run molecular dynamics simulations to study the atomistic interactions between Trm10 and its substrate tRNA as well as ssDNA, and use this information to identify potential residual sites of mutations for evolved Trm10. The outcomes of this research would provide information for site-directed mutagenesis experiments to generate a novel GTBE enzyme.

Gabriel Van Konynenburg

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Mentored by Dr. Stephanie Jed, Literature

Aging in Film

In this paper, I will explore the complex topic of aging in film. focusing on the older adult population and the various ways in which they are portrayed in a variety of different film categories. While emphasizing certain issues that impact the older adult community, I will bring awareness and spark meaningful dialogue. Thoroughly dissecting how film is capable of connecting and engaging viewers also faced with similar aging related circumstances and experiences. There is limited research on this topic and my purpose is to combine film and gerontology. With the increasing cost of living and the growing population it is dire that we prioritize the rights, respect, and health of elders.

Arely Vasquez

Data Science, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Jingbo Shang, Data Science

Using Machine Learning Models to Support First-generation Students attend College

Higher education is something so rewarding for not only the student themselves, but it is an accomplishment for the family that is beyond just a degree. A first-generation college student is defined as a student who neither of their parents has obtained a 4-year college degree. Statistically, this vulnerable group of students are less likely to attend college; and therefore, they need extra help in high school to encourage and help them go to college. In this project, we propose to employ data analytic techniques to identify the factors most correlated with the first-generation students' decisions to attend college. Specifically, we conduct our experiments based on a questionnaire dataset collected from 16,000 high school students across the nation

tracking their education status two years after their high school study. We have built a range of machine learning models seeking to identify whether a high school student will eventually attend college and what are the key factors influencing their decision. Based on the best performing model, we found that the most impactful factors to the first-generation college student are the support of high school guidance counselors, taking AP classes, and the mother's expectations of the child's future education. We believe our results would shed lights towards better supporting first-generation students.

Daniel Vazquez

Physics, UC San Diego
Converge Incubator
Mentored by Jacques Chirazi, Office of Innovation and Commercialization - Basement / Blackstone Launchpad Program

Team Rush Hour

Team Rush Hour is working on improving sanitation at transportation hubs and transit vehicles in order to provide a safe return to public transportation. We have partnered with SANDAG to understand how their visionary 2021 regional plan, that hopes to reinvigorate public transportation around San Diego, will be affected in the age of COVID. We are also working closely with SD MTS to understand current safety measures, gauge their effectiveness, and propose updated strategies.

Joseph Vechinski

Marine Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Eric Allen, Departments of Biological Sciences

Trends in Microbial Communities of Southern California Marine Fishes

Microbial communities on living organisms are known to have profound effects on health and metabolic function. Using microbial data previously collected by the Allen lab at Scripps Institute of Oceanography, we sought to analyze trends among microbial communities across a variety of factors in local marine fish, such as mobility, location, and trophic level. We predict that life history and diet will be strongly correlated with the type size of microbes found on fish.

Luis Velez Vera

Chemical Physics, San Diego State University
STARS
Mentored by Dr. Tenio Popmintchev, Department of Physics

Efficient Generation of High Harmonic X-rays for Femtosecond-to-Attosecond Spectroscopies Using UV-VIS-IR Lasers

Luis Velez Vera (San Diego State University), Aldair Bonila (California State Polytechnic University, Pomona), Cesar De La Torre Castaneda (CSU San Bernardino) Katarina Brekalo (CSU Stanislaus), Meghan Shen (UC San Diego), Yingying Cui (UC San Diego), Siyang Wang (UC San Diego), Dimitar Popmintchev (UC San Diego), Tenio Popmintchev (UC San Diego/Photonics Institute, Vienna)

Generating hard x-ray lasers under conventional linear optics requires an immense amount of energy. The applications for them are numerous, including nanoelectronics design and atomic imaging. This amount of energy can be reduced by several orders of magnitude when using nonlinear optics, through a process of high harmonic generation accompanied by phase matching. This process runs an initial laser beam through high harmonic generation and phase matching inside a noble gas vacuum chamber, which subsequently produces an x-ray laser beam of a desired wavelength. This project reports theoretical simulations in MatLAB that emulate Gaussian laser beam parameters, and the respective ionization rates needed in a noble gas vacuum chamber. These simulations allow the creation proper high harmonic generation and phase-matching. Once calculated, consequent simulations in Zemax can measure the resulting wavelengths of x-ray light. These simulations mirror a spectrometer that produces coherent diffractive imaging with femtosecond to attosecond time scales and up to atomic resolution.

Anh Vo

Global Health and International Studies, UC San Diego
McNair Scholars Program
Mentored by Dr. Rebecca Fielding Miller, School of Medicine

#GameChangers: Sexual Resistance Program in Eswatini

Gender-based violence is a serious public health issue among young university students. However, traditional sexual violence prevention intervention often has little effect on addressing gender-based violence. In response to this challenge, the University of Eswatini adapted and implemented an evidence-based intervention called #GameChangers. The framework of #Gamechangers centered on the notion of resistance which reinforces the belief that preventing sexual assault is always the responsibility of the perpetrator and never the victim. #GameChangers' workshop modules are designed to create discussion relevant to gender-based violence among young university women to disrupt harmful gender norms and debunk victim-blaming

myths. This study aims to qualitatively understand participants' and facilitators' conceptions of power and gender at various levels through their participation in the #GameChangers program. We analyzed 10 in-depth interviews conducted of participants and facilitators of the #Gamechangers program in Eswatini and extracted salient themes from all interview transcripts and utilized modified grounded theory approach. Our findings revealed that participants, through the process of group dialogue, are able to recognize gender-based power differentials and feel empowered to address them to various degrees on the individual, interpersonal, and community levels.

