URC

36th Annual UNDERGRADUATE RESEARCH CONFERENCE

Saturday, April 22, 2023
8am - 4pm

CONFERENCE PROGRAM

UC San Diego
UNDERGRADUATE RESEARCH HUB

Conference Program

2023 Undergraduate Research Conference at UC San Diego

Welcome to the 36th Annual Undergraduate Research Conference (URC) at UC San Diego, which showcases the scholarly and creative work conducted by undergraduates at UC San Diego. The URC is the only campuswide conference to recognize undergraduate scholars in all fields during the academic year, and provides student researchers the opportunity to present their work at small roundtables moderated by an expert in their discipline.

This year's conference will be the first in-person URC since 2019, and we are excited to once again meet face-to-face to allow for increased engagement, participation, and celebration of outstanding undergraduate research. The 2023 URC features over one hundred and eighty undergraduate scholars who have been nominated by their faculty mentors to participate in this unique event.

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

The URC is planned and coordinated by the Undergraduate Research Hub (URH), which is a unit of Student Retention and Success within UC San Diego Student Affairs. Special thanks to Bev Fruto, URC Coordinator, for her dedication and hard work planning this year's conference, and to URH Director Dr. David Artis and URH Assistant Director Veronica Bejar. Additional thanks to Dr. Marie Sheneman, Mercedes Favors, Dr. Sophia Tsai Neri, Dr. Kirsten Kung, Dr. Thomas Brown, Daniel Movahed, Tessa Benedict-Philipp, and Samantha Pagdilao for their support in planning this conference.

Contents

Conference Schedule

8 - 8:45 AM	Check-in & Breakfast
8:45 - 9:20 AM	Welcome Remarks Intro: Dean Artis Executive Vice Chancellor Elizabeth Simmons Chancellor Pradeep Khosla
9:30 - 10:30 AM	Morning Session I
10:40 - 11:40 AM	Morning Session II
11:45 AM - 12:45 PM	Lunch
12:55 - 1:55 PM	Afternoon Session I
2:05 - 3:05 PM	Afternoon Session II
3:15 - 3:45 PM	Closing Remarks
3:45 - 4:00 PM	Photos and Certificates

Panel Presentation Schedule

Morning Session I, 9:30 – 10:30 AM

Panel #	Panel Name	Location
1	Bioengineering	**Room 1**
2	Cancer	**Room 2**
3	Regenerative Medicine and Stem Cells	**Room 3**
4	Social Psychology	**Room 4**
5	Native American and Indigenous Studies	**Room 5**
6	Perceptions of Self and Others	**Room 6**
7	Medicine and Disease I	**Seuss Library**
8	Protein Engineering and Gene Expression	**Atkinson Pavilion**
9	Chemistry	**Dining Room Terrace**
10	Alzheimer's Disease, Hormones, and Neurodegeneration	**Cecil's Lounge**

Morning Session II, 10:40 – 11:40 AM

Panel #	Panel Name	Location
11	Psychosis, Isolation, and Social Context	**Room 1**
12	Genome Editing Applications	**Room 2**
13	Reproductive Health	**Room 3**
14	Neuroscience	**Room 4**
15	Neurodegeneration and Neural Repair	**Room 5**
16	Learning and Education	**Room 6**
17	Medicine and Disease II	**Seuss Library**
18	Film	**Atkinson Pavilion**
19	Chemistry and Biochemistry	**Dining Room Terrace**
20	Neuroscience and Cognitive Science	**Cecil's Lounge**

Afternoon Session I, 12:55 -1:55 PM

Panel #	Panel Name	Location
21	Technology and Economics	**Room 1**
22	Computational Methods in Biology	**Room 2**
23	Genetics and Genomes I	**Room 3**
24	Ecology and Behavior	**Room 4**
25	LGBTQ+ Studies	**Room 5**
26	Neurobiology	**Room 6**
27	Medicine and Disease III	**Seuss Library**
28	Anxiety and Depression	**Atkinson Pavilion**
29	Environmental/Social Factors and Well-Being	**Dining Room Terrace**
30	Physics	**Cecil's Lounge**

Afternoon Session II, 2:05 – 3:05 PM

Panel #	Panel Name	Location
31	Ethnic Studies	**Room 1**
32	Mathematics	**Room 2**
33	Genetics and Genomes II	**Room 3**
34	Electrical and Computer Engineering	**Room 4**
35	Literature, Language, and Philosophy	**Room 5**
36	Topics in Engineering	**Room 6**
37	Education	**Seuss Library**
38	Addiction and Substance Use	**Atkinson Pavilion**
39	Public Health	**Dining Room Terrace**
40	Computer and Data Sciences	**Cecil's Lounge**

Panel Details

Morning Session I

9:30 – 10:30AM

Panel 1: Bioengineering

Room 1

Moderator: Dr. Barbara Calabrese

Lidia Vazquez

Mentor: Dr. Olivia Graeve

Europium-doped Hydroxyapatite for Bone Healing Applications

Gaya Kalyan

Mentor: Dr. Robert J Sah

Structure of the Rabbit Anterior Cruciate Ligament Analyzed by Micro-Computed Tomography

Scott Skalak

Mentor: Dr. Adam Engler, Professor and Chair of Bioengineering

Preservation of Cardiomyocyte Lamin Reduces Age Dependent Decline of Cardiac Function

Ryan Li and Angela Liu

Mentor: Professor Robert Sah

Biaxial tensile testing apparatus to determine tensile strength of small soft tissue samples

Panel 2: Cancer

Room 2

Moderator: Prof. Katie Fisch

Celina Shen

Mentor: Christina Towers

Mitochondrial-Derived Vesicles in Cancer Cells

Pranava Gande

Mentor: Associate Professor Weg Ongkeko

Characterization of tRNA derived fragments in Lung Squamous Cell Carcinoma with Respect to Tobacco Smoke

Kristiana Wong

Mentor: Professor Christina Towers

Autophagic Inhibition in Pancreatic Cancer Cells

Catalina Fogg & Isabella Panagiotou

Mentor: Trey Ideker

Improving upon Prime Editing via Co-Selection

Panel 3: Regenerative Medicine and Stem Cells

Room 3

Moderator: Prof. David Schlaepfer

Vicky Han

Mentor: Shiri Gur-Cohen, Ph.D. Assistant Professor

Asymmetric lymphatic niche instructs hair follicle stem cell regeneration

Kavitha Thirumaran

Mentor: Dr. Karl Wahlin

Growth Factor Production and Mediation of Stem Cell Differentiation

Gloria Udogu

Mentor: Shiri Gur-Cohen, PhD, Assistant Professor

Lymphatic Circuits Shape Stem Cell Fate in Health and Disease

Sonia Rivero

Mentor: Professor Karl Wahlin

Gene-editing Safe Harbor Sites for Stable Expression in Differentiated Stem Cells

Panel 4: Social Psychology

Room 4

Moderator: Oliva Mota Segura

Lu Tong

Mentor: Yến Lê Espiritu, Distinguished Professor

Gender, Class, and Immigration: Perceptions of Sham Marriage by Chinese International Students

Shaila Sarathy

Mentor: Claire Edington

Understanding the mental health of Rohingya Refugees in Bangladesh through a historical and cultural lens

Finnley Armacost

Mentor: Dr. Amy Binder

Community, Diversity, Disillusionment, and the Thirst for Change: The Far Left on College Campuses

Chen Zhang

Mentor: Professor Christena Turner

How do undergraduate Japanese, Chinese, and Korean international students at UC San Diego view World War II Imperial Japan differently and what shapes those differences?

Panel 5: Native American and Indigenous Studies

Room 5

Moderator: Prof. Thomas R. Schmidt

Anne Parnell

Mentor: Dr. Mary Klann

Seeking Justice: Limited Tribal Jurisdiction in Cases of Sexual Violence

Aaron Morales

Mentor: Lecturer Mary Klann

1892: Cabrillo, Historical Memory, and Indigenous Resistance

Hannah Drake

Mentor: Ross Frank, Associate Professor

The Origin of UCSD: Kumeyaay History & Land Tenure

Lisa Zhou

Mentor: Manuel Shvartzberg Carrió

Inland Empire Militarization Project

Panel 6: Perceptions of Self and Others

Room 6

Moderator: Prof. Celeste Pilegard

Banso Nguyen

Mentor: Adena Schachner, Professor

Children's understanding of others' visual perspectives over video chat

Katrina Abeto

Mentor: Dr. Gail Heyman

Children's Considerations of Economic Constraints When Inferring Others' Mental States

Alexa Duran

Mentor: Dr. Adena Schachner (Principal Investigator)

When seeing is not believing: Children's reality judgment in AR

Elysia Kim

Mentor: Lindsey Powell

Infants' Understanding of Helping Actions

Panel 7: Medicine and Disease I

Seuss Library

Moderator: Prof. Omar Mesarwi

Megan Hackbarth

Mentor: Omar Mesarwi, MD - Assistant Clinical Professor

Effect of Obesity in Combined Sustained and Intermittent (Overlap) Hypoxia

Madison Mitchell

Mentor: Sreekanth Chalasani

Understanding Autism-Associated Changes to Gut Health in C. Elegans

Brooke Johnson

Mentor: Dr. Fabian Rivera Chavez

Phage susceptibility of Vibrio cholerae under cholera toxin-inducing conditions

Theodore Berger and Yan Graf

Mentor: Dr. William Gerwick, Distinguished Professor of Oceanography and Pharmaceutical Sciences

Synthesis of Epoxyketone-Based Plasmodium Proteasome Inhibitors

Panel 8: Protein Engineering and Gene Expression

Atkinson Pavilion

Moderator: Dr. Megan Routzong

Tyler Hurlimann

Mentor: Dr. Zoran Radic

Interactions of Bis-Oxime Antidotes with Fenamiphos Inhibited Acetylcholinesterase In Silico and In Vitro

Matthew Tate

Mentor: Nathan Shaner, Associate Adjunct Professor

Engineering Red Fluorescent Proteins

Khoa Tran

Mentor: Colleen McHugh, Assistant Professor

The long non-coding RNA DUBR regulates human colon cancer cell growth through direct interactions with NuRD complex proteins and DNMT1

Twisha Kurlagunda

Mentor: Dr. Alan R. Saltiel

The role of MKP1 in regulating b3-adrenegic pathway in adipocytes

Jana Mitrevska

Mentor: Dr. Lena Gerwick

Nutrimental modifications lead to alterations in cytotoxic metallophore production in an Indonesian marine cyanobacterium

Panel 9: Chemistry

Dining Room Terrace
Moderator: Angelica Orlova

Wilson Lubeck
Mentor: Dr. Bradley Moore
Mechanism of nitrile formation in the biosynthesis of aetokthonotoxin

Clarisa Bautista
Mentor: Dr. Tatiana Mishanina
Transcription and folding of the E. coli mntP riboswitch

Max Varley
Mentor: Jeffrey Rinehart, Associate Professor of Chemistry and Biochemistry
Intermolecular Dipolar Coupling as a Suppressor of Through-Barrier Relaxation in a Series of Single-Ion Magnets

Jake Anderson
Mentor: Dr. Michael K. Gilson
Accelerating Drug Discovery by Developing an Improved Energy Model for Molecular Simulations

Panel 10: Alzheimer's Disease, Hormones, and Neurodegeneration

Cecil's Lounge
Moderator: Dr. Sharon Nichols

Mariel Micael
Mentor: Dr. Nicola Allen
Disease Progression of Alzheimer's Disease Mouse Models by Sex

Nidhi Checka
Mentor: Dr. Subhojit Roy, MD, PhD
CRISPR-based gene therapy for Alzheimer's disease

McKinna Barnes
Mentor: Matthew Panizzon, Associate Professor
Impact of age at menopause, APOE status, and hormone replacement therapy on Alzheimer’s disease related brain features

Sowmya Gudapati and Neha Thiyagarajan
Mentor: Panizzon, Matthew; Associate Adjunct Professor, Psychiatry
Parity, MMSE, and memory: the hormonal drivers of late-life cognitive sex differences

Morning Session II

10:40 – 11:40 AM

Panel 11: Psychosis, Isolation, and Social Context

Room 1

Moderator: Dr. Christian Cazares

Sreetama Chowdhury

Mentor: Professor Colin Depp

Classifying positive and negative symptoms of psychosis with psycholinguistic features derived from the Social Skills Performance Assessment

Shagun Taneja

Mentor: Dr. Colin Depp

Loneliness, Belongingness, and Burdensomeness in Individuals with serious mental Illness

Alexandra Garcia

Mentor: Dr. Kay Tye

Role of Medial Prefrontal Cortex in Processing Social Stimuli After Isolation

Panel 12: Genome Editing Applications

Room 2

Moderator: Dr. Marcus Kelly

Vivian Pham

Mentor: Gene Yeo, PhD, MBA

Inhibition of the RNA surveillance factor SMG7 in Triple Negative Breast Cancer cells suppresses tumor growth, in vivo

Hei Yu Annika So

Mentor: Professor Alexis Komor

Elucidating the mechanisms behind base editing outcomes through CRISPRi screens

Abdullah Ashiq

Mentor: Dr. Xin Jin

Enabling AAV-based in vivo Perturb-seq

Daphne Huanca Vargas

Mentor: Nan Hao

Single-cell dynamics of FcγRI expression during IFN-γ activation of mouse macrophages

Panel 13: Reproductive Health

Room 3

Moderator: Molly Huang

Ramya Ukkan

Mentor: Dr. Marianna Alperin

Comparison of Pelvic Floor Muscle Architecture Across Sexes

Katelyn Fong

Mentor: Lindsey Burnett, Ph.D., M.D., Assistant Professor

Mouse Pelvic Floor Muscles Undergo Pregnancy-Induced Adaptations that Protect Against Parturition-Associated Strains

Hector Chavez

Mentor: Kathleen Fisch, Assistant Adjunct Professor

Placental Mutational Burden Negatively Correlates with Gestational Age in Early-Onset Preeclampsia

Hillary Zhou

Mentor: Dr. Amanda Lewis

Understanding Gardnerella vaginalis biofilm formation on braided and monofilament sutures

Panel 14: Neuroscience

Room 4

Moderator: Dr. Federica Klaus

Chelsea Shao

Mentor: Takaki Komiyama, Professor of Neurobiology and Neurosciences

HD influences on the the connection between striatum and cortex

Skyler Zheng

Mentor: Deanna J. Greene, Ph.D. / Associate Professor

Automated cortical and subcortical segmentation of brain MRI scans with manual intervention: examining anatomical differences in Tourette syndrome

Nicole Granados

Mentor: Edward Callaway, PhD

Targeting neural recordings within the superior colliculus

Wendy Wang

Mentor: Christina Gremel, Associate Professor

Orbitofrontal-premotor circuit contribution to action and outcome information

Panel 15: Neurodegeneration and Neural Repair

Room 5

Moderator: Prof. Cole Ferguson

Sirasit Prayotamornkul

Mentor: Lingyan Shi, Ph.D.