Minh Vo

Computer Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Truong Nguyen, ECE

Fall Risk Detection From Video Using Key Joint Locations

Fall risk detection plays an important role in the health of the elderly and HIV patients, and many others. Balance boards, which classify a patient's fall risk by analyzing their center of pressure (CoP) during a period of steady standing, is the norm in fall risk detection at hospitals. However, accurate balance boards are normally expensive, which will drive up costs of treatment. My group is researching a method to accurately detect fall risk from a video feed from cameras as a more affordable alternative. Given front-facing videos feed of multiple participants of different fall risk levels standing on a balance board, the goal is to extract relevant data from these videos, then using neural networks to predict participants' CoP locations throughout the video, using balance board data as ground truths. Then, we classify the participant's fall risk as either low, moderate, or high, using the predicted CoP locations. I am experimenting with key joint extraction network HRNet to find locations of key joints (shoulders, knees, wrists, etc.) from images of people. I apply this method on every frame of all participant videos to generate datasets of key joint locations, then input these datasets to a specialized neural network in order to train it to predict CoP locations. Current results show that the network can predict the CoP locations with some accuracy for a participant with high fall risk, which shows potential that we can apply this method to more participants and increase the level of accuracy.

Hong Wang

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Chris Mi, Department of Electrical and Computer Engineering

Modeling of an extremely high power charging system for all electric airplanes

To make all-electric airplane (AEA) commercially viable, the AEA must be able to carry a large number of passengers and conduct flights frequently. For a mid-range airplane, the average time interval between landing and departure is around only 2 hours. Therefore, the charging stations are required to efficiently charge AEA within a short time. Besides, based on the rough calculation, the charging process must attain a megawatt power level, which is much larger than the power rating for the current charging system. However, due to the non-ideality of power transfer in the charging system, the power dissipation is a crucial concern because even though only 5% of power dissipation, the loss of energy may be unmanageable. Moreover, in the commercial application, the charging station should not only work safely under the extremely high-power situation to avoid system malfunctions such as catching fire, but also extend the battery life cycle. Hence, choosing optimal topologies in the charging system to reduce the power dissipation and hazard with fast-charging capability is essential. In this project, the Boeing 737-Max8 is used as a reference for the future AEA model to calculate the energy consumption for each flight. Furthermore, the aircraft traffic information in a middle-sized airport is investigated for analyzing the required maximum power and average power by the charging system. The results are used in modeling and designing the fast-charging system, which will be verified by MATLAB Simulink.

James Wang

Chemical Engineering, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Nisarg Shah, NanoEngineering

Modeling effects of immunosuppressive PD-L1 biomaterials on T cell proliferation in the lymph node microenvironment

The signaling pathway of programmed cell death 1 receptor (PD-1) and programmed cell death receptor ligand 1 (PD-L1) has been well characterized as a mechanism employed by cancer cells to evade T cell-mediated cell death by inducing exhaustion of T cells. The role of PD-1/PD-L1 in mediating immune evasion of cancer cells and the framework of prior work in cancer immunology presents an opportunity to develop a strategy to facilitate the treatment of autoimmune disorders arising from a loss of immune self-regulation. Modeling key interactions between antigen presenting cells and T cells will provide experimental parameters for PD-L1-mediated suppression of autoreactive T cells. Here I develop an agent-based model to simulate T cell interactions with PD-L1-based suppressive artificial antigen-presenting cells (aAPCs)

and dendritic cells (DCs) within the lymph node. I created a 3D simulation space to represent the lymph node and placed suppressive aAPCs and DCs in fixed positions and CD4 and CD8 T cells in random initial positions. By comparing the proliferation profiles of different interaction mechanisms and at a range of suppressive aAPC concentrations, I determined the parameters for PD-L1 mediated suppression and provided a framework for how PD-L1 expressing biomaterials might control T cell activation and proliferation. My computational model suggests that PD-L1-based suppressive beads can limit T cell activation by preventing cell arrest on dendritic cells, a critical step for T cell proliferation.

Henry Wang

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Saharnaz Baghdadchi, Electrical and Computer Engineering

Integrated Optical Phased Arrays for Optical Trapping

Optical phased arrays apply the principles of constructive and destructive interference of the light fields emitted from an array of radiating elements in order to engineer an arbitrary intensity pattern in free space. By controlling the amplitude and phase profile at the input to each radiating element any desired field pattern can be achieved. Integrated optical phased arrays have become popular in a variety of applications for their ability to form and dynamically steer an emitted beam without the need for any mechanical devices. Optical trapping or optical tweezers employ highly focused beams to manipulate sub-micron scale objects. The intensity gradient of a gaussian beam creates a microscopic restorative force that effectively holds an object in place. Optical tweezers are used in biology and medicine as a means to investigate the force mechanisms of single cell systems, the construction of artificial cell structures, and the field of cell sorting. We use the optical simulation software, Lumerical, in order to design and test the capabilities of an integrated optical phased array for the goal of optical trapping. Using standard Silicon on Insulator wafers and Complementary Metal-Oxide-Semiconductor (CMOS) processes we design a hybrid silicon photonic device that can achieve beam forming and dynamic beam steering at the focus through control of the input phase profile. Furthermore, we investigate the possibility of dynamic polarization control in order to further manipulate the targets.

Jacob Watson

Psychology, CSU Bakersfield
STARS
Mentored by Dr. Chitra Mandyam, Anesthesiology

The protective effects of Endostatin on the expression of PECAM-1 in the medial prefrontal cortex in chronic ethanol exposed rats

Alcohol Use Disorder (AUD) is a relapsing disorder that induces traumatic neurophysiological effects during withdrawal/abstinence. Chronic intermittent ethanol vapor inhalation (CIE) in rodents is a well-defined model of moderate to severe AUD. Prior research in CIE rats has shown greater consumption of ethanol in an operant self-administration paradigm compared with CIE naive rats. CIE rats show enhanced somatic and motivational withdrawal behaviors during abstinence when compared to CIE naive rats. CIE rats also show enhanced relapse to ethanol seeking behaviors during protracted abstinence. Enhanced relapse is associated with increases in gliosis and neuroinflammatory responses--visualized as enhanced proliferation of oligodendrocyte progenitor cells and enhanced expression of platelet-endothelial cell adhesion molecule-1 (PECAM-1) in the medial prefrontal cortex (mPFC). Ongoing studies aim to determine whether the increases in PECAM-1 in the prefrontal cortex play a role in relapse to ethanol. To do so, we used endostatin to inhibit the expression of PECAM-1 during withdrawal and abstinence from CIE in adult male Long-Evans rats. mPFC tissue was processed for immunohistochemistry to evaluate the effect of endostatin treatment on PECAM-1 expression. Our hypothesis is that endostatin will inhibit the upsurge of PECAM-1 expression during withdrawal/abstinence from CIE and these changes will correlate with reduction in gliosis in the mPFC. Implications of these findings would be to use endostatin as a pharmacotherapeutic treatment to assist in decreasing the propensity for alcohol relapse in individuals suffering from moderate to severe AUD.

Benjamin Werb

Oceanic and Atmospheric Sciences, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Ryan Kastner, Computer Science

Smartfin: Gathering Oceanic Data from Recreational Surfers

Climate change has created an urgent need for data collection about shifting ocean dynamics in the nearshore zone, a crucial region to study because of its large impact on coastal health. Unfortunately, the traditional method of using anchored buoys for data collection has left oceanographers with a low spatial density of measurements to use for research, leaving the vast majority of the coastline understudied. One solution to fill this gap is Smartfin, a surfboard fin equipped with an internal measurement unit (IMU), GPS, and temperature sensor. Its purpose is to engage recreational surfers to collect important oceanic data including sea surface temperature (SST) and

significant wave height (Hs) while simply spending time in the nearshore zone. This technology can significantly increase the spatial density of measurements without the need to build and maintain many additional buoys. In this study, we gauge the ability of the Smartfin to determine wave height measurements and explain methods used to improve the results of IMU-based wave height calculations. Through these methods and new validation techniques, we aim to reduce Smartfin's real-world error in significant wave height calculations by more than 45%.

Clara Wong

Human Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Stephen Howell, Department of Medicine

Efficacy of RSPO1-fusion Protein against Cancer Cells containing LGR receptors

The R-spondin 1 (RSPO1) protein is part of a family of four R-spondin (RSPO) proteins found in humans (Kim, 2006). The RSPO family of proteins has recently been a topic of scientific interest due to a correlation found between high expression of RSPO proteins and the growth of cancerous tumor cells. The RSPO1 protein specifically has also been discovered to play a significant role in tumor cells as the RSPO1 protein greatly increases the mortality risk of certain cancers. RSPO1 can be used to play a role in hormone therapy. Since the RSPO1 receptor, a leucine-rich repeat-containing G-protein coupled receptors or LGR receptor is found on cell surfaces of aggressive-growth tumor cells or cancerous cells, the research may explore a new method of non-invasive tumor treatment (RSPO1, 2019). In this project, female nude mice inoculated with tumor cells expressing the LGR receptors will be administered doses of an RSPO1-containing fusion protein, and cytotoxicity of the fusion protein on the tumor will be measured by observing changes to the size of the tumor. Cytotoxicity of the fusion protein on the mice will also be determined via imaging of specific internal organs to determine damage.

Lindsay Wong

Molecular Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Weg Ongkeko, Surgery

Immune landscape of cancers caused by viral factors

Roughly 12% of cancers worldwide can be attributed to viral agents. However, recent advances in immunotherapy have shown promise in treating several virus-induced cancers. Despite its promise, there are still many who fail to respond to this treatment. This study aims to discern how viruses in virus-induced cancers affect genes implicated in the immune system as well as potentially give insight on the development of this differential clinical response. The virus-caused cancers examined include head and neck squamous cell cancer and cervical squamous cell

carcinoma in relation to human papilloma virus, liver hepatocellular carcinoma in relation to hepatitis B virus and hepatitis C virus, and stomach adenocarcinoma in relation to Epstein-Barr virus. By studying how these viruses interact with the immune system in tumor environments, we aim to not only elucidate the molecular mechanisms by which viruses promote the pathogenesis of cancer through immune evasion, but to also explore novel gene targets for immunotherapy on a pan cancer scale. Computational analyses such as differential expression, survival, and clinical variable analysis were performed to determine significantly dysregulated immune-associated genes implicated in virus-induced cancers.