Super-resolution DO-SRS and 2PEF Bioimaging of Subcellular Metabolic Dynamics Regulated by Excess L-Methionine in Amyotrophic Lateral Sclerosis

Tiffany Gavin

Mentor: Binhai Zheng- Neurosciences Professor

Researching the role of astrocytic LZK expression in spinal cord injury repair and recovery by determining the direct effect of astrocytic LZK expression on functional recovery, the indirect effect of astrocytic LZK expression on axon regeneration, and through transcriptomic profiling of LZK-manipulated astrocytes

Max Gruber

Mentor: Christina J. Sigurdson, DVM, PhD, Departments of Pathology and Medicine

Prion Protein-induced Neurodegeneration in the Central Nervous System of Drosophila Melanogaster

Vaishali Gautam and Jenny To

Mentor: Dr. Gene Yeo

Binding-Proteins discovered to be novel regulators of aberrant subcellular localization of CHMP7 via image-based pooled CRISPR screens

Panel 16: Learning and Education

Room 6
Moderator: Dr. Tal Waltzer

Tiffany Nguyen
Mentor: Gail Heyman
How Adolescents Balance Performance Goals With Academic Integrity

Annie Tang
Mentor: Dr. Celeste Pilegard
An eye movement analysis of the spatial contiguity principle based on expertise

Tiffany Widjaja
Mentor: Dr. Emma H. Geller (Ph.D.), Associate Teaching Professor
The Effects of Self-Explanation and Refutation on the Learning Styles Misconception

Yuhan Tao
Mentor: Dr. Celeste Pilegard
Shaping Perceptions of Science and Scientists through Counterstereotypical Representations in a Classroom Setting

Megan Tavares
Mentor: Dr. Celeste Pilegard
Can the Testing Effect Help Protect Students Against Stereotype Threat?

Panel 17: Medicine and Disease II

Seuss Library

Moderator: KDay Lee

Benjamin Bestmann

Mentor: Dr Laurel Riek

Post-Stroke Gait Rehabilitation with Robot-Based Personalized Care

Valerie Hsu

Mentor: Dr. Maripat Corr

Microglial TLR4 contribute to signs of inflammation in a mouse model of inflammation

Chloe Afif

Mentor: Dr. Omar Mesarwi

Time restricted eating improves intermittent hypoxia-induced dysglycemia

Alex Chung and Kyle Young

Mentor: Dr. Lingyan Shi

The Interplay of Unchecked Degrading Protease Activity on Insulin Receptors and Sleep-requirement

Panel 18: Film

Atkinson Pavilion
Moderator: Dr. Betty Ramirez

Chloe Sun
Mentor: Geraldine Fiss, Associate Teaching Professor in Inter-Asia and Transpacific Studies: China Focus
The Strength of Restraint: A Comparative Analysis of Still Life and A City of Sadness

Ho-Hsin Wang
Mentor: Thomas Schmidt
Lost in Transitions: The Power, Privilege, and Positionality of Sofia Coppola and her Films

Laurel Feldner
Mentor: Professor Thomas R. Schmidt
This Is, Like, Totally Bogus: How media representations of the Valley Girl impact women

Nicole Choung
Mentor: A.B. Boateng
Yellow Fever: The Effects of Pornography on the Fetishization of Asian Women in America

Tony Wang
Mentor: Gershon Shafir
The impact and changes brought to the Chinese youth group and society by Japanese anime - based on interviews with Chinese anime fans

Panel 19: Chemistry and Biochemistry

Dining Room Terrace
Moderator: Angelica Orlova

Ruby Tseng
Mentor: Zoran Radic
Expression of human Acetylcholinesterase, Affinity Purification and Characterization of Novel Bis-oxime Antidote Interaction

Nadia Goiset
Mentor: Dr. Zoran Radić
Interactions of Two Pairs of Structural Isomers of Uncharged Bis-oxime Antidotes with Inhibited Human Acetylcholinesterase In Silico and In Vitro

Sharon Roth
Mentor: Bradley S. Moore, Professor
Whole Cell Biocatalysis

Hunter Schaffer
Mentor: Dr. William Gerwick
Malarial Protease Inhibitor Development

Panel 20: Neuroscience and Cognitive Science

Cecil's Lounge
Moderator: Catherine Tallman

Harriet Mak
Mentor: Gene Yeo
Synaptic activity and network synchronization in 16p11.2 CNV cortical organoids

Ramina Mortazavi
Mentor: Shelley Halpain, PhD.
ER F-Actin in the somatodendritic compartments of hippocampal neurons and its role in excitotoxicity

Athena Leisching & Luowen Yu
Mentor: Dr. Lara Rangel
Rhythmic Dynamics of Rat Dentate Gyrus during Associative Spatial Memory Task

Jacquelyn Tsui & Michelle Gomez
Mentor: Dr. Christine Smith
Hippocampal subregions and their relationship to traditional cognitive tests and news event memory in older adults with normal cognition or mild cognitive impairment

Afternoon Session I

12:55 -1:55 PM

Panel 21: Technology ande Economics

Room 1

Moderator: Prof. Boatema Boateng

Berns Piffard

Mentor: Gershon Shafir, Distinguished Professor

When David Becomes Golaith: How Cryptocurrency Came to Reflect the Financial Market it Meant to Dismantle

Christina Song

Mentor: Aram Grigoryan, Assistant Teaching Professor

School Admission Reforms and Housing Markets: Empirical Evidence from New York City

Somalea Hayward

Mentor: Professor Kelly Gates

Bumble as a Feminist Dating App: Inclusion, Safety Discourse, and Surveillance

Panel 22: Computational Methods in Biology

Room 2

Moderator: Prof. Claire Meaders

Kyra Fetter

Mentor: Dr. Ferhat Ay

Loop Catalog: A comprehensive database of uniformly processed high-resolution protein-centric chromatin conformation capture datasets curated from the literature

Manan Chopra

Mentor: Karl Jonas Wahlin, Ph.D.

Transcriptomic Analysis of Early-Stage Developing Retinal Ganglion Cells Induced from Human Stem Cells

Gino Prasad

Mentor: Vineet Bafna, Professor

Automated image analysis to identify patterns of amplification in cancer cells

Huaze Gao

Mentor: Pei-an (Betty) Shih, MPM, PhD

Gene Expression Analysis in Anorexia Nervosa and Healthy Control Women

Panel 23: Genetics and Genomes I

Room 3

Moderator: Prof. David Schlaepfer

Lok Ue Martha Chow

Mentor: Professor Omar S. Akbari

An Evolutionarily Stable Split-Gene Drive system for Population Suppression of Anopheles Gambiae

Anjali Srinivasan

Mentor: Cole Ferguson, Assistant Professor

Histone ubiquitination is associated with activating chromatin modifications in the developing brain

Mayra Mendiola

Mentor: Susan Ackerman

Sequence variation upstream of a cytoplasmic tRNA modifies expression

Nadine Rosete

Mentor: Dr. Karsten Zengler

Determination of Microbial Guilds and Niches Enable Targeted Modifications of the Skin Microbiome

Panel 24: Ecology and Behavior

Room 4

Moderator: Dr. Vikram Shende

Aaron Deans

Mentor: Dr. Simone Baumann-Pickering

Describing sperm whale (Physeter macrocephalus) demographics in the western North Atlantic using passive acoustic data

Kailey Ramsing

Mentor: Dr. Jennifer Smith

Understanding changes in algal community dynamics on coral colonies following bleaching events

Hannah Budroe

Mentor: Dr. Moira Decima, Assistant Professor & Curator of the Pelagic Invertebrate Collection at Scripps Institution of Oceanography

Depth-Resolved Patterns in Zooplankton Diversity in Subtropical and Subantarctic Waters: a Size-Structured Metabarcoding Approach

Irene Chen

Mentor: Sreekanth Chalasani, Associate Professor

The early worm catches the bacteria: An exploration of foraging in C. elegans

Panel 25: LGBTQ+ Studies

Room 5

Moderator: Prof. Geraldine Fiss

Abigail Wright

Mentor: Gloria Chacón, associate professor

Misogynistic Consequences of the Conquest: Representations of La Malinche and Chicana Lesbians as the 'Bad Women' of Mexico

Cade Pretorius

Mentor: Professor Michel Estefan

The Tragedy of Conformity: Gender Construction in an Online Transgender Community

Marley Gough

Mentor: Gershon Shafir, Distinguished Professor

Passing Inside & Out: A Queer Take on a Social Phenomenon

Avni Sardana & Macey Keung

Mentor: Prof. Michael Trigilio

Antifragile Zine Issue Four: Anachronism

Panel 26: Neurobiology

Room 6

Moderator: Dr. Michael Rieger

Medhaansh Gupta

Mentor: Dr. Nicholas Spitzer

Overexpression of functional postsynaptic GABA receptors in Xenopus larvae stabilizes expression of GABA synthetic enzymes

Garrett Danque

Mentor: Christina Sigurdson, Professor of Pathology

Mechanisms of Axon Degeneration in Prion Disease

Andrew Zhang & Gizem Altinok

Mentor: Dr. Gulcin Pekkurnaz

Neurons Depend on O-GlcNAcylation for Energy and Stress Defense

Panel 27: Medicine and Disease III

Seuss Library
Moderator: KDan Lee

Gwendalynn Stilson
Mentor: Dr. Maripat Corr
Toll-like Receptors 7 and 9 Govern Sex Differences in a Mouse Model of Inflammatory Arthritis

Kyle Freedman
Mentor: Nigel Calcutt, Professor
Topical Delivery of Muscarnic Receptor Antagonist and Axonal Sodium Channel Blocker Combination Reduces Peripheral Neuropathy in Mice

Kristine Olvera
Mentor: Omar Mesarwi, Assistant Clinical Professor
Intermittent hypoxia is associated with increased mortality in a moue model of COVID-19

Sanika Chaudhari
Mentor: Dr. Alice Zemljic-Harpf
Sex differences in lipid metabolism: long-term atorvastatin or rosuvastatin administration effects on voluntary locomotive activity and cardiac function

Mihir Dixit
Mentor: Dr. Alice Zemljic-Harpf
Ertugliflozin attenuates cytosolic Ca2+ levels after alpha-1 adrenergic stimulation in cardiac myocytes

Panel 28: Anxiety and Depression

Atkinson Pavilion
Moderator: Prof. Cory Root

Anna Wilke
Mentor: Dr. Cory Root
Intercalated Cells of the Amygdala: Insights into Connectivity and Behavioral Implications

Coty Chen
Mentor: Dr. Daniel Stout; Assistant Professor
The Effect of Working Memory Training on Fear Extinction

Lucas Owens
Mentor: Sharon Nichols, Ph.D.
Potential Mechanisms and the Relationship Between Cannabis Use and Anxiety in Youth With and Without HIV

Srimaye Samudrala
Mentor: Dr. Michael Mccarthy, Associate Adjunct Professor, Psychiatry
The Association of the Post Illumination Pupillary Response to Seasonal Mood Variation Shows Diurnal Variation

Panel 29: Environmental/Social Factors and Well-Being

Dining Room Terrace
Moderator: Lilibeth Watson

Andrea Tran
Mentor: Kay M. Tye, Ph.D
Examining the effects of social exclusion on physical pain behavior

Bra'a Durubeh
Mentor: Kay Tye, Neuroscientist and Professor
Internal state changes elicit differential responses from distinct amygdala circuits

Cameron Hicks
Mentor: Karen Dobkins PhD
Measuring effects of "Learning Sustainable Well-Being" on Mental Health and Resilience

Veronica Hernandez
Mentor: Dr. Lisa Eyler
Impact of COVID-19 Related Anxiety in Adults with Schizophrenia

Panel 30: Physics

Cecil's Lounge
Moderator: Prof. Adam Burgasser

Ashley Thorshov
Mentor: Professor Henry Abarbanel
Analyzing the Variation in Earth's Magnetic Field

Xingzhou Yu
Mentor: Henry Abarbanel, Distinguished Professor
Symplectic Numerical Methods

Isabella Martinez
Mentor: Farhat Beg, Shao-Chi and Lily Lin Chancellor's Endowed Chair in Engineering Science Department of Mechanical & Aerospace Engineering
Using Matlab as a tool to analyze and measure the Magneto-Raleigh Taylor Instability during Gas puff Z-pinch Experiments.

Sirius Song
Mentor: Prof. Tenio Popmintchev
Generation of Extreme UV and Soft X-ray Light with Orbital Angular

Afternoon Session II

2:05 – 3:05 PM

Panel 31: Ethnic Studies

Room 1

Moderator: Rosalva Romero

Jasmine Robinson

Mentor: Boatema Boateng, Associate Professor at UC San Diego

The Representation of Black Women Fashion Designers in The Music Industry

Zara Irshad

Mentor: Professor Thomas Scmidt

Stand-up to stardom: navigating brown comedy and its social repercussions

Isabel Koeppen

Mentor: Professor A.B. Boateng

Black Women's Experience at Predominately White Institutions with a Focus on Intersectionality and Racial Projects

Panel 32: Mathematics

Room 2

Moderator: Prof. Kisun Lee

Xun Gong

Mentor: Anthony Sanchez, Chancellor's Postdoc

Monodromy of a symmetrical surface

Atmik Das

Mentor: Prof. Reuven Hodges

Approximate Counting of Standard Set-Valued Tableaux

Linghao Zhang

Mentor: Jiawang Nie / Professor of Mathematics

Polynomial Optimization Over Unions of Semialgebraic Sets

Panel 33: Genetics and Genomes II

Room 3

Moderator: Prof. Cole Ferguson

Nicholas Guo

Mentor: Professor Kathleen Fisch

Rare Damaging Mutations in Placental Tissue Associated with Preeclampsia

Laurie Chang

Mentor: Associate Professor Tatum Simonson

COVID-19 Family Genetics Project

Sansa Chen

Mentor: Dr. Omar S. Akbari

Adapting pgSIT to the Malaria Vector Anopheles gambiae for Confineable Population Suppression

Claire Williams

Mentor: Samuel Pfaff Adjunct Professor

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

Panel 34: Electrical and Computer Engineering

Room 4

Moderator: Prof. Karcher Morris

Jonathan Zamora

Mentor: Xiaolong Wang, Assistant Professor

Graph Inverse Reinforcement Learning from Diverse Videos

Annabella Macaluso

Mentor: Xiaolong Wang

Policy Adaptation from Foundation Model Feedback

Venkataram Edavamadathil Sivaram

Mentor: Ravi Ramamoorthi

Parameter-space ReSTIR for Differentiable and Inverse Rendering

Alexander Tang

Mentor: Professor Curt Schurgers

Smartfin: The Smart Surfboard that Tracks Data on the Ocean

Panel 35: Literature, Language, and Philosophy

Room 5

Moderator: Maggie Thach Morshed

Ashley Feng

Mentor: Assistant Professor Jacobo Myerston-Santana

The Hippocratic Oath: Legally Binding?

Jingyi Chen

Mentor: David O. Brink, Distinguished Professor

Assessing Julia Annas's Criticisms of John Stuart Mill's Arguments for Gender Equality and Women's Liberation

Erin Baseman

Mentor: Geraldine Fiss Assistant Teaching Professor

A Twenty-First "Peter Pan:" How Girlhood and Femininity in Children's Literature Has Changed A Century Later

Tate McFadden

Mentor: Associate Teaching Professor Geraldine Fiss

Carmen Maria Machado & Topographies of Trauma and Archival Silence in Queer Literatures

Natalie Côté

Mentor: Dr. Emily Clem

Learning about Language from Stacked Iconicity in Korean

Panel 36: Topics in Engineering

Room 6

Moderator: Jacobo Cervera Torralba

Ethan Foss

Mentor: Prasad Gudem, ECE Adjunct Professor

Flight Dynamics of Boomerangs: Impact of Joint Angle

Jonathan Yu

Mentor: Dr. Robert Sah

Biaxial Tensile Testing Device Design

Diane Bou-assi

Mentor: Farhat Beg, Shao-Chi and Lily Lin Chancellor's Endowed Chair in Engineering Science Department of Mechanical & Aerospace Engineering

Data Analysis of Z-pinches

Bernice Lozada

Mentor: Dr. Ester Kwon, Assistant Professor

Targeting Lipid Nanoparticles to the Blood Brain Barrier for Traumatic Brain Injury

Mya Verrett

Mentor: Dr. Tina Ng

Improve the User Interface for Patient Hypertonicity Evaluation

Panel 37: Education

Seuss Library

Moderator: Prof. Melinda Owens

Lilyan Mendez

Mentor: Assistant Teaching Professor Claire Meaders

Effect of a Chemistry Learning Intervention on Introductory Biology Students' Performance and Sense of Belonging in Biology

Allison Wiley

Mentor: Michel Estefan - Assistant Teaching Professor

The Longevity and Resilience of Meritocracy during a Crisis: How Students View the Value of a College Degree

Shaelin Chong & Jerick Kim

Mentor: Dr. Melinda T Owens

Multiple Effects of Scientist Spotlights Assignments in an Introductory Biology Course

Arturo Amaya

Mentor: Dr. Carlos Jensen

Not Seeing The Forest For the Trees - Curricular Complexity at UCSD

Panel 38: Addiction and Substance Use

Atkinson Pavilion
Moderator: Prof. Cory Root

Melody Chao
Mentor: Dr. Thomas Hnasko
Projections from mu-opioid receptor expressing neurons of the ventral tegmental area

Talyn Hughes
Mentor: Giordano de Guglielmo, PharmD, PhD
Rat strain differences in opioid addiction-like behaviors

Mohini Iyer
Mentor: Giordano de Guglielmo, PharmD, PhD
Relationship Between Addiction-like Behaviors and Gut Microbiome and Metabolomics in Alcohol-dependent Rats

Celine Yang
Mentor: Michael A. Taffe, Principal Investigator
Δ9-tetrahydrocannabinol effects on oxycodone intake via intravenous self-administration in rats

Lillian Liu
Mentor: Cory Root Assistant Professor
Toward Understanding How Sensory Processing Informs Reward-Associated Decisions: Feed-Forward Inhibition in the Olfactory Circuit

Panel 39: Public Health

Dining Room Terrace
Moderator: Dr. Mahsa Pourhamzeh

Salma Parra Pulgarin
Mentor: Corinne McDaniels-Davidson
Contrasting the Social Needs and Circumstances of Hispanic/Latino and Non Hispanic White Patients in Southern California

Rubi Gomez
Mentor: Dr. Britta Larsen
Social Support and Its Relationship to Physical Activity Outcomes

Mustafa Ali
Mentor: Dr. Wael Al-Delaimy, Professor
COVID-19 and Immigrants

Tausala Eteuati & Isabella Campa
Mentor: Angela Lowe
Adderall Use Among UCSD Undergraduate Students: STEM vs. Non-Stem Majors

Panel 40: Computer and Data Sciences

Cecil's Lounge
Moderator: Juno Seong

Peter Eckmann
Mentor: Dr. Rose Yu
LIMO: Latent Inceptionism for Targeted Molecule Generation

Daniel Ji
Mentor: Niema Moshiri
GEMF Online Tools: web applications for accessible and intuitive epidemic simulation

Brandon Liu
Mentor: Terry Sejnowski
Directed Graph Neural Networks for Classifying Mental Illness in MRIs

Phu Dang & Leena Kang
Mentor: Niema Moshiri, Professor
Exploratory and Predictive Analytics for Precision Medicine

Abstracts

Katrina Abeto

Psychology with a specialization in Clinical Psychology, Marshall

Mentored by Dr. Gail Heyman

Children's Considerations of Economic Constraints When Inferring Others' Mental States

Children are amazingly capable of making sophisticated social inferences. One critical factor that may impede such a capacity is whether children can recognize external constraints. In the past year, Katrina has been working on a project examining whether children can consider the effects of economic constraints on people's choices, which provides theoretical insights into cognitive development, as well as significant implications for our understanding of poverty-based prejudice and societal inequality.

Chloe Afif

Molecular and Cell Biology, ERC

Mentored by Dr. Omar Mesarwi

Time restricted eating improves intermittent hypoxia-induced dysglycemia

Obstructive sleep apnea (OSA) is associated with dysglycemia, insulin resistance, and type 2 diabetes mellitus. Intermittent hypoxia (IH) modeling OSA has been shown to induce similar metabolic effects in mice. Time restricted eating (TRE) has been shown to improve the metabolic profile in mice and in human subjects. It is unknown whether TRE can reverse IH-induced dysglycemia. Wild-type C57BL/6J mice were fed a high-fat diet for four weeks to induce mild obesity, and then half were exposed to IH modeling severe OSA, and the other half were

exposed to room air (RA). Within each exposure group, half were fed with a time-restricted schedule, with access to food for nine hours per day during the active phase, from 9:00 pm to 6:00 am, while the other half had ad libitum access to food. These hypoxia and feeding exposures lasted for an additional four weeks, with weight and food intake being recorded daily, and glucose tolerance tests (GTT) performed before and after exposure. At the end of the four weeks, the mice were euthanized. Serum insulin and ghrelin were measured. TRE reversed IH-induced glucose intolerance, and TRE improved fasting glucose in IH, but not in RA. Serum insulin was not elevated in IH mice fed ad libitum, implying pancreatic dysfunction driving IH effects. Serum ghrelin was low in all animals. We conclude that in this model of OSA, TRE can mitigate hypoxic effects, implying that intermittent fasting may be a viable means of improving metabolic function in those with OSA.

Mustafa Ali

Public Health, Muir

Mentored by Dr. Wael Al-Delaimy, Professor

COVID-19 and Immigrants

Several studies have reported on the prevalence of COVID-19 vaccines in the general population and the frequency of vaccinations; however, little is known regarding the vaccine among immigrants and their reasonings behind their decisions regarding the vaccine. Here we report on the frequency of COVID-19 vaccinations among recent immigrants to the United States along with the factors that influenced their knowledge and decisions. Our findings indicate that although a significant majority of the immigrant population we studied is vaccinated, a majority also believes some sort of myth related to the COVD-19 pandemic and the vaccine. Additionally, we found that within the surveyed population women, older individuals, and individuals with preexisting health conditions had statistically increased levels of stress and anxiety related to COVID-19. With the conclusion of our surveys, we were able to use these findings to

inform how we approached members of these communities and combated the misinformation they had internalized.

Gizem Altinok

Molecular and cell biology, Revelle

Mentored by Gulcin Pekkurnaz

Neurons Depend on O-GlcNAcylation for Energy and Stress Defense

Neurons are highly energy-dependent cells and derive the majority of energy molecule ATP from glucose. Glycolysis and subsequently mitochondrial oxidative phosphorylation (OXPHOS) break down glucose for ATP production while the pentose phosphate pathway (PPP) uses glucose to combat oxidative stress. Nutrient-sensing post-translational modification O-GlcNAcylation dynamically regulates glucose metabolism, sustaining neuron's normal physiological functions. O-GlcNAcylation of hexokinase 1(HK1), the first and rate-limiting enzyme of glycolysis, results in its anchoring to the mitochondrial surface. Anchoring of HK1 recruits other glycolytic enzymes to the mitochondrial outer membrane, forming a glycolytic complex, which allows the direct shuttling of glycolysis's product into mitochondria to power OXPHOS. The compartmentalization of glycolysis and mitochondrial OXPHOS via O-GlcNAcylation increases ATP production rates, supporting active neuron's high energy demand. However, OXPHOS generates ATP at the expense of reactive oxygen species (ROS) production. ROS accumulation leads to oxidative stress and cell death. Glucose metabolism through PPP combats oxidative stress. Glucose-6-phosphate dehydrogenase (G6PD), the first and rate-limiting enzyme of PPP, produces NADPH that facilitates ROS breakdown. G6PD is primarily expressed in neurons from cell cultures derived from embryonic rat brains.O-GlcNAcylation increases G6PD activity and enhances NADPH production. Preliminary data also suggest that O-GlcNAcylation affects G6PD's localization in neurons.

Arturo Amaya

Computer Engineering, Warren

Mentored by Dr. Carlos Jensen

Not Seeing The Forest For the Trees - Curricular Complexity at UCSD

Curricular complexity is an important factor in students' success at university. UCSD has one of the most complicated sets of curricula in the US. We look at various metrics surrounding the prerequisite chains of sample 4 year plans to highlight unnecessarily complex plans, detrimental plan evolution, critical courses and toxic major-college pairs to hopefully suggest improvements for advisors and students.

Jake Anderson

Chemistry, Marshall

Mentored by Dr. Michael K. Gilson

Accelerating Drug Discovery by Developing an Improved Energy Model for Molecular Simulations

Molecular dynamics (MD) simulation is a core technique in computer-aided drug design which relies upon tuned sets of empirical potentials to calculate energies and simulate dynamics accurately. Liquid-state systems require consideration of solvent molecules, greatly increasing their computational costs. One technique for accelerating liquid state MD simulation is the use of implicit solvent models that treat water as a continuum medium, removing the need for simulation of individual water molecules. The generalized Born (GB) model is one such implicit solvent model that considers each atom as a van der Waals sphere with a parameterizable radius called the “GB radius”. The radii of these spheres then change as a function of the spheres’ local surroundings, becoming “effective Born radii”. The most popular functional form for the effective

Born radius of an atom was developed by Onufriev et al. (OBC), built on the work of Still et al. An issue we found with these variants of GB models is that they lead to under-screening of charge interactions in host-guest (H-G) systems, notably cucurbiturils. Optimizing the GB radii to experimental H-G ABFE data led to a decrease in accuracy for small molecule hydration free energies (HFEs). Because the GB radii cannot be optimized simultaneously to fit well to experimental HFE and H-G binding free energies, we investigate the use of different functional forms for the effective Born radius and the GB energy between atoms. The new functional forms are parameterized against experimental HFEs and H-G ABFEs using the OpenFF-Evaluator and OpenMM software packages.

Finnley Armacost

Sociology, Muir

Mentored by Dr. Amy Binder

Community, Diversity, Disillusionment, and the Thirst for Change: The Far Left on College Campuses

The youth turnout for the 2022 Midterms was the second highest in nearly three decades and exit polls revealed that 18-29s were the only age group in which a strong majority supported the Democratic party. However, despite apparent support, many young voters, particularly the most liberal among them, are increasingly critical of the Democratic Party. This article examines a particularly politically engaged subset of the Far Left—Leftist activists on college campuses—and draws on qualitative interviews and ethnographic observations to reevaluate the demographic and ideological makeup of the Far Left. I also seek to explains the Far Left's support for the Democrats despite their comparatively poor opinion of the party and what factors contribute to individuals adopting a Far Left political ideology. This article finds that The Far Left is a well-defined and interconnected population of students on college campuses that is remarkably ideologically and demographically diverse despite its small size. However, despite their diversity, Far Left activists maintain a

common set of values and vocabulary which centers a general frustration and mistrust with the political status quo. Still, Far left support for the Democratic Party is explained by their perceived choice between the "lesser of two evils," as one participant put it. Additionally, the political ideology and opinions of Far Left students are mainly influenced by personal experiences of oppression, the opinions and experiences of peers, and negative experiences related to political issues.

Abdullah Ashiq

Molecular and Cell Biology, Revelle

Mentored by Dr. Xin Jin

Enabling AAV-based in vivo Perturb-seq

Human genetic studies on neurodevelopmental disorders, such as autism spectrum disorder (ASD), have tied them to 'risk genes,' where inherited or de novo genetic variants significantly increase one's likelihood for developing these disorders. Several ASD-risk genes have been identified, yet their molecular mechanisms are still unclear. In vivo Perturb-seq allows us to clarify these mechanisms. Via CRISPR Cas-9, we can knock out many genes simultaneously in prenatal forebrain progenitors and individually sequence postnatal, developed cells' transcriptomes. We can therefore discover each gene's role in different cell types, providing greater insight into their molecular mechanisms. In vivo Perturb-seq requires lentiviral vectors to deliver gRNAs, which guide Cas9 to the correct gene loci, to the progenitors. Adeno-associated viral (AAV) vectors are less toxic and have many serotypes targeting different cell types. However, AAVs are unable to integrate into the host genome, diluting gRNA expression as cells divide during brain development. My project aims to overcome this issue through a separate transposase PiggyBac (HypPB) that integrates the gRNA and a fluorophore reporter into progenitors' genomes, providing abundant and sustained expression. To demonstrate abundance in vitro, we will transfect gRNA plasmids into HT22 immortalized neuronal cells with or without HypPB to observe

fluorophore expression level. To demonstrate sustainability in vivo, we will inject gRNA AAVs with or without HypPB in embryonic mice and stain for fluorophore expression postnatally in cortex. Overall, our project will demonstrate HypPB's ability to integrate AAV gRNA into progenitors' genomes, enabling more efficient and flexible AAV-based in vivo Perturb-seq studies.