Jin Yi Wu

General Biology, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Sandra Sanchez-Roige, Psychiatry

CADM2, cell adhesion molecule, and its effects on impulsivity and synapse morphology

Impulsivity describes the predisposition towards risky and premature responding and is associated with numerous neuropsychiatric disorders. Using genome-wide association studies, Sanchez-Roige et al (2019) identified robust associations between the gene cell adhesion molecule 2 (CADM2) and various measures of impulsive behavior. CADM2 is a regulator of synaptic signaling and is enriched in areas of the brain that regulate impulsivity, such as the nucleus accumbens (NAcb). Although there is compelling evidence for an association between CADM2 and impulsivity, the mechanism for which this gene modulates impulsive behavior remains unclear. Using a conditional knockout (KO) mouse model of Cadm2 established by Sanchez-Roige et al, I explored the molecular consequences of Cadm2 deletion by characterizing dendritic spine morphology (which comprise of thin, stubby, mushroom, filopodia, branched, and total number of spines) between Cadm2 KO and wild type (WT) mice in the NAcb. Cadm2 KO and WT mice showed a similar number of thin and branched spines. However, Cadm2 KO mice displayed a tendency for having a higher number of mushroom and stubby spines and overall total spines than WT mice. The contrasting morphology results suggest that Cadm2 may influence mouse models of impulsive behavior by disrupting synapse organization. This multidisciplinary work examines the mechanisms that contribute to the remodeling of synapses, thus advancing the molecular understanding of impulsivity.

Raini Wu

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Dinesh Bharadia, Electrical and Computer Engineering

Viewport-adaptive 360-degree video streaming

A key component of immersive virtual reality (VR) content, 360° video contains content in every direction with each frame. Traditional VR headsets utilize a wired connection to deliver this high quality content with minimal latency. However, wires limit mobility and cannot be scaled to large areas. To enable delivery of high quality content over a wireless link, some optimization must be performed. Unlike traditional videos, only a small fraction of 360° video is visible at any one time. State-of-the-art approaches to delivery of 360° video utilize viewport-adaptive streaming, which adapts delivered content based on the visible portion. Current methods of viewport-adaptive streaming project 360° video to equirectangular projection (ERP), which is then segmented into tiled regions. A subset of the tiled regions is delivered, allowing for bandwidth savings. However, the tiled approach to viewport-adaptive streaming has several fundamental limitations. In our work, we explore a novel system of viewport-adaptive streaming based on the truncated square pyramidal (TSP) projection which removes these inadequacies of tiled viewport-adaptive systems. In TSP projection, the quality of the video is uniformly reduced, allowing for less jarring boundaries relative to a tiled implementation while allowing for similar bandwidth savings. Experimental results show improvements over existing viewport-adaptive systems, with no additional client-side overhead relative to a tiled ERP baseline.

Gaotong Wu

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr.Pengtao Xie, ECE

self-supervised learning for time-series classification

In this project, Momentum Contrast unsupervised learning method, known as MoCo, is implemented to perform classification problems. MoCo passes the query queue into a network encoder and the key queue into a momentum encoder, then the encoded query and encoded keys use contrastive loss which makes the query similar to the positive key and dissimilar to the negative key. By replacing the network encoder or the memory bank for the key queue with a momentum encoder, MoCo solves the problem of massive memory or outdated keys. One of the tasks is to set the encoder of the query queue as LSTM-FCN which is a concatenation of two branches: one fully convolutional block containing three temporal convolutional blocks, with each temporal block succeeding by batch normalization and ReLU activation function, and one basic or attention LSTM followed by a dropout layer. The outputs of these two branches are concatenated together and go into a softmax layer

for classification purposes. LSTM-FCN is commonly used for times-series classification and we are using it into Moco to complete the time-series classification task. Moreover, positive keys are formed by data augmentation on the current query. In this project, window cropping, fourier transform, flipping and noise adding are chose as time-series data augmentation. In a nutshell, the project explores to use LSTM-FCN as the encoder for the query queue and pick four data augmentation methods to generate the positive keys.

Anfeng Xu

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

Mathematical Underpinning of Information Acquisition Systems

Let $x \in [0,1]^N$ be an unknown vector of length $N = 2n$, where n is a natural number. In our setting, we assume x to be sparse with k entries of 1 and the rest entries to be 0. Let W_N be a Walsh-Hadamard matrix of dimension N, with its -1 entries replaced by 0. At time t, we choose a measurement vector(i.e. beamforming vector) $w_t \in [0,1]^N$ from the rows of W_N. After each measurement, we get an observation $y_t = \langle x, w_t \rangle$. Let's say that we can determine x right after τ measurements. Our objective is to determine $w1, w2,...$such that $E[\tau]$ is minimized. We propose algorithms choose the measurement vectors sequentially and adaptively. Through simulations, we approximate the expected number of measurements required to recover the unknown binary vector.

Nancy Xu

Visual Arts - Media, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Jordan Crandall, Visual Arts

Big Brother — A short story and screenplay by Nancy Xu

How do we value our time, and our lives? "Big Brother" is a short story and feature-length screenplay that explores how a neoliberal society often answers that question for us. In it, I adopt the concepts of secular faith — devotion to our finite life as a means to an end itself — and new technologies of power from two works: Martin Hagglund's This Life and Byung-Chul Han's Psychopolitics, respectively. By grappling with and examining the relationship between those two notions, "Big Brother" begs the question of why we are driven to pursue what we do, and if our endeavors are accurate reflections of our priorities and values.