McKinna Barnes

Cognitive and Behavioral Neuroscience, Muir

Mentored by Matthew Panizzon, Associate Professor

Impact of age at menopause, APOE status, and hormone replacement therapy on Alzheimer's disease related brain features

The decrease in circulating estrogens characteristic of menopause is hypothesized to contribute to age-related neurodegeneration. Hormone replacement therapy (HRT) aims to restore circulating estrogen levels, however, this treatment may only be beneficial if administered shortly after menopause, and increasing evidence suggests that APOE e4 carriership status may moderate the relationship(s) between estrogen and neuropathology. Using a sample of 795 naturally postmenopausal women from the Women's Health Initiative (Mean age = 69.6, SD = 3.6), we examined whether the age of menopause (AOM) was associated with the Alzheimer's Disease Pattern Similarity Score (ADPSS), a composite anatomical score used to evaluate AD risk, and if this association was moderated by APOE e4 allele status or HRT use. Among 395 women who received HRT, we examined whether use during the "critical window" or APOE status moderated the association between AOM and the ADPSS. Linear regression models covarying for age at MRI scan and smoking history did not show a significant association between AOM and ADPSS. Among HRT users, there was a significant 3-way interaction between AOM, APOE status and HRT use within the critical window ($b = -0.02$, $p = 0.04$). Post-hoc models stratified by APOE status and the timing of HRT showed a significant negative association between AOM and the ADPSS only

among APOE e4 carriers receiving HRT after the critical window (N = 77; b = -0.001, p = 0.02). These results suggest that interactions between APOE, AOM, and HRT use affect anatomical structure at an older age.

Erin Baseman

Literature/Writing, Sixth

Mentored by Geraldine Fiss Assistant Teaching Professor

A Twenty-First "Peter Pan:" How Girlhood and Femininity in Children's Literature Has Changed A Century Later

A primary criticism of J.M. Barrie's Peter Pan (1911) focuses on the way in which female characters are depicted throughout the story. Wendy and Tinkerbell's characters' fundamental purpose in Peter Pan is to serve Peter and the other boy characters. In contrast, Kirsty and Rachel in Daisy Meadows' children's book Ruby the Red Fairy (2003) emerge with individual personalities that are not confined to traditional gender roles. Additionally, although Ruby the Red Fairy is a female-dominated narrative, boys and girls are portrayed neutrally so that neither gender is represented as greater than the other. This differs from Peter Pan, a text in which the male characters hold more weight in terms of importance in society. In this paper, I argue that the contemporary children's book Ruby the Red Fairy represents a new Peter Pan at the turn of the millennium by portraying girlhood and femininity in a way that reflects a more progressive society. Creating a story centered around girls, the text moves away from a traditional focus on boyhood tales and signifies a societal change in expectations for girls and their interests. The representation of girls in Ruby the Red Fairy creates a more accurate depiction of girlhood; one that includes the desire for adventure and imagination within girls, in a way that is underrepresented in Peter Pan's Wendy. This change in the portrayal of femininity allows a more updated version of Peter Pan to be brought into the twenty-first century.

Clarisa Bautista

Chemistry, ERC

Mentored by Dr. Tatiana Mishanina

Transcription and folding of the E. coli mntP riboswitch

In bacteria, gene expression levels can be modulated by regulatory RNA elements. For example, bacteria have regulatory RNA elements called riboswitches, which are encoded in the 5' untranslated region of mRNA transcripts. Riboswitches bind to ligands in the environment, such as metal ions and metabolites; this binding event prompts the RNA to rearrange its structure. Consequently, this structural rearrangement regulates transcription and translation of downstream mRNA, affecting the expression of the protein that the mRNA encodes. In E. coli, the mntP gene encodes a membrane protein that exports manganese out of the cytosol, and its expression is controlled by a riboswitch element. It has been found that this riboswitch specifically senses and responds to the manganese ion Mn2+. Manganese binding to the mntP riboswitch triggers the RNA to rearrange its structure to increase translation of the mntP gene, facilitating manganese efflux from the cytosol and helping to prevent manganese toxicity. Although responses to manganese in the mntP system have been explored, the specific mechanisms of ligand binding to the riboswitch and subsequent effects on transcription and folding of the mntP riboswitch remain unknown. To help fill this gap in knowledge, transcription of the sequence encoding the mntP riboswitch will be examined since the rate of transcription plays an important role in RNA structure formation. Specifically, I am reconstituting transcription on the mntP riboswitch sequence in vitro to analyze how the transcription rate is affected by (i) changing manganese concentration and (ii) the presence of protein factors that may assist the RNA folding and ultimate regulatory decision. Ultimately, these experiments will provide crucial insights that will help piece together the underlying regulatory mechanisms of the mntP riboswitch.

Benjamin Bestmann

Bioengineering, Revelle

Mentored by Dr Laurel Riek

Post-Stroke Gait Rehabilitation with Robot-Based Personalized Care

Stroke is the primary cause of disability in the US, and the need for rehabilitative services is increasing as stroke survivorship rates rise. Body weight treadmill training is beneficial for post-stroke rehabilitation, but robot-based personalized care (RBPC) has emerged as a promising approach due to its adaptability and intensity of treatment. This study presents a novel RBPC gait training system that utilizes human-robot interaction (HRI) to provide personalized feedback to post-stroke hemiparetic patients. The system includes a robot that visualizes patient progress on its screen and provides real-time feedback during rehabilitation. The goal is to improve rehabilitation outcomes by reducing the treatment's physical and cognitive demands and supplementing healthcare providers. This study aims to represent a platform for an important step forward in the field by combining robotics and healthcare to create a more engaging and interactive experience for patients. The collected data measures the angle, frequency, and power generated by the body using concentric muscle activity and characterizes the full gait cycle of a leg. The threshold value for ankle power (iA2) is used to determine each patient's step goal, and each value in the iA2 and step/stride count sections is converted into a future value, which is used to make a visual representation of the patient's progress. The application was developed using Android Studio and Visual Studio, and a mix of Google Chrome and Google Nexus 7 was used to simulate the program. A further aim is to directly pull data from the database to streamline the process.

Diane Bou-assi

Chemical Engineering, Revelle

Mentored by Farhat Beg, Shao-Chi and Lily Lin Chancellor's Endowed Chair in Engineering Science Department of Mechanical & Aerospace Engineering

Data Analysis of Z-pinches

As fusion energy research advances, scalable laboratory mechanisms have been developed to accurately observe plasma confinement systems using electric current applied in the z-direction to develop a magnetic field that will allow the compression of that plasma, known as z - pinch. These experiments can allow z - pinches to be observed in terms of what factors may cause certain instabilities/inefficiencies to arise. Additionally, through creating a greater familiarity with these trends, additional factors can be seen to mitigate these inefficiencies, known as Magneto-Rayleigh Taylor Instabilities (MRTI'S). Specific factors that have been observed to improve MRTI's are the applications of axial magnetic fields, increasing the number of shells surrounding the gas, etc. This information can further be used to efficiently generate high sources of energy that can be applied to methods like thermonuclear fusion. Here, this data is analyzed through MATLAB to investigate the trends of MRTI's throughout different shots of z-pinches, experimentally conducted at Cornell University using a 1 Mega Ampere pulsed power generator. The code modifies the shots at each stage into 4 frames, transforming the images into grayscale, then use pixels in the image to get a rough estimate of how the MRTI's within a shot may increase/decrease throughout the z - pinch. This creates a greater familiarity of the trends of the effects of different parameters being modified in the environment like including an axial magnetic field. More efficient fusion energy output can be reached through a heightened understanding of which factors improve the results of Z-pinches.

Hannah Budroe

General Biology & History, Revelle

Mentored by Dr. Moira Decima, Assistant Professor & Curator of the Pelagic Invertebrate Collection at Scripps Institution of Oceanography

Depth-Resolved Patterns in Zooplankton Diversity in Subtropical and Subantarctic Waters: a Size-Structured Metabarcoding Approach

Zooplankton play critical ecological roles in trophic transfer and biogeochemical cycling, and their community composition is closely associated with the physical conditions of their environment. Zooplankton species can often be used as sentinels of oceanographic change, because they can be associated with very specific water masses. In this study, I use a DNA-metabarcoding approach, based on 18S rRNA amplicon sequencing, to assess the similarities and variability of zooplankton communities across different depths and water mass types, and biological conditions in the Southern Ocean. The study region, the Chatham Rise, sees the mixing of Subantarctic (SA) and Subtropical (ST) waters with distinct physicochemical conditions. The mixing of cold iron-limited SA waters and warmer nitrogen-limited ST waters creates a region of high productivity that is economically important for New Zealand fisheries; however, recent warming events have seen large-scale changes in pelagic communities, including increasingly frequent blooms of nutritionally-sparser gelatinous plankton. Preliminary analysis shows that there are distinct mesozooplankton communities between SA and ST waters. Community composition of the smaller (0.2-1mm) zooplankton is different between epipelagic (<200m depth) and mesopelagic (200m-1000m depth) environments. Mesopelagic communities are best predictive of water density, while epipelagic communities are much more variable. This study forms a size-structured baseline survey of zooplankton diversity, enabling the detection of Southern Ocean ecosystem shifts in response to climate change.

Natalie Côté

Linguistics, Warren

Mentored by Dr. Emily Clem

Learning about Language from Stacked Iconicity in Korean

A word is iconic when its form—its sound, shape, or structure—somehow reflects its meaning. Perhaps the most recognized examples of iconicity in language are onomatopoeia; words like ding-dong, knock-knock, and bang. However, iconicity in the world's languages goes far beyond mimicking sounds, and is often highly systematic. New research has found that some languages can productively combine multiple iconic strategies in one word; a phenomenon called "stacked iconicity." Now that stacked iconicity has been identified, linguists want to understand how, where, and how often it shows up, how it affects a language's internal organization, as well as how it behaves compared to single iconicity, which is when languages can use only one iconic strategy within a word. My work contributes to this line of study by identifying and analyzing an instance of stacked iconicity in Korean ideophones. Ideophones are sensory words that can express not only sounds, but textures, shapes, movements, states, and more in a vivid and descriptive manner. Within this class of words, Korean employs an iconic structural strategy and two different types of iconic sound symbolism, all of which can be used together, producing large constellations of iconic words with highly nuanced meanings. In addition to arguing for stacked iconicity in Korean, I also bring in evidence from the history of language contact between Korean and Middle Chinese which suggests that the way that languages change over time may be influenced by whether or not they have stacked iconicity.

Isabella Campa

Public Health, ERC

Mentored by Angela Lowe, Lecturer

Adderall Use Among UCSD Undergraduate Students: STEM vs. Non-Stem Majors

The use of non-prescribed adderall among undergraduate students is a growing concern, with potential negative health effects and ethical implications. This study aims to investigate the usage rates of non-prescribed adderall among STEM and non-STEM undergraduate majors at UCSD. An anonymous Qualtrics survey was distributed to UCSD undergraduate students between February 20, 2023, and February 28, 2023. The survey collected data on student majors and whether they had taken unprescribed adderall to improve academic performance. A chi squared test of independence was used to compare findings between non-prescribed adderall use groups. Of the 207 responses received, 150 students reported they had not taken unprescribed adderall to improve their academic performance. Among STEM majors, 111 reported no usage of unprescribed adderall, while 29 non-STEM majors reported no usage. Twenty undergraduate students reported using unprescribed adderall, with 14 STEM majors and 6 non-STEM majors reporting usage. The results of this study suggest that non-prescribed adderall usage rates among undergraduate students at UCSD are relatively low. There was no significant relationship between undergraduate STEM majors and the usage of unprescribed adderall. However, the small sample size limits the generalizability of these findings, and the self-reported nature of the data may introduce response bias. Further research is needed to confirm these findings and to develop strategies to address non-prescribed adderall usage among undergraduate students.

Laurie Chang

Molecular and Cell Biology, Seventh

Mentored by Associate Professor Tatum Simonson

COVID-19 Family Genetics Project

Fibroblast growth factor 10 (FGF10) is involved in wound healing and tissue repair and is essential for epithelial regeneration after injury. Viruses like COVID-19 can damage lung epithelium and, in severe cases, cause respiratory failure. Absence or disturbance of the FGF10 signaling pathway can result in long-term organ dysfunction or even fatal outcomes. Other lung diseases, such as bronchopulmonary dysplasia, idiopathic pulmonary fibrosis, and chronic obstructive pulmonary disease exhibit dysregulated FGF signaling, illustrating the importance of this pathway in various pathological states. The “Latino/x and/or Hispanic” (L/H) population in San Diego has been disproportionately impacted by COVID-19 with 315 deaths out of 100,000 individuals. This is twice the rate of deaths for the county and three times the rate of deaths of the “White” race/ethnicity. Yet, the L/H population is not represented in recent large-scale genomic analyses of COVID-19 (based largely on individuals of European ancestry). Our group obtained genome-wide association studies (GWAS) data from the COVID-19 Host Genetics Initiative and performed analyses specific to the H/L American (AMR) cohort of 12,841 individuals. We identified a tagging genetic marker (single-nucleotide variant, SNV) near the FGF10 gene that was significantly associated with COVID-19 severity in the AMR cohort. We further determined this SNV is overrepresented in L/H individuals treated with life support (i.e., extracorporeal membrane oxygenation) at UC San Diego. In addition to this genetic locus, our analyses revealed other promising candidates specific to the L/H population, and we hypothesize variants within these regions can influence severity outcomes within this population.

Melody Chao

Neurobiology, ERC

Mentored by Dr. Thomas Hnasko

Projections from mu-opioid receptor expressing neurons of the ventral tegmental area

The ongoing opioid epidemic calls for a closer look into the mechanism behind opioid addiction. μ-opioid receptor (MOR) helps mediate the effects of opioids, specifically their analgesic and rewarding effects. In the ventral tegmental area (VTA), MOR is expressed on GABAergic neurons referred to as interneurons because they have been thought to release GABA onto local dopamine neurons exclusively. The binding of an opioid to MOR inhibits GABA neurons. Thus, dopamine neurons will be disinhibited, which contributes to the rewarding effects of opioids. However, neurons in the VTA have been shown to project both distally and locally. Currently, there are no selective molecular markers to identify neurons that only project locally in the VTA, unlike other brain regions, so it is unknown if certain subsets of neurons in the VTA are indeed interneurons. Therefore, we examined MOR-expressing GABA neurons in order to clarify whether or not they make distal projections. We injected an AAV5 virus into the VTA of 3 mice to express ChR2:mCherry and then performed immunohistochemistry, which allowed for the tracing of projections. We found that MOR-expressing VTA neurons make distal projections to the ventral pallidum, nucleus accumbens, prefrontal cortex, and lateral habenula. Our results indicate that at least some MOR-expressing neurons in the VTA make distal projections, showing that MOR is not a selective interneuron marker in the VTA. While there is the possibility that some are indeed interneurons, this finding will lead to a greater foundational understanding of the circuitry of opioid addiction.

Sanika Chaudhari

Human Biology, Revelle

Mentored by Dr. Alice Zemljic-Harpf

Sex differences in lipid metabolism: long-term atorvastatin or rosuvastatin administration effects on voluntary locomotive activity and cardiac function

Statins are prescribed to reduce low density lipoprotein-cholesterol (LDL-C) levels to prevent and treat secondary cardiovascular disease. Statin-associated muscle symptoms (SAMS) include skeletal muscle weakness, pain, cramps, and exercise intolerance. Although women are more likely to report SAMS, the mechanics of sex differences in statin adverse effects remain unclear. We hypothesized that hydrophilic rosuvastatin (Rosu) may lead to fewer statin adverse effects than the lipophilic atorvastatin (Ator). Long-term effects (12-months) were investigated by monitoring lipid/enzyme profiles voluntary locomotive activity, and cardiac function. Male (M) and female (F) C57Bl6J mice received Ator, Rosu, or vehicle (Veh) by daily oral gavage (M+Ator, F+Ator, M+Rosu, F+Rosu, M+Veh, and F+Veh, n= 9-12 each). M+Veh mice presented higher total-C and high-density lipoprotein (HDL)-C serum levels than F+Veh mice (total- C mg/dl, Mean ± SEM; M+Veh 131.4 ± 7.4, F+Veh 90.5 ± 4.8, M+Veh vs F+Veh, and HDL-C mg/dl, Mean ± SEM; M+Veh 82.8 ± 3.3, F+Veh 58.6 ± 3.4, M+Veh vs F+Veh, * $p<0.0002$). Ator and Rosu administration reduced voluntary total distance moved in M+Ator, M+Rosu, F+Ator, and F+Rosu mice, when compared to M+Veh and F+Veh. After 10m-long daily statin or vehicle administration, echocardiography revealed that M+Ator, M+Rosu, F+Ator, and F+Rosu presented preserved systolic ejection fraction (%EF) while tissue Doppler analysis detected decreased E'/A' ratios.
Sex differences in lipid metabolism exist in young mice, but statin administration reduced voluntary activity and induced diastolic cardiac dysfunction in both sexes. Long-term Ator and Rosu administration induced physiological alterations similar in heart failure with preserved ejection fraction.

Hector Chavez

Molecular and Cell Biology, Sixth

Mentored by Kathleen Fisch, Assistant Adjunct Professor

Placental Mutational Burden Negatively Correlates with Gestational Age in Early-Onset Preeclampsia

The placenta exists in a hypoxic environment during early pregnancy, making it susceptible to somatic genetic mutations caused by oxidative stress and rapid cell proliferation. Oxidative stress is one of the leading factors involved in cellular aging causing genetic mutations, cellular senescence, and mitochondria dysfunction over time. While it has been demonstrated that healthy placentas accumulate somatic mutations as they develop, we hypothesize that diseased placentas display an accelerated aging phenotype through the accumulation of somatic mutations. To address this, we analyzed RNA-seq data from 84 human placentas throughout gestation from healthy (N=33) and preeclamptic pregnancies (N=51). We identified rare single nucleotide variants, insertions and deletions using GATK Best practices Workflow for RNA-seq short variant discovery using bcbio-nextgen and annotated with VEP and LOFTEE. Mutational burden, defined as the total number of rare mutations per megabase, was calculated after strict quality control and filtering for rare (gnomADg<0.05) variants using maftools in R. Linear regression models were employed to determine the association between mutational burden and gestational age. Differences in mean values were computed with a pairwise t-test. This study revealed that mutational burden in early-onset preeclampsia placentas is negatively correlated to gestational age (R2=0.256; p-value=0.032). The early-onset preeclampsia group had a higher mutational burden relative to the other groups (p-value<0.05). This study revealed a significant correlation of mutational burden with gestational age in early-onset preeclampsia, paving the way for additional investigation of accelerated aging in placentas and its contribution to the development of preeclampsia.

Nidhi Checka

Neurobiology, Warren

Mentored by Dr. Subhojit Roy, MD, PhD

CRISPR-based gene therapy for Alzheimer's disease

The hallmark neuropathology of Alzheimer's disease (AD) is extracellular deposits (plaques) of amyloid beta (Ab) which are found throughout the brain. Ab is formed by sequential cleavage of APP (amyloid precursor protein) – a protein with a central and indisputable role in AD – by beta and gamma secretases. In physiologic states, the APP protein is cleaved by α-secretases to generate neuroprotective sAPPα; but in AD (both sporadic and familial), the alternative β-cleavage pathway is active, generating pathologic fragments (including Ab). Our lab has developed a gene-editing strategy to target the extreme C-terminus (C-term) of APP that attenuates pathologic β-cleavage products by disrupting a pentapeptide "YENPTY" domain at the APP C-term, and this retains the edited APP (APP-ΔC) at the cell-surface, augmenting neuroprotective and neuroregenerative α-cleavage. Here, we leveraged CRISPR gene-editing technology to edit the APP C-terminus in healthy and AD mouse models and evaluated safety and efficacy. To test our strategy in vivo, we used two different CRISPR-editing approaches. First, we generated germline edits in Wt and APP knockin (APP NL-G-F) mice by injecting embryos with APP C-term targeting CRISPRs. In another set of experiments, we packaged APP C-term CRISPRs into AAV vectors and systemically injected AAVs into APP-KI mice. WtΔC showed no cognitive deficits or histological abnormalities compared to Wt controls. KI-ΔC showed dramatic reduction of amyloid beta plaques and associated neuroinflammatory markers and similar results were observed in AAV-treated KI mice. In total, these data demonstrate the feasibility of APP C-terminus CRISPR editing as a therapeutic for AD.

Irene Chen

Neurobiology, Revelle

Mentored by Sreekanth Chalasani, Associate Professor

The early worm catches the bacteria: An exploration of foraging in C. elegans

All animals need food to survive, therefore, food search - also known as foraging - is a ubiquitous behavior that often requires an animal to make complex decisions for survival. To study foraging, I use C. elegans as an experimentally tractable model system. In my experiments, individual worms are placed in arenas with a bacterial food patch of varying concentration. I record their behavior for one hour as they forage in these environments. By extracting the location and posture of the worm and quantitatively analyzing these data, I seek to better grasp whether their foraging strategy is a constant, inherent process or if it fluctuates with environmental changes.

Coty Chen

Psychology, Revelle

Mentored by Dr. Daniel Stout; Assistant Professor

The Effect of Working Memory Training on Fear Extinction

Anxiety and stress-related disorders are highly prevalent and associated with significant functional impairment. One of the most prominent mechanisms associated with therapeutic symptom reduction in anxiety and stress disorders is fear extinction. Fear extinction is learning that a cue that was previously a danger is now no longer dangerous. Fear extinction relies, in part, on working memory. Working memory is a short-term memory system involved in maintaining task goals in mind and inhibiting irrelevant information. This raises the possibility that improving working memory through computerized working memory training may

also improve extinction learning. The aim of the present study is to compare working memory training to sham training on fear extinction learning measures while electroencephalography (EEG) and electrodermal activity are recorded in a sample of low to moderately anxious individuals. We hypothesize that those who receive working memory training will show reduced levels of fear indicated by lower electrodermal and EEG measures during extinction learning compared to those who receive sham training. The findings from the current project will help determine if enhancing working memory through computerized training shows the potential to enhance behavioral and neural markers of fear extinction, mechanisms that are integral to current anxiety and stress disorder treatments.

Sansa Chen

Molecular and Cell Biology, Marshall

Mentored by Dr. Omar S. Akbari

Adapting pgSIT to the Malaria Vector Anopheles gambiae for Confineable Population Suppression

Malaria is a life-threatening disease that is transmitted through the bite of female anopheline mosquitoes. Because traditional methods to kill mosquitoes such as insecticides and bed nets are becoming less effective, scientists are developing a toolkit of genetic vector control technologies as alternatives for control of these deadly vectors. However, gene drives and other genetic modification technologies suffer from their uncontrollability,development of genetic resistance, and public resistance. Alternatively, pgSIT is a confinable and mostly resistance-free genetic technology that has demonstrated suppression effects in other pests but has not yet been developed in the primary vector, A. gambiae. In pgSIT, sterile males are produced through inducible CRISPR knockout and are released into the wild. Wild females that mate with these sterile males fail to produce viable offspring, resulting in single-generation population suppression, with sustainable population suppression

achievable through iterative releases. Here, we adapt pgSIT to A. gambiae by targeting four genes for knockout: 2 genes required for proper female development (fle and dsx) and 2 fertility genes (b2 tubulin and zpg). We find that the viable knockout offspring were almost exclusively sterile males. Combined with our preliminary cage trials, we show that our pgSIT system has potential to be a powerful vector suppression tool for A. gambiae.

Jingyi Chen

Political Science - Public Law, Marshall

Mentored by David O. Brink, Distinguished Professor

Assessing Julia Annas's Criticisms of John Stuart Mill's Arguments for Gender Equality and Women's Liberation

John Stuart Mill was a 19th-century English philosopher who made influential contributions to the utilitarian and liberal moral and political traditions. He defended gender equality and women's liberation in his work The Subjection of Women (1869) and served as a member of Parliament persistently advocating for women's suffrage. His defense of sexual equality is still worth discussing today. However, there have been modern criticisms of Mill's feminist credentials. In her essay "Mill and the Subjection of Women", Julia Annas criticizes Mill for vacillating between reformist and radical agendas and for being insufficiently radical. In this presentation, I will discuss my current progress in examining Mill's central arguments in The Subjection of Women and try to assess whether Annas's criticisms of Mill are fair and reasonable.

Shaelin Chong

Molecular and Cell Biology, Marshall

Mentored by Dr. Melinda T Owens

Multiple Effects of Scientist Spotlights Assignments in an Introductory Biology Course

The Scientist Spotlight is a homework assignment that features the personal and scientific stories of a counter-stereotypical scientist (Schinske et al., 2016). They have been shown to decrease student's stereotypes about scientists, increase student perceptions of how relatable scientists are, and increase course grades (Schinske et al., 2016; Yonas et al. 2020). Previous research on Scientist Spotlights has tended to either use close-ended questions or to focus on student responses generated as part of the Scientist Spotlight assignments themselves. We hypothesized that any additional effects could be found by analyzing open-ended student responses from the end of the term, as the students were reflecting on what they have learned from the course as a whole. We asked what ideas related to science identity, self-efficacy, or diversity were evoked by the Scientist Spotlights. We also asked whether these ideas appeared more frequently in students from minoritized groups. We found that 47% (98/208) of all students mentioned the Scientist Spotlights as part of their Final Reflection. When comparing students from minoritized groups to their non-minoritized counterparts, we found no significant differences in the prevalence of mentioning Scientist Spotlights or in mentioning any of the themes. Our study adds to the literature examining the myriad effects of Scientist Spotlight assignments on student ideas about diversity in science, self-efficacy, and humanizing scientists and provide further support for introducing Scientist Spotlights or similar assignments into courses.

Nicole Choung

Communications, Muir

Mentored by A.B. Boateng

Yellow Fever: The Effects of Pornography on the Fetishization of Asian Women in America

American perspectives and productions of pornographic material have perpetuated the existence of “Yellow Fever”, or the fetishization of Asian women, specifically from the perspective of the White male Gaze. The history of White Imperialism has contributed to the sexualization of Asian women, as women were viewed as objects of pleasure for U.S. soldiers during wartime. In current times, pornography and "hentai" (pornographic Japanese anime) in America proliferate harmful stereotypes toward Asian women, painting them as being exotic, hypersexual, and submissive. The proliferation of these characteristics creates fetishization for Asian women, particularly involving White men. Due to this phenomenon, Asian women are susceptible to high rates of sexual assault and violence. To best limit the existence of "Yellow Fever", Americans must acknowledge the severity of Asian fetishization along with its history and refrain from promoting the porn industry in its current state.

Sreetama Chowdhury

Cognitive Science w/Spec. Machine Learning & Neural Computation, Muir

Mentored by Professor Colin Depp

Classifying positive and negative symptoms of psychosis with psycholinguistic features derived from the Social Skills Performance Assessment

As language deficits are common in psychosis, speech samples and the analysis thereof using natural language processing may be informative when it comes to diagnosis. To date, there has been limited investigation into the association of speech characteristics and severity of positive and negative symptoms of psychosis — with our exploration, we aim to utilize

machine learning to be able to classify patients by the severity of these symptoms via analysis of psycholinguistic features extracted from the Social Skills Performance Assessment (SSPA.) To achieve these aims, we sub-selected a key set of SSPA features from the full extent of the scale by measuring the strength of their respective relationships with various symptoms on the Positive And Negative Syndrome Scale (PANSS.) We then fed these most highly correlated features, as well as binarized versions of each patient's score — systematically binarized based on severity, splitting the 1-7 scale into categories of 3 or lower and 4 or higher — on the given PANSS symptom, into different machine learning models to train and test for accuracy of classification. Our sample consists of BPD or schizophrenia-positive participants in the Cognitive Dynamics Lab's Introspective Accuracy and Social Cognition and Suicide studies.

Phu Dang

Data Science and Real Estate & Development, ERC

Mentored by Niema Moshiri, Professor

Exploratory and Predictive Analytics for Precision Medicine

Before personalized healthcare, treatment plans varied in effectiveness across patients with the same cancer type, where researchers have found differences in genetics and lifestyles that explain the varying outcomes. Precision Medicine is an emerging field in Biomedical Sciences that seek to target a personalized treatment plan using an individual's information (e.g., biomarkers, environment, family history, personal habits, and dietary patterns). In this project, we utilize women's health data from the Women's Healthy Eating & Living (WHEL) study to measure relationships between metrics and assess the predictive power of patients' data regarding the recurrence likelihood of breast cancer events. In our exploratory analysis, we generated in-depth multivariate visualizations to identify correlations, particularly patterns involving variables of interest, such as quality of life, tumor type, recurrence status, and demographic

variables that may reveal biases in data collection due to systemic socioeconomic factors. We found that (1) patients with more role limitations due to physical/emotional problems reported answers reflecting higher quality of life and mental health; (2) larger increases in alpha-carotene are associated with stable quality of life over time; and (3) the patient group with missing data points at study conclusion has markedly lower numbers of individuals with at least a college education. We then select learning features for our Machine Learning models using a binary breast cancer recurrence status as the target variable. We achieved 89% recall, 87% accuracy and precision, with resampling being the best approach to our imbalanced dataset.