Yilin Xu

Biochemistry/Chemistry, UC San Diego
Multidisciplinary Educational Approach to Reducing Cancer Disparities
Mentored by Dr. Georgia Robins Sadler, Department of Surgery

A Literature Review of BRCA Mutations and Survival Disparities in Breast Cancer Among Women of African Ancestry (WAA)

Women of African Ancestry (WAA) are less likely to be diagnosed with breast cancer (BC) but are more likely to die from it. This literature review was conducted to elucidate the latest scientific evidence related to identifying correlations of BRCA mutations, triple-negative breast cancer (TNBC), and adverse outcomes in WAA. PubMed, ScienceDirect, and Google Scholar were explored using a variation of key terms such as women of African ancestry, Black women BRCA 1 and 2 mutations, health disparities, genetic mutations, and TNBC. All full-text articles meeting search criteria in English published between 2005 and 2020 were examined. WAA continue to have the second-highest breast cancer incidence rate, but the highest mortality rate compared to other women, in spite of the national focus to improve outcome. WAA are more likely to be diagnosed with TNBC and at an earlier age. WAA were reported to have a higher percentage of BRCA mutations which may be contributing to the disproportionate diagnosis of TNBC. Underuse of genetic testing for BRCA mutations may delay diagnosis and prompt treatment, thereby contributing to low survival rates. WAA have a lower survival disparities compared to other women. Genetic testing education is essential to helping WAA to understand their personal risk, which could facilitate early cancer detection, opportunities for second opinions, and prompt treatment, leading to better outcomes.

Haoru Xue

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Ramsin Khoshabeh, Electrical and Computer Engineering

CV-Based Localization on Educational Autonomous Robotic Car

The project aims to enable computer-vision based localization technology on low-cost autonomous robocars for undergraduate education in design and machine learning (ECE 140). From a small-scale simulation in Unity, up to deploying robocars on a physical track, it would address the cost of more advanced localization technology in classroom settings, and offer intuitive hands-on experience with ML in general. Students begin with a sandbox in Unity where the features of the space are easily identifiable. After collecting images and location data, they will construct python scripts to train a neural-net to predict the agent's location based on image input. Next is to move onto a street-scene simulation; where the localization and drive-control networks will work in conjunction to complete more complicated tasks, such as navigation. Finally, the technology is deployed onto an actual robocar to assess its

performance in the real world. Over ninety percent of the cost will be reduced by using a trivial camera ($10), opposed to 2D lidar (over $100). Based on the running results, there is great accuracy in ideal situations (MSE test loss < 0.05); it has been compiled into interactive modules for quick and easy to understand educational purposes. There is still progress to be made in the real-world like simulation where the localization neural-net must have consistent accuracy to achieve navigation.

Justin Yang

Cognitive Science, UC San Diego
Undergraduate Research Scholarships
Mentored by Dr. Judith Fan, Psychology

Communicating what we perceive and know about objects by drawing

We can use drawings to convey what we know about objects at different levels of abstraction, ranging from photorealistic renderings to schematic diagrams. What cognitive mechanisms enable people to produce such varied drawings? We hypothesized that ongoing perceptual processing and long-term memory jointly constrain drawing production, such that drawings produced while viewing an object contain more diagnostic information than those drawn purely from memory. The current study evaluates this hypothesis by comparing drawings of objects cued with a photograph to those cued with a category label. Sixty participants produced 12 drawings of different objects, divided between these "photo-cue" and "label-cue" conditions. We found that they used a similar number of strokes in both conditions (label: 10.8 strokes; photo: 10.2 strokes; $b=-0.675$, $t=-0.502$, $p=0.618$), suggesting that such low-level measures may not distinguish between them. By contrast, a machine learning classifier trained to identify the drawn object using high-level features of each sketch was able to classify photo-cued sketches more accurately than label-cued sketches (photo: 76.0% classification accuracy; label: 60.4%, $b=-0.733$, $t=-2.73$, $p<0.01$), suggesting that participants were better able to include semantically relevant information about objects in the presence of the photograph. Together, these results help advance our understanding of how drawings communicate what we see and know about the visual world.

Donna Yerat-Rodriguez

Political Science with minor Ethnic Studies, UC San Diego
Triton Research & Experiential Learning Scholars (TRELS)
Mentored by Dr. Luz Chung, Educational Studies

Redefining Success in Higher Education through Testimonios (testimonies) First-Generation College Students at UCSD

In Yosso's (2006) article, "Whose culture has capital? A critical race theory discussion of community cultural wealth" the author describes the narrative that surrounds first-generation college students from low-income communities. This

narrative portrays them as lacking the cultural capital to succeed in institutions of education that contribute to their perceived poor performance in academia. This narrative contributes to first-generation college students from underprivileged communities falling prey to what is known as "imposter syndrome" (Clance 1995) because they are challenged to define what success looks like within higher education. In this research, I will be using Yosso's concepts of community cultural wealth, which include aspirational, familial, linguistic, and navigational capital to understand how students utilize these forms of capital to define success for themselves. The guiding questions in this research are: How do first-generation college students define success for themselves? In Beverly (2000), Testimonio, Subalternity, and Narrative Authority the author explains testimonios (testimonies) as a first-person narrative. This research project will be utilizing testimonios to center the voices and experiences of first-generation college students at a Southern California public university. Through the use of testimonios, I hope to highlight how student's culture, language, and backgrounds help them navigate higher education while defining success for themselves.

Fei Yin

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Truong Nguyen, Electrical and Computer Engineering

Multi-view Reconstruction

The goal of this project is to enable real-time 3D model reconstruction of a moving person. The reconstruction utilizes color and depth data provided by Intel's Realsense cameras. Although there are existing methods, such as Kinect Fusion, that accomplish similar tasks, most of those methods involve moving a single camera to capture then reconstruct static scenes or targets only, instead of moving ones. The project currently builds on one of such methods, InfiniTAM. We aim to extend its functionalities to support multiple calibrated Intel Realsense Depth Cameras and use its GPU-accelerated TSDF algorithm to synthesize the depth and RGB streams from multiple views to reconstruct moving targets frame by frame in real time. We seek to progressively enable multi-camera reconstruction of static person, moving person, and finally, real-time multi-camera reconstruction of a moving person. Due to the high precision required in calibrating Realsense cameras, we develop and utilize simulated data for extensive testing. Potential applications of this project include, but are not limited to, VR recording and Holoportation.

Lindsey Young

Mechanical Engineering, UC San Diego
Converge Incubator
Mentored by Jacques Chirazi, Office of Innovation and Commercialization - Basement / Blackstone Launchpad Program

The Gender Minorities in Engineering Initiative

The Gender Minorities in Engineering Initiative is a network of both working professionals and academics actively seeking to promote opportunities for minorities starting a career in engineering via an online platform. This initiative directly connects minorities in engineering to a role model who knows exactly what they're going though-- because they did it themselves. Users can chat with mentors, set up meetings for in-person attention, gain access to exclusive job opportunities, and have a safe space to foster their growth in engineering. There is currently no resource like this available. There are large organizations who do a great job at spreading awareness about gender inequality, but finding a mentor is a somewhat difficult and lengthy process. Furthermore, most of these large platforms are specifically targeted at women, failing to recognize transgender and gender-queer folks who are facing discrimination in engineering just as cisgendered women do. The Gender Minorities in Engineering Initiative puts users in direct and immediate contact with mentors without the pressure of having mandatory monthly meetings or any sort of schedule to stick to. The Gender Minorities in Engineering Initiative's mission is to help gender minorities achieve their full potential in the field of engineering, promote inclusion and diversity, and advocate for gender equality in both academia and the professional world.

Weginbara Youpele

Electrical Engineering, UC San Diego
California Louis Stokes Alliance for Minority Participation (CAMP) in Science, Engineering and Math
Mentored by Raghav Subbaraman, Electrical and Computer Engineering

Beam-Forming Calibration through UART-to-SPI Data Conversion

In order for mmWave 5G-NR waves to reach their desired performance level in mobile applications, beamforming methods must be improved upon and evaluated seriously. These beamforming methods are tested through a custom 5G-NR compliant mmWave testbed that serves as an evaluator of beam management algorithms. This testbed can be used to demo and collect data on Vehicle-to-Everything (V2X) communication applications. Applications of V2X can target issues that can improve the vehicles' sensing ability such as bad weather and long range sensing by collecting sensing and driving data between cars and combining the information. Within the testbed, these algorithms are stored in an effort to use them to calibrate the antenna of a 8x8 phased array. The phased array is used to locate the

positioning of the vehicle relative to the positioning of the last antenna that was calibrated. To ensure these antennas are moving at a real time speed we will be using the beam management algorithms to create beam-forming weights that correspond to the 64 antennas of the phased array. Through SPI protocol and a CMOD A7 35T FPGA board, these weights will be able to control the phased array through a DC Board at near instantaneous speeds. The programming of the FPGA will be done through Xilinx and Vivado to design data conversion algorithms for UART to SPI conversion.

Xinyang Yu

Electrical Engineering, UC San Diego
Electrical and Computer Engineering SRIP
Mentored by Dr. Zhichao Li, ECE

Autonomous Quadrotor Robots

Hobbyist drones are now widely used in today's world. With advances in embedded computation and sensing technology, hobby-level drones become readily available to the public. However, there is yet to be an open-source and expandable drone platform for different kinds of research purposes. In order to close this gap, our project aims at building a quadcopter drone platform which is able to do autonomous mapping and 3D environment reconstruction. It includes a powerful Intel NUC computer, high-performance networking device, and various reliable sensing devices like global-shutter camera, high-precision IMU and GPS, facing down LiDAR, etc. To support those devices, a major component of the project is designing a power distribution PCB board. To build the drone, frame, motors and propeller are carefully selected according to project requirements. Hardware construction of the robot involves skills such as CAD design, laser cutting, and 3D printing. Furthermore, once the hardware is in place you need to install sensor drivers so that they can communicate properly to the flight controller and companion computer. Next we set up a network using Ubiquiti devices so the drone can communicate with the ground station reliably over a long-range. Basic PID controller theory will be learned, in order to tune parameters of the flight controller to achieve stable hovering. Finally, we would like to achieve a waypoint following task. Detailed development guides will be written along the way to make the project more valuable and beneficial to future researchers.

Eric Yu

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Learning Modular Policies for Robotic Control

Reinforcement Learning (RL) is a powerful paradigm for solving robotic control problems, yet a well-known open issue is robustness and generalization across a diverse set of morphologies and tasks. Especially when dealing with high-dimensional problems like training structurally complex robots to walk, classical RL algorithms oftentimes fail and need to be supplemented with other techniques. Changing the task also mandates re-engineering entire chunks of code, manually tuning hyperparameters, or configurations, and hours of training. I am investigating the performance of policy gradient algorithms following an Actor-Critic (AC) framework in training a multi-jointed robot to move, by combining imitation learning with a variant of Shared Modular Policies (SMP) architecture. Initial findings on the performance of naïve Proximal Policy Optimization (PPO) following an imitation learning reward system suggest that naïve PPO alone is not enough to train a 16-jointed Laikago robot to walk or stand. Improvements are observed when breaking down the overarching controller into sub-controllers for each motor, which suggests a promising direction.