Garrett Danque

Molecular and Cellular Biology, Revelle

Mentored by Christina Sigurdson, Professor of Pathology

Mechanisms of Axon Degeneration in Prion Disease

Prions are aggregated proteins that trigger the normal prion protein, PrPC, to misfold. This process is shared with other prion-like proteins, including amyloid β in Alzheimer's disease. Unlike PrPC, the aggregate, PrPSc, is highly stable and challenging to degrade. Neurons can utilize autophagy or exosomes to clear PrPSc, but when these mechanisms fail, there is further spread of infectious, neurodegenerative prions. This is exemplified by axon pathology in prion disease, as prions can accumulate in axons, inducing axonal degeneration and causing clinical symptoms. Therefore, by studying the molecular basis of axonal degeneration in prion disease, we strive to identify new therapeutic targets for treating prion disease and other neurodegenerative diseases. We use a newly generated knock-in mouse model of prion disease (Prnp92N) with a G92N mutation in the Prnp gene. These mice exhibit similar neurotoxicity to real prion disease but lack infectious PrPSc aggregates. As a result, they enable us to investigate axonal pathology in the absence of protein aggregates and elucidate the role of axons in prion disease and

neurodegeneration. My research aims to 1) determine axon structure, function, and pathology of the Prnp92N model by utilizing immunofluorescence, histology, and live axon imaging and 2) compare the Prnp92N model with bonafide prion disease in mouse models and humans (sporadic Creutzfeldt-Jakob disease). This research will shed light on the mechanisms of axonal degeneration in prion disease and other neurodegenerative diseases, where axonal pathology still exists despite the absence of protein aggregates.

Atmik Das

Mathematics-Computer Science, ERC

Mentored by Prof. Reuven Hodges

Approximate Counting of Standard Set-Valued Tableaux

I have partnered with Prof. Reuven Hodges to implement the main algorithms explained in his paper- "Approximate Counting of Standard Set-Valued Tableaux". The goal here is to approximately count the number of Standard Set-Valued Tableaux (SVT) of a certain shape and content. SVTs are combinatorial objects which appear in algebraic combinatorics. The counting of these objects is conjectured to be #P-Complete, nonetheless, in specific cases approximate counting in polynomial time is possible. A partition is a weakly decreasing sequence of integers which is represented by a Young diagram- a pictorial depiction in the form of boxes. In an SVT, each value appears in a box in the diagram exactly once. The implementation plan is to generate these combinatorial objects and conduct a probabilistic analysis on them to obtain lower limits for the generation probability. These steps act as building blocks for the fully polynomial almost uniform sampler (FPAUS) which is performed via a process called rejection sampling- a method that translates the behavior of the algorithm from one probability distribution to another one. It takes the generation algorithm and converts it so that its output is almost uniform from the tableaux set. The last stage of the project would be obtaining an approximate result by constructing a fully polynomial

randomized approximation scheme (FPRAS). This would end the implementation of the ideas mentioned in the paper. After this, we will see if these ideas can be applied to other combinatorial objects theoretically and then in an applied sense.

Aaron Deans

Marine Biology, Muir

Mentored by Dr. Simone Baumann-Pickering

Describing sperm whale (Physeter macrocephalus) demographics in the western North Atlantic using passive acoustic data

Sperm whales are cosmopolitan toothed whales characterized by strong sexual dimorphism between the larger, independent adult males; and the smaller females, who form social groups with their offspring. As vocal animals, sperm whales are prime candidates for study using passive acoustic monitoring. Our study included nine sites throughout the western North Atlantic, where offshore hydrophones recorded the ocean soundscape between April 2015 and June 2019. Using the interval between consecutive foraging echolocation clicks as a proxy for sex, we describe the demographic composition of sperm whales in the western North Atlantic. Sperm whale clicks were isolated and classified according to the inter-click interval. This study revealed a stark regional difference in overall sperm whale presence, with greater presence north of the Gulf Stream. Male presence was low relative to social group presence in the northern region – a surprising result, given that male sperm whales are known to travel further poleward than social groups. We also sought to calculate the probability of detecting sperm whale clicks by modeling sound transmission loss for each study site, then combining each output model with information on sperm whale diving behavior in a Monte Carlo simulation of click detection. This project lays the groundwork for future acoustic density estimation of sperm whales by sex in the western North Atlantic, which will provide important information for the management of sperm whales in this region.

Mihir Dixit

Bioengineering: Biotechnology, Seventh

Mentored by Dr. Alice Zemljic-Harpf, MD

Ertugliflozin attenuates cytosolic Ca2+ levels after alpha-1 adrenergic stimulation in cardiac myocytes

A novel class of antidiabetic drugs, called gliflozins, inhibit sodium-glucose cotransporter 2 (SGLT2i) to lower blood glucose in patients with Type II diabetes (T2DM). Gliflozins reduce mortality and heart failure (HF) hospitalizations in diabetic and non-diabetic HF patients, but molecular mechanisms are unclear since SGLT2 is not expressed in cardiac myocytes. We hypothesize that the SGLT2i ertugliflozin (ERTU) will alter cytosolic Ca2+ concentration ([Ca2+]cyt) in contracting cardiomyocytes after adrenergic stimulation. Cardiomyocytes were isolated from 0–2-day old mice, treated for 72 hours with either ERTU (100 nM, and 1 µM), cariporide (10 µM CARI), ERTU and CARI, or vehicle. After 72 hours, cells were loaded with Fura-2, baseline [Ca2+]cyt recorded, and after phenylephrine (PE, 100 µM) stimulation, [Ca2+]cyt was recorded for additional 30 minutes. 1 µM ERTU exposure did not alter baseline [Ca2+]cyt, but 100 nM ERTU increased baseline compared to vehicle. Both ERTU concentrations reduced [Ca2+]cyt peaks after PE, but 100 nM ERTU to a lesser degree. In contrast, 72-hour-long NHE1 inhibition with CARI increased [Ca2+]cyt baseline compared to vehicle and ERTU, and further enhanced [Ca2+]cyt peaks after PE. Because sustained exposure to ERTU reduced while NHE-1 inhibitor CARI increased [Ca2+]cyt, this data indicates for the first time that ERTU's beneficial effect on [Ca2+]cyt homeostasis is independent of NHE1 inhibition. Since disturbed Ca2+ handling and Ca2+ overload are hallmarks of HF, reduced [Ca2+]cyt levels after sympathetic stimulation may contribute to cardioprotective effects of SGLT2i. To unravel the molecular mechanisms behind ERTU's influence on cardiac [Ca2+]cyt further studies are needed.

Hannah Drake

History & Ethnic Studies, Marshall

Mentored by Ross Frank, Associate Professor

The Origin of UCSD: Kumeyaay History & Land Tenure

A look into the history of UC San Diego's land tenure, this paper documents how our campus ended up where it is, alongside a Kumeyaay focused history of the land our university resides on. Tracing back UCSD's land acquisition reveals the interconnectedness of militarism and settler colonialism, disclosing ties that continue to shape the way our university is run today. I argue that the celebration of militarism that is prominent throughout UCSD's telling of its origins erases Kumeyaay connections to our campus and that this dominant narrative–one that disavows UCSD's responsibility to its Indigenous communities–needs to be disrupted. As an established site for cultural/knowledge production, it's important to be conscious of the ways we tell our histories and who is excluded in those narratives. This work is an effort at retelling our university's history in a way that centers Kumeyaay perspectives and epistemologies.

Alexa Duran

Clinical Psychology, Sixth

Mentored by Dr. Adena Schachner (Principal Investigator)

When seeing is not believing: Children's reality judgment in AR

Children are increasingly able to access Augmented Reality (AR) technologies, which embed interactive virtual entities into the physical world. How do children understand a world augmented by AR technology? Focusing on AR live video content (i.e., live video with AR filters that alter real-world content), we aim to investigate (1) How do children make judgments on the reality status of AR objects? And (2) Do

they exhibit information-seeking behaviors to make reality status judgments about AR? In a within-subject design, 3-to 6-year-old children are asked to judge which image they see on two live videos is the real one in the real world. In the control condition, both videos have no AR filter (i.e., the videos function like mirrors that reflect the real world). In the experimental condition, one of the two videos has no AR filter, but the other has an AR filter that replaces a real-world image. The order of conditions is fixed, where the control condition is always tested first. We predict that children will explore and rationally infer the nature of the AR content. If so, children in the experimental condition should produce information-seeking behaviors (visual reorienting, or tactile search) specifically toward AR entities, to resolve their uncertainty about its nature. In addition, we will explore a developmental change in children's response to and understanding of AR. We predict that younger children will be less likely to make correct judgments on the reality status of AR objects.

Bra'a Durubeh

Neurobiology, Revelle

Mentored by Kay Tye, Neuroscientist and Professor

Internal state changes elicit differential responses from distinct amygdala circuits

How do dynamic changes in homeostatic needs govern reactions to reward and punishment? Positive and negative emotional stimuli are encoded by valence states in separate populations of basolateral amygdala (BLA) projections to the nucleus accumbens (NAc) and centromedial amygdala (CeM), respectively. Diversified mechanisms as such influence the search for food, despite an increased likelihood of being prone to circumstantial threats. In vivo two-photon calcium imaging unveils increased activity in BLA -> NAc neurons following food deprivation, and reciprocal decreased activity in BLA -> CeM neurons. A model introduced supporting these findings establishes the excitability

from BLA -> NAc neurons vitalizes food-seeking behavior in response to food-deprivation. In a sated state, negative valence overrules positive valence processing. A drastic relocation in BLA projections are influenced based on altered homeostatic needs, which changes valence encoding. This increased reward value results in a rapid shift between NAc-projecting and CeM-projecting populations of BLA neurons mediating approach and avoidance behaviors. Our findings contribute to the greater question of how changes in homeostatic state influence the processing of negative and positive valence. Understanding this fundamental relationship between valence processing and homeostatic need contributes to further investigation of how these systems may be disordered in the case of pathologies such as eating disorders or depression.

Peter Eckmann

Computer Science, Muir

Mentored by Dr. Rose Yu

LIMO: Latent Inceptionism for Targeted Molecule Generation

Generation of drug-like molecules with high binding affinity to target proteins remains a difficult and resource-intensive task in drug discovery. Existing approaches primarily employ reinforcement learning, Markov sampling, or deep generative models guided by Gaussian processes, which can be prohibitively slow when generating molecules with high binding affinity calculated by computationally-expensive physics-based methods. We present Latent Inceptionism on Molecules (LIMO), which significantly accelerates molecule generation with an inceptionism-like technique. LIMO employs a variational autoencoder-generated latent space and property prediction by two neural networks in sequence to enable faster gradient-based reverse-optimization of molecular properties. Comprehensive experiments show that LIMO performs competitively on benchmark tasks and markedly outperforms state-of-the-art techniques on the novel task of generating drug-like compounds

with high binding affinity, reaching nanomolar range against two protein targets. We corroborate these docking-based results with more accurate molecular dynamics-based calculations of absolute binding free energy and show that one of our generated drug-like compounds has a predicted KD (a measure of binding affinity) of 6·10−14 M against the human estrogen receptor, well beyond the affinities of typical early-stage drug candidates and most FDA-approved drugs to their respective targets. Code is available at https://github.com/Rose-STL-Lab/LIMO.

Venkataram Edavamadathil Sivaram

Computer Science, Warren

Mentored by Ravi Ramamoorthi

Parameter-space ReSTIR for Differentiable and Inverse Rendering

Differentiable rendering is frequently used in gradient descent-based inverse rendering pipelines to solve for scene parameters -- such as reflectance or lighting properties -- from target image inputs. Efficient computation of accurate, low variance gradients is critical for rapid convergence. While many methods employ variance reduction strategies, they operate independently on each gradient descent iteration, requiring large sample counts and computation. Gradients may however vary slowly between iterations, leading to unexplored potential benefits when reusing sample information to exploit this coherence. We develop an algorithm to reuse Monte Carlo gradient samples between gradient iterations, motivated by reservoir-based temporal importance resampling in forward rendering. Direct application of this method is not feasible, as we are computing many derivative estimates (i.e., one per optimization parameter) instead of a single pixel intensity estimate; moreover, each of these gradient estimates can affect multiple pixels, and gradients can take on negative values. We address these challenges by reformulating differential rendering integrals in parameter space, developing a new resampling estimator that treats negative functions, and combining these ideas into a reuse algorithm for inverse texture optimization. We

significantly reduce gradient error compared to baselines and demonstrate faster inverse rendering convergence in settings involving complex direct lighting and material textures.

Tausala Eteuati

Public Health, Seventh

Mentored by Angela Lowe

Adderall Use Among UCSD Undergraduate Students: STEM vs. Non-Stem Majors

The use of non-prescribed adderall among undergraduate students is a growing concern, with potential negative health effects and ethical implications. This study aims to investigate the usage rates of non-prescribed adderall among STEM and non-STEM undergraduate majors at UCSD. An anonymous Qualtrics survey was distributed to UCSD undergraduate students between February 20, 2023, and February 28, 2023. The survey collected data on student majors and whether they had taken unprescribed adderall to improve academic performance. A chi squared test of independence was used to compare findings between non-prescribed adderall use groups. Of the 207 responses received, 150 students reported they had not taken unprescribed adderall to improve their academic performance. Among STEM majors, 111 reported no usage of unprescribed adderall, while 29 non-STEM majors reported no usage. Twenty undergraduate students reported using unprescribed adderall, with 14 STEM majors and 6 non-STEM majors reporting usage. The results of this study suggest that non-prescribed adderall usage rates among undergraduate students at UCSD are relatively low. There was no significant relationship between undergraduate STEM majors and the usage of unprescribed adderall. However, the small sample size limits the generalizability of these findings, and the self-reported nature of the data may introduce response bias. Further research is needed to confirm these findings and to develop strategies to address non-prescribed adderall usage among undergraduate students.