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Spatial Audio Demonstration

As of now, there are not many online tools available to learn about spatial audio, and almost no demos that experiment with personalization of head-related transfer function (HRTF). HRTF describes how a sound wave is affected by the head and body as it travels through space, so personalizing it to an individual's anthropometric measurements can improve sound localization. The CIPIC database contains ear measurements and corresponding HRTFs of 45 people that can be used by researchers to find an individual's closest HRTF match. Previous HRTF matching techniques have extracted distances from ear pictures, relying mostly on ear size. Our Matlab application offers three algorithms that provide a match based on ear shape. The user can select from block segmentation with Hu moment invariants, principal component analysis, and Q-vector analysis. After the closest ear shape match from the CIPIC database is identified, the corresponding HRTF is used in our demo (instead of the standard MIT KEMAR model HRTF). The demo was created by building on a Github program of a sound moving 360 degrees horizontally. We used C language with Simple DirectMedia Layer 2 libraries, creating a layout for the user

to specify the azimuth of the sound that they are hearing. We are creating an easily accessible, streamlined educational module for users to learn about spatial audio, and test for themselves whether the localization of the audio is improved.

Hanin Zayat

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Transcultural Translation: Transcription and Interpretation of Bilingual and Non-native Speakers in Feature-Length Spanish Language Films Through Captioning and Subtitling

The globalized world relies on computers to transmit information from spoken to written word, or to translate from one language to another. Online translation reduces communication to words which may not make sense across cultures to a human reader. Computer listening is limited by the variety of data that is made available. Different languages, dialects, or quality of audio may result in inaccurate automated captions. Transcultural translation in media is a form of accessibility and a product of a globalized online world. Along with computer help, humans provide context and make informed cultural decisions to make audiovisual media accessible. Through the use of softwares like Aegisub for Windows, or apps like EasySub and Subbr for Android and Chromebook, subtitles and captions can be edited by hand.
This project demonstrates the techniques and rules of transcription and translation through samples from Spanish-language feature-length films ranging from the 1940's to 2010's that include non-native or bilingual speakers. Increasing globalization and the tendency of multilingual speakers to have languages bleed into one another can be a limitation if a translator is not multilingual or doesn't understand the context of the speaker's background. This explores transcriptions that are true to a speaker's dialect, including syntax or grammatical errors, then analyzes how translations can be true to the original speech, reflecting the context while still being clear and understandable to a viewer.

Jiawen Zeng

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Contrastive Self-supervised Learning for Graph Classification

Data from bioinformatics, cheminformatics, social networks, etc can be represented as labeled graphs. In cheminformatics, for instance, nodes could be helices, sheets, or turns in protein, and edges could be connections between nodes that are along the same Amino Acid sequence or close in spatial structure. With the assumption that structural similarities imply function similarity, we could predict the function through

graph classification. A contemporary machine learning method named contrastive learning is targeted to learn similar and dissimilar things for a machine-learning model. In this study, we investigate a graph classification approach based on contrastive self-supervised learning. Our plan is that through the learning model, we can take a graph as input and predicts which class this graph belongs to.

Xiangjian Zeng

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RLS Harmonic Powerline Noise Cancellation in Median Nerve Recording

Powerline interference often characterizes the measurement and is responsible for a large portion of noise in peripheral nerve recordings. Traditional noise cancellation methods involve using a notch filter of the powerline frequency. However, previous study shows its disadvantage as powerline noise can vary in frequency by as much as 1Hz. Here a multi-layered Recursive Least Square (RLS) algorithm system is proposed to greatly reduce the energy of noise harmonics in median nerve recording. A low-cost and widely compatible hardware implementation featuring Teensy is proposed to prove its efficiency. With that, we achieve a more than 20dB dampening of the noise component in the recorded signal.

Zhen Zhai

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Belief Propagation List Decoder for Polar Code

Polar codes are a class of error-correcting codes that have attracted considerable attention since their invention by Arikan in 2009. They have recently been adopted in the next generation wireless communication standard (5G). The current state of the art decoder for polar codes is successive cancelation list decoding (SC-list), an extension of the original SC decoding proposed by Arikan. An alternative to SC-list decoding is belief propagation (BP) decoding, which was also first suggested by Arikan. Unlike SC-list decoding, which is inherently single-pass and serial in nature, BP decoding is an iterative, graph-based decoding algorithm that allows for parallel and high-throughput implementation. Moreover, whereas SC-list decoding produces only hard (bit) decisions, BP decoding provides soft (likelihood) decisions useful in more complex detection architectures. However, BP decoder performance is substantially inferior to SC-list decoding. Recently BP-list decoding, in which BP decoding is simultaneously implemented on several permutations of the BP decoder factor graph, has been shown to help close the performance gap. The set of permutations plays an important role in influencing the decoder performance, and if

carefully chosen could allow BP-list decoding to match or even outperform SC-list decoding. Our goal is to discover a way to find optimal factor graph permutations for use in BP-list decoding.

Claire Zhang

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Time-Resolved Single Cell Analysis of Neutrophil Diversity In Myocardial Infarction

Myocardial infarction (MI) triggers an acute inflammatory response, leading to rapid recruitment of neutrophils into the injured heart. Neutrophils are conventionally described as transcriptionally homogenous, short-lived first responders; however, recent works have suggested they are more functionally diverse than previously thought, encompassing distinct subtypes which may either facilitate resolution of inflammation or exacerbate injury. Relative to other cell types, the full temporal dynamics and heterogeneity of infarct neutrophils remain largely unexplored. Here, we leverage time-series single-cell RNA sequencing (scRNA-seq) to characterize the intracardiac granulocytic landscape as it evolves on days 1, 2, and 4 after MI. We observe time-dependent activation of the NFkB and HIF-1a transcriptional programs. We also capture the delayed emergence of a neutrophil subset previously undescribed in cardiovascular inflammation, characterized by recovery of Myc activity and expression of Siglec-F, a canonical surface marker for eosinophils. Overall, these findings add to current understandings surrounding infarct neutrophil diversification and elucidate a novel neutrophil subset, whose origins and role in the post-MI repair and remodeling process necessitate further exploration.