Laurel Feldner

Communication and Political Science, Muir

Mentored by Professor Thomas R. Schmidt

This Is, Like, Totally Bogus: How media representations of the Valley Girl impact women

The Valley Girl phenomenon was born in Los Angeles's San Fernando Valley and entered into mainstream popular culture during the early 1980s. The media industry brought the sound, the slang, and the negative stereotypes of the girls who frequented the Galleria Mall to consumers across the country. This phenomenon was born of natural vocal qualities which gained a negative connotation as they were most often attributed to teenage girls which contributes to the denigration of women all while being disguised as a fun joke. The rise of the Valley Girl since then has been meteoric with some of our most loved and hated on screen characters adopting these quintessentially Southern Californian characteristics. Through socio-linguistics, media analysis, cultural historical analysis, and interviews, I trace the root of the Valley Girl trope and its impact on real life women as they enter the workforce and higher education. Hollywood latched onto this once niche stereotype, turning regional slang combined with natural vocal qualities into a caricature, leading to a phenomenon that has now lasted for over 40 years. Californian women have been damned to a popular culture that considers us ditzy, shallow, and stupid thanks to negative portrayals in the media which have been backed by older academics making unfounded scientific claims about voices that have since been disproven. The Valley Girl phenomenon is indicative of a society that would prefer to condemn women as "ditzy" and "shallow" as an excuse to maintain the status quo, which is totally bogus.

Ashley Feng

Classical Studies & Philosophy, ERC

Mentored by Assistant Professor Jacobo Myerston-Santana

The Hippocratic Oath: Legally Binding?

Every year, medical students take the Hippocratic Oath upon graduation from medical school. Since its first recorded use, the Hippocratic Oath has changed drastically to reflect contemporary beliefs about the professional ethics of medical practitioners and appropriate treatments for patients. Modern medical schools commonly omit notable phrases in the original Oath pertaining to euthanasia, abortion, and surgery.
The primary objective of my research is to explore how the language of the original Hippocratic Oath may have been influenced by contemporary philosophical attitudes towards euthanasia, abortion and surgery, and how even in modern times the Oath reflects the evolving dialogue between medicine and the law. I'll discuss popular claims that the original Hippocratic Oath was heavily rooted in Pythagorean philosophy as shown through its attitude towards suicide, surgery and other compelling evidence, and then compare the content of the Oath to other philosophical and medical attitudes on the same subjects such as Plato and Aristotle. We'll also look at evidence of modern medical student attitudes, influenced by political ideologies, towards the same topics to explore the relevance of the Hippocratic Oath in modern medicine, and legal texts to highlight the permeation of ancient philosophical attitudes into modern legal decisions.

Kyra Fetter

Bioengineering: Bioinformatics, Warren

Mentored by Dr. Ferhat Ay

Loop Catalog: A comprehensive database of uniformly processed high-resolution protein-centric chromatin conformation capture datasets curated from the literature

The human genome, if stretched out, would span approximately two meters linear distance. To fit inside a micrometer-wide cellular nucleus, chromatin folds in a highly intricate, non-random manner. Chromatin conformation studies increasingly recognize chromatin's 3D architecture as a mediator of genome regulation via long-range DNA-DNA interactions. The Hi-C assay combines DNA-DNA proximity-based ligation and high-throughput sequencing, capturing pairs of genetic loci genome-wide in close contact in 3D-space. HiChIP combines immunoprecipitation of DNA-binding proteins with Hi-C to produce higher resolution chromatin interaction contact maps, often showing loops between gene regulatory elements like promoters and enhancers. These maps allow us to link disease risk genetic variants, identified from genome-wide association studies (GWAS), to target genes for many diseases. We created a database of HiChIP data curated from literature to elucidate the relationship between 3D chromatin conformation, DNA-binding proteins, and disease. Our database encompasses 486 human and 194 mouse HiChIP samples from 89 studies representing over 100 cell types including cancer, keratinocyte, immune, kidney, neural, and others. We designed a pipeline including tools developed by the Ay Lab to uniformly process all samples. We developed a web portal "Loop Catalog" enabling bulk download, WashU, UCSC, and IGV genome browser visualization, and network analysis. Preliminary motif analysis identified ZNF460 to be highly enriched in conserved regulatory loop anchors across diverse cell types. As HiChIP datasets increase tissue and cell type coverage, Loop Catalog will enable researchers to easily access uniformly processed chromatin loop data and perform larger-scale variant, motif, and other biological analyses.

Catalina Fogg

Neurobiology, ERC

Mentored by Trey Ideker

Improving upon Prime Editing via Co-Selection

The CRISPR/Cas9 system is a widely-used platform for genome editing. Disrupting gene function with CRISPR is straightforward, but making specific edits to genes has remained more challenging. Prime editing has recently emerged as a general technique to quickly make specific genetic changes with clinical relevance. Prime editing requires that at least two components be expressed in a cell line to make a given genetic edit: an enzyme called PEMax, and the engineered prime editing guide RNA (epegRNA) that specifies the location of the desired genetic edit and the desired final DNA sequence at that location. However, prime editing efficiency remains too low for pooled screens. To improve upon prime editing efficiency, we have employed a “co-selection” strategy that relies on the principle that some single cells are inherently more efficient than others at prime editing. Through co-selection, we were able to isolate cells with successful repairs to a fluorescent marker in order to enrich for edits in a gene of interest. For cells in which the co-selection strategy was employed, the editing efficiency increased by ten-fold. Because this strategy provides high editing efficiency, its scope can be widely used in pooled screens to study mutations of clinical relevance.

Katelyn Fong

Neurobiology, Revelle

Mentored by Lindsey Burnett, Ph.D., M.D., Assistant Professor

Mouse Pelvic Floor Muscles Undergo Pregnancy-Induced Adaptations that Protect Against Parturition-Associated Strains

Pelvic floor muscles undergo mechanical strain during parturition, resulting in muscle dysfunction and subsequent development of pelvic floor disorders. Preclinical animal models are needed to study the relationship between birth injury and pelvic floor muscle function. In the rat model, pelvic floor muscles undergo protective adaptations against parturition-associated strains. Mouse models have the advantage of increased genetic models compared to rats with similar architectural difference index. We sought to determine whether mouse pelvic floor muscles undergo protective adaptations during pregnancy to withstand parturition-associated strains to validate a mouse model of simulated birth injury. Pelvic floor muscles coccygeus, iliocaudalis, and pubocaudalis from 3-month-old C57/BL6 late-pregnant (E16.5) and non-pregnant animals with and without physiologic vaginal distension were fixed in situ and harvested. Architectural parameters determining muscle excursion and force-generation, including muscle fiber and sarcomere lengths, were measured using digital calibers and light microscopy. Vaginal distension volume was determined by comparison of mouse neonatal head parameters to those of distension balloon.
Pregnancy significantly increased muscle fiber length in all pelvic floor muscles compared to non-pregnant animals. Sarcomere length was unaffected. 0.3-ml balloon volume best-approximated fetal head dimensions to mimic physiologic distension during parturition. Vaginal distention resulted in longer sarcomere lengths in non-pregnant compared to pregnant animals, indicating protection against sarcomere hyper-elongation during pregnancy. This study demonstrates that pregnancy induces adaptations in pelvic floor muscle structure by increasing muscle fiber length by adding sarcomeres serially. These adaptations protect against sarcomere hyper-elongation due to simulated birth injury with physiologic vaginal distension volumes.

Ethan Foss

Mechanical Engineering, ERC

Mentored by Prasad Gudem, ECE Adjunct Professor

Flight Dynamics of Boomerangs: Impact of Joint Angle

Prior work on the study of flight trajectory of boomerangs focused on tri-bladder design instead of the traditional–V boomerangs due to simplicity of analysis. In this paper, we study the impact of joint angle of traditional–V boomerangs on their flight trajectories. An ultra-compact, custom UWB wireless positioning tag that is small enough to embed in the arms of a traditional–V boomerang without impacting the aerodynamics of the boomerang was developed. Flight trajectories of 3D printed traditional–V boomerangs with joint angles of 300, 500, 700, 900, 1100 and 1300 were measured using meshed UWB wireless positioning system. The measured flight trajectories for different joint angles were compared with the simulation results.

Pranava Gande

Bioengineering: Bioinformatics, Warren

Mentored by Associate Professor Weg Ongkeko

Characterization of tRNA derived fragments in Lung Squamous Cell Carcinoma with Respect to Tobacco Smoke

Lung squamous cell carcinoma (LUSC) is a highly heterogeneous cancer, which is influenced by etiological agents such as tobacco smoke. Accordingly, transfer RNA derived fragments (tRFs) are implicated in both cancer onset and development and demonstrate potential to act as targets for cancer treatments and therapies. Therefore, we aimed to characterize tRF expression, with respect to LUSC pathogenesis and clinical outcomes. Specifically, we analyzed the effect of tobacco smoke on tRF expression. In order to do so, we extracted tRF read counts from MINTbase v2.0 for 425 primary tumor samples and 36 adjacent normal

samples. We analyzed the data in three primary cohorts: (1) all primary tumor samples (425 samples), (2) smoking induced LUSC primary tumor samples (134 samples), and (3) non-smoking induced LUSC primary tumor samples (18 samples). Differential expression analysis was performed to examine tRF expression in each of the three cohorts. tRF expression was correlated to clinical variables and patient survival outcomes. We identified unique tRFs in primary tumor samples, smoking induced LUSC primary tumor samples, and non-smoking induced LUSC primary tumor samples. In addition, many of these tRFs demonstrated correlations to worse patient survival outcomes. Notably, tRFs in the smoking induced LUSC and non-smoking induced LUSC primary tumor cohorts were significantly correlated to clinical variables pertaining to cancer stage and treatment efficacy. We hope that our results will be used to better inform future LUSC diagnostic and therapeutic modalities.

Huaze Gao

psychology, Warren

Mentored by Pei-an (Betty) Shih, MPM, PhD

Gene Expression Analysis in Anorexia Nervosa and Healthy Control Women

Anorexia nervosa (AN) is an eating disorder with high mortality and is notorious for its poor treatment outcomes and high relapse rates. The etiology of AN remains unknown. Fasting and postprandial specimens were used for RNA sequencing analysis from 6 ill AN, 16 weight-recovered AN, and 13 control women. RNA sequencing data were analyzed for differentially expressed genes (DEG) in various between-group comparisons. DEG results were used to identify associated pathways and functions in DAVID bioinformatic tool. The hsa01100: Metabolic pathways were identified as the most frequently associated pathways with DEGs between all AN cases and controls. These pathways accounted for 7.9% of the DEGs. The second most common pathway was hsa05022: pathways of neurodegeneration, related to 3.3% of the DEGs. The percentage of DEGs associated with metabolic pathways varied among different analyses:

9.7% of DEGs between ill AN and controls in fasting state, 8.2% between recovered AN and controls in fasting state, 8.8% between ill AN and controls in fed state, and 9.9% between recovered AN and controls in fed state. Among shared DEGs between ill AN and recovered AN under both fasting and fed conditions, metabolic pathways were also the most frequently associated pathway finding. Of the overlapping fasting state DEGs found when comparing DEGs between ill AN and controls and DEGs between recovered AN and controls, 9.0% were associated with metabolic pathways. Of the overlapping fed state DEGs found when comparing DEGs between ill AN and controls and DEGs between recovered AN and controls, 8.1% were associated with metabolic pathways. In this hypothesis-generating study, the hsa01100: Metabolic pathways was the most frequently-associated pathway of DEGs between AN and controls identified under various between-group comparisons, followed by hsa05022: pathways of neurodegeneration. Our results suggest metabolism dysregulation may play a crucial role in AN pathology.

Alexandra Garcia

Psychology, Muir

Mentored by Dr. Kay Tye

Role of Medial Prefrontal Cortex in Processing Social Stimuli After Isolation

The social environment around us influences our behavior. For example, previous studies show that acute social isolation produces prosocial behaviors, and chronic social isolation results in antisocial behaviors following re-introduction to a social group. Additionally, social behaviors are differentially motivated by social rank placement. Many lines of research point toward the medial prefrontal cortex (mPFC) as a potential region for processing and representing features in our social environment. While the mPFC is important for representing social features, the changes it undergoes following shifts in social context have yet to be investigated. We hypothesized that manipulations in social context through varying isolation lengths and forced social rank changes

will impact socioemotional behaviors and the coding properties of mPFC neurons. To test this, we used in vivo cellular resolution calcium imaging of mPFC neurons in freely behaving mice coupled with machine learning tools to measure mPFC neural activity as animals engaged in the resident intruder task and rehousing paradigm. As part of these experimental designs, adult male mice are presented with a novel juvenile male mouse in acute versus chronic isolation conditions, where we recorded their social interaction time to observe changes in neuronal activity and behavior following increasing durations of isolation. In a separate cohort, we recorded the social ranks of mice before and after rehousing as they completed the elevated plus maze and sucrose preference tests. Taken together, our findings may uncover the neural mechanisms relevant to our processing of socioemotional information to dictate our interactions with the environment.

Vaishali Gautam

Neurobiology, Sixth

Mentored by Gene Yeo

Binding-Proteins discovered to be novel regulators of aberrant subcellular localization of CHMP7 via image-based pooled CRISPR screens

Amyotrophic lateral sclerosis (ALS) is a devastating neurodegenerative disease caused by the degeneration of upper and lower motor neurons, resulting in loss of movement, respiratory failures, and death. Nuclear pore complex (NPC) injury in sporadic ALS (sALS) patient-derived neurons (iPSNs) seemingly results in the loss of nuclear TDP-43 and its RNA metabolism function, as well as degradation via an ESCRT-III pathway. However, the molecular events that lead to these pathologies remain unknown. Recent work has identified aberrant nuclear accumulation of the ESCRT-III protein-charged multivesicular body protein 7 (CHMP7) as an early prominent initiating event in ALS pathogenesis. Nuclear CHMP7 pathology triggers NPC injury and deficits in active nucleocytoplasmic transport (NCT). Functionally, NPC injury impacts NCT, nuclear TDP-43

function and localization, and overall neuronal survival. However, the proteins that regulate CHMP7 nuclear import and/or retention remain elusive. To address that, we have employed genome-wide CRISPR-based automated imaging screen technologies to identify genes that, when knocked down, lead to CHMP7 nuclear mislocalization. RNA Binding Proteins have been identified to highly regulate CHMP7 nuclear localization and can ultimately result in NPC injury in iPSNs. We further disrupted these newly identified CHMP7 – protein interactions using screening techniques and small molecules, connecting enhanced nuclear recruitment of CHMP7 to ALS-associated nuclear accumulation of CHMP7. Collectively, our work dissects the heretofore unknown mechanisms that regulate CHMP7 and has identified novel proteins that contribute to CHMP7 nuclear localization in human motor neurons in health and disease. This can potentially serve as new therapeutic targets for ALS pathology.