Qingyuan Zhang

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A New Camera Platform for Computer Vision Application

Thus far, highly accurate computer vision systems have had to rely on expensive non-traditional camera based technologies, such as 3D LIDAR, for depth perception, so it would be desired if a new computer vision system that is both cheap and highly accurate can be developed. There are three phases to this project: first, we need to theorize a model that this new computer vision system is going to use, second, we need to verify that such model can be an improvement to the existing models, and third, we must develop a computer vision algorithm to detect objects and depth and make sure it is optimized for the aforementioned system. During the first phase, we worked out a hypothesis on an improvement for the current camera systems, and now during the second and third phase, we are collecting data using test stands as

well as software application we have developed to verify the model's improvement on the accuracy of depth perception and develop a computer vision algorithm that is tailored for the new proposed system of ours.

Minghui Zhao

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ULoc - Robust, Scalable, cm-accurate UWB based localization

Most VR headsets use optical technology, such as infrared cameras, to accurately position the player. However, in many applications using optical technology means that the headset has to be in the tracker's line of sight and without any blockage in order for the positioning to work. In order to perform player tracking in non line of sight situations, we designed and developed a novel VR tracking system - ULoc, using Ultra Wideband positioning technology. The tracking system consists of a tag to be tracked, with one Ultra Wideband RF transceiver DW1000, and 4 fixed anchors boards each consisting of an array of same transceiver laid out on a custom-designed PCB. We developed microcontroller code to interface with the array of RF transceivers in precise timing, and applied Digital Signal Processing, as well as Python Data Analysis & Visualization techniques, to perform testings and experiments. We collected location data at different distances and angles to validate localization results and measured system resolution. From the experiments, we developed and are refining our localization algorithm using a combination of angle of arrival and time of flight data, as well as the ranging protocols to achieve higher scalability.

Annie Zhou

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Media Bias and What it Reveals About Political Power during the COVID-19 Pandemic

In the era of COVID-19, the flow of information and knowledge regarding the disease should be easily grasped. A disease that is so easily spread and could be a serious risk to the health of many people must be understood. But what happens when that information is corrupted by media bias? We took important words such as "Masks" and "PPE", and investigated their relationship in 16 different newspapers from all over the country and as well as the twitters of senators from the states that these newspapers are located in. Thus far, initial findings in analyzing data showed that more conservative newspapers and senators are less likely to mention words regarding the COVID-19 pandemic then liberal newspapers and senators, which is

indicative of a selectivity bias. When looking at words such as "Reopening Plans", however, the opposite effect occurs where conservative newspapers actually mention the phrase more than liberal newspapers. Furthermore, states with less coronavirus cases are less likely to have their news sources mention these phrases.

Ethan Yi Zhu

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Help Us Help You: How Racially and Ethnically Diverse Biobank Contributions Enable Stronger Basic Biology Research

Patients, clinicians, and the public may be aware of biobanking, the donation of biological samples to a clinical data/specimen bank, but lack awareness of how biobanks are used. This study shows the value of biobank research, stressing not only the benefits of patient participation but also the importance of contributions from diverse racial and ethnic groups. This study searched for potential biological contributions to the disparity in Black and White colorectal cancer (CRC) disease prognosis. The study focused on POM121, a nuclear pore protein recently linked to colorectal cancer aggression, using The Cancer Genome Atlas database. Among all CRC patients, Black patients show statistically significantly greater POM121 expression compared to White patients, a difference which increases among deceased patients, and deceased T4 patients. These results suggest a biological component to the racial disparity in CRC warranting further research while demonstrating the value of biobank donations. Though this research was possible for CRC, biobank samples for other diseases, such as prostate cancer, lack sufficient racial and ethnic diversity to be evaluated the same way. Given the potentially significant findings attainable from well-diversified biobanks, it is critical that clinicians, patients, and the general public understand how biobank donations build well-diversified databanks that help develop findings that can be widely generalized, as well as group-specific.

Siyuan Zhu

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FMCW Radar Imaging for Autonomous Driving

Radars are becoming more popular in the field of autonomous driving nowadays because, with larger wavelengths and active transmission of signals, they perform better object detection tasks in adverse weather conditions(like rainy days) and bad lighting conditions(at night or in tunnels) than lidars and cameras. With FMCW(Frequency Modulated Continuous Wave) radar particularly, we are able to

get more informative data that has a larger detection range, higher range and angle resolutions, and therefore rich points cloud can be generated by FMCW radars. By performing CFAR(Constant False Alarm Rate) detection on different modules in the post-processing pipeline, we can further fine tune the useful information that a points cloud generated. With the help of low-level data like range, velocity, AoA(Angle of Arrival) and reflection intensity information contained in radar data, we can use the method of 3D Radar Cube surrounding the detected objects to increase the accuracies of objects identification and classification tasks with CNN(Convolutional Neural Network).

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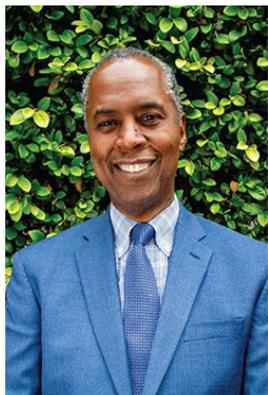
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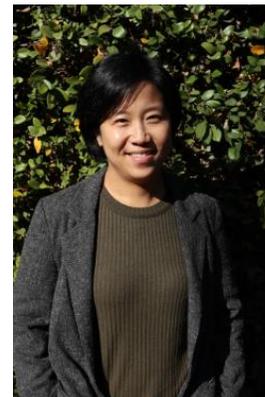
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