Tiffany Gavin

Molecular and Cell Biology; Clinical Psychology, Marshall

Mentored by Binhai Zheng- Neurosciences Professor

Researching the role of astrocytic LZK expression in spinal cord injury repair and recovery by determining the direct effect of astrocytic LZK expression on functional recovery, the indirect effect of astrocytic LZK expression on axon regeneration

After spinal cord injury (SCI), astrocytes become reactive in a process called astrogliosis. These reactive astrocytes surround the lesion and form an astrocyte scar border. Our lab recently previously discovered that LZK (or MAP3K13) regulates reactive astrogliosis and scar formation after a dorsal spinal cord crush injury. The effect of LZK-mediated astrogliosis on neural repair and regeneration is still not clear. We aim to investigate this question utilizing genetically modified mice and RNA sequencing. We are testing the effect of astrocytic LZK overexpression or deletion on behavioral recovery after a contusion injury. We will also assess the effect

of the same LZK manipulations on corticospinal tract (CST) axon regeneration that is induced by Pten suppression or IGF1/OPN overexpression. To identify potential downstream effectors of LZK signaling, we are setting up the RiboTag approach to examine the transcriptomic profiles of LZK-manipulated astrocytes. The relationship between the LZK and STAT3 pathways are also being examined with genetic analyses. Studying LZK-mediated astrogliosis provides an opportunity to dive deep into the mechanisms involved in astrocyte border formation and function. Together, these experiments will provide important insight into the cellular and molecular processes involved in astrogliosis and its functional consequences in SCI, which provides the basis for developing effective therapeutic interventions for spinal cord injury in the future.

Nadia Goiset

Bioengineering: Biotechnology, Sixth

Mentored by Dr. Zoran Radić

Interactions of Two Pairs of Structural Isomers of Uncharged Bis-oxime Antidotes with Inhibited Human Acetylcholinesterase In Silico and In Vitro

Organophosphates (OPs) are chemicals found in pesticides or nerve agents that covalently inhibit enzymes such as acetylcholinesterase (AChE), affecting the propagation of signals in both central and peripheral nervous systems. Intoxication typically leads to cardiovascular issues, respiratory issues, or even death and can only be combatted through the use of antidotes. Despite the efficacy of currently approved antidotes, there is still room for improvement to increase the likelihood of survival and completeness of recovery after exposure to OPs. Our goal is to determine what structural design is better at accessing the active center of OP-inhibited human acetylcholinesterase (hAChE) and is therefore more effective at reactivating its catalytic activity.
This will be done by comparing two pairs of structural isomers, LG-1935 with LG-700 and TAL-910 with LG-823. Each pair has the same chemical

composition but differs in where the substituents bearing reactive nucleophilic groups are bound to the central heterocyclic ring. Comparisons will be done in silico through virtual reality modeling of antidote-enzyme interactions and in vitro by monitoring the kinetics of OP-hAChE reactivation using spectrophotometric Ellman assays. We hypothesize that by having substituents in a 1,3 conformation vs a 1,4 conformation, the antidote's form will fit better in the active center and as a result bind in a more productive orientation, increasing the effectiveness of the antidote. By determining which structural configuration is more effective at enzyme reactivation, we can deduce what structural designs to implement in the synthesis of newer antidotes.

Michelle Gomez

Psychology: Cognitive & Behavioral Neuroscience, Sixth

Mentored by Christine Smith, Ph.D.

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

Individuals with Mild Cognitive Impairment (MCI) are at risk for developing Alzheimer's disease (AD). According to existing tests, MCI patients exhibit extensive impairment in remembering the past (retrograde memory, RM) concurrent with only mild impairment in new learning. This finding suggests that more sensitive RM tests could identify MCI closer to when subtle neural and cognitive changes begin, therefore improving earlier diagnosis and access to interventions. In older adults with either MCI (N=36) or normal cognition (NC) (N=34), we examined if a novel RM news events test (RM-NET) can significantly predict brain volumes of hippocampal subregions known to decline in AD (i.e., CA1 and subiculum). For comparison, we also examined associations between the subregions and composite scores for five domains of cognition derived from existing neuropsychological tests (Executive Function, Semantic Memory/Language, Episodic Memory, Attention/Processing Speed,

Visuospatial Function). Only positive associations were tested. Episodic memory composite scores significantly predicted the volumes of the whole hippocampus, dentate gyrus, and subiculum (the effect in CA1 was only marginally significant) in the MCI group. No significant associations were identified with other domains of cognition. RM-NET scores significantly predicted the volumes of the whole hippocampus, subiculum, CA1, and dentate gyrus in the MCI group. No significant relationships were identified in the NC group for the cognitive domain composite scores or the RM-NET. The RM-NET holds promise for tapping into the brain structures that are known to decline early in AD.

Rubi Gomez

Public Health - Community Health Sciences, Sixth

Mentored by Dr. Britta Larsen

Social Support and Its Relationship to Physical Activity Outcomes

Obesity has been a long-standing public health issue for children in the United States, affecting an estimated 14.7 million adolescents. The prevalence of obesity is disproportionately greater in Latina adolescents than non-Latino White adolescents likely because they are not meeting the recommended physical activity guidelines of an average of 60 minutes per day of moderate-to-vigorous intensity physical activity. Social relationships, crucial during adolescence, are an important factor affecting Latina adolescent girls' attitudes toward physical activity. This study will examine whether social support from parents or peers is more strongly linked to adolescents' physical activity in Latina adolescents. Data were derived from a randomized trial of a mobile technology-based physical activity intervention for Latina adolescents called Chicas Fuertes, conducted by the University of California San Diego. A cross-sectional analysis will draw on the baseline data from 136 adolescent participants ages 13 to 18, collected from August 2020 to March 2023. A multiple-regression analysis will be conducted to compare the strength of the links between each of the predictor variables (parental social support and

friend social support) and the outcome (attitudes toward physical activity). It is expected that peer social support will have a stronger influence on attitudes toward physical activity than parental support because as adolescents develop friendships, they spend more time with friends and reduce the amount of time spent with their parents. Differentiating which social relationships have a greater influence will aid in understanding the factors that may improve physical activity among adolescent Latinas in the U.S.

Xun Gong

Mathematics, Revelle

Mentored by Anthony Sanchez, Chancellor's Postdoc

Monodromy of a symmetrical surface

We introduce the idea of origamis, Veech groups, and Kontsevish-Zorich cocycle. Further, we study a highly symmetrical and quite remarkable surface and compute the Zariski closure of the Kontsevich-Zorich monodromy groups arising from such a geometrically meaningful surface. We prove our results by finding the generators for the monodromy groups and then examine the actions of SL(2, Z) on the homology basis of this surface to see its geometric significance.

Marley Gough

Sociology, Sixth

Mentored by Gershon Shafir, Distinguished Professor

Passing Inside & Out: A Queer Take on a Social Phenomenon

Passing — the act of being able to assume membership of different identities, oftentimes to gain new privileges — is present in every moment of every day, whether actively or passively done, but generally it's considered an individual struggle controlled by the self. This definition does not align with the dominant definition in the queer public consciousness which considers passing to be both an internal and external struggle, predicated on both what one does individually and what is perceived of them by society. Given this misalignment, we're left with this question: what is passing, and what are its manifestations and discontents in the day-to-day lives of queer people in both straight and queer communities? This study utilizes symbolic interactionism and stigma to break down this definition and explain the reasoning behind queer peoples passing choices. Hegemonic masculinity and emphasized femininity are subsequently used to describe how someone might pass. Through qualitative interviews with a variety of queer people with differing identities I sought to understand their individual definitions of passing which almost all aligned with a new proposed definition: the act of being able to assume membership of different identities (be they straight or queer) and be assumed to be of the chosen identity. I also sought to understand how passing appeared and caused friction in their day-to-day lives, and found that most discussion around passing revolved around conformation or deviance from social gender norms, and there was pressure to pass for safety in both straight and queer spaces.

Nicole Granados

General Biology, Marshall

Mentored by Edward Callaway, PhD

Targeting neural recordings within the superior colliculus

An organism makes decisions based on a combination of cognitive and sensory information. How the brain combines, prioritizes, and uses information for organismal goals are major questions in systems neuroscience. The superior colliculus (SC) receives cortex-wide inputs and contains topographic maps, with superficial SC responding to saliency of stimuli in sensory space, and deep SC signaling its outputs in motor space. More mysterious is the influence of the prefrontal cortex (PFC) on SC responses; PFC information tends to be abstract, cognitive, and non-spatially-mapped. We hypothesize that SC neurons play a role in spatially mapping potential cognitive information from PFC alongside sensory and motor information. To investigate this, we record neuronal activity from the SC and PFC using multi-shank silicon microprobes while mice perform visually-guided behaviors. To target our probe placements to regions of SC that receive synaptic inputs from PFC, we inject the retrograde tracer cholera toxin subunit beta (CTb) at various coordinates in the mouse SC, largely informed by a recent SC anatomical tracing study[1]. We determine the ideal coordinates for SC recordings based on the presence of neuronal labeling within PFC regions, such as the medial, lateral, and ventrolateral orbitofrontal, prelimbic, infralimbic, and anterior cingulate cortices. By determining our SC recording coordinates, these experiments will help us (1) interpret differences in neural activity between different SC recording penetrations based on the nature of their upstream PFC subregion, (2) direct placement of a second, PFC subregion-specific probe, to investigate the role of the SC in integrating information.

Max Gruber

Neurobiology, Revelle

Mentored by Christina J. Sigurdson, DVM, PhD, Departments of Pathology and Medicine

Prion Protein-induced Neurodegeneration in the Central Nervous System of Drosophila Melanogaster

Prion diseases are fatal neurodegenerative disorders characterized by neuronal loss and the accumulation of misfolded, membrane-bound prion protein aggregates (PrPSc) in the brain. PrPC, the normal cellular prion protein encoded by the Prnp gene, has been implicated in binding oligomers, including PrPSc, Aβ oligomers, and α-synuclein assemblies, that form in patient brains with neurodegenerative disease. However, the mechanism by which PrPC interacts with PrPSc and causes neuronal death is poorly defined. The 92N-PrPC point mutation may be a tool to help to elucidate the neurotoxic pathway, as it has been shown to result in spontaneous spongiform degeneration in mice despite the absence of PrPSc and prion infectivity. Due to their low cost, rapid reproduction rate, short life span, and susceptibility to genetic manipulation, Drosophila melanogaster are an excellent candidate for studying prion-induced neurodegeneration. To investigate prion disease in a non-mammalian model, we generated transgenic 92N-PrPC and wild type mouse (WT) PrP control Drosophila lines, which were sequence validated by PCR. Western blot analysis revealed that the 92N-PrPC point mutation is uniquely expressed in the 92N-PrPC fly lines. Lifetime and climbing (motor function) assays have been conducted to test behavioral differences between 92N-PrPC and WT-PrPC and non-transgenic control groups. These experiments show the generation of a mutant prion protein disease model in Drosophila, and future experiments will focus on assessing behavior, histopathology, and signaling pathways towards a goal of understanding how mutant prion protein induces neuronal death.

Sowmya Gudapati

Human Biology, ERC

Mentored by Panizzon, Matthew; Associate Adjunct Professor, Psychiatry

Parity, MMSE, and Verbal Memory: the hormonal drivers of late-life cognitive sex differences.

While women suffer from higher rates of Alzheimer's disease and dementia than their male counterparts, the cause(s) of this relationship are unclear. Reproductive factors specific to women have been proposed as possible contributors to this sex difference. Specifically, during pregnancy and birth, women experience extreme hormonal changes, which cause lasting impacts on brain structure and function. Studies that have explored the relationship between the hormonal effects of parity and cognitive functioning have contradicting conclusions. This study explores the effects of parity and its effects on late-life cognitive status as defined scores on the Mini-Mental State Examination (MMSE) and verbal memory tests. This study conducted a preliminary random effects meta-analysis of three studies examining the partial correlation between parity and MMSE as well as three studies examining the partial correlation between parity and verbal memory. The results of the meta-analysis for MMSE indicated that there was marginally significant between-study heterogeneity ($Q(2) = 4.80$, $p = 0.09$) and that parity was significantly negatively associated with MMSE performance ($b = -0.11$, $p = 0.001$). The analysis for verbal memory indicated that parity was not significantly associated with immediate verbal memory recall performance ($b = -0.02$, $p = 0.80$), but was significantly negatively associated with delayed recall performance ($b = -0.03$, $p = 0.04$). Overall, this study provides evidence supporting that parity affects MMSE performance and delayed verbal memory. A complete meta-analysis will be conducted to further elucidate the nature of the association between parity and cognitive functioning.

Nicholas Guo

Bioinformatics, Muir

Mentored by Professor Kathleen Fisch

Rare Damaging Mutations in Placental Tissue Associated with Preeclampsia

Placental dysfunction is a hallmark of preeclampsia (PE) which affects 3-8% of pregnancies, with 10-15% of maternal mortality associated with PE and eclampsia. PE is primarily characterized by new onset hypertension often presenting with proteinuria, end-organ dysfunction, and fetal growth restriction. The role genetic mutations play in placental histopathological lesions, placental dysfunction, and maternal disease during pregnancy is unexplored, paving the way for novel investigation into the mutational landscape of preeclamptic placentas. We investigated rare, damaging, loss-of-function mutations in placentas with and without placental lesions from healthy pregnancies and those affected by PE. We performed variant analysis from RNA sequencing data of 152 human placentas including 53 normotensive and 83 with PE or superimposed PE (siPE). We identified variants using the GATK Best Practices Workflow for RNAseq short variant discovery implemented in bcbio-nextgen. After these variants were annotated and run through a quality filter, we prioritized rare, damaging, loss-of-function variants resulting in 11,970 variants across 3,395 genes. We performed clinical enrichment analysis which identified 6 significantly mutated genes enriched in PE+siPE and 6 genes enriched in histopathological lesions. Of note, DVL1 is enriched in PE samples ($p = 0.005$, Odds Ratio = 5.24) at a deletion (c.1507+1_1508-1del) common to all samples harboring this mutation. This study has identified potentially clinically significant variants present in placentas associated with preeclampsia.

Medhaansh Gupta

General Biology, Seventh

Mentored by Dr. Nicholas Spitzer

Overexpression of functional postsynaptic GABA receptors in Xenopus larvae stabilizes expression of GABA synthetic enzymes

Gamma-aminobutyric acid (GABA) is an inhibitory neurotransmitter synthesized from glutamate by GAD 67 and GAD 65 enzymes localized in the neuronal cell body and in axonal processes, respectively. At the Xenopus cholinergic neuromuscular junction, we have previously shown that overexpression of the GABAARαβ$\boldsymbol{\gamma}$ receptor in postsynaptic muscles stabilizes the expression of GAD 67 and GABA in presynaptic motor neurons. However, it is not known if this manipulation also stabilizes GAD 65. The appropriate GAD 65 antibody was selected following literature review and BLAST analysis. Initial standardization for immunostaining with GAD 65 antibody in whole mount larvae did not detect any antigen, even in the spinal cord where GAD 65 is expressed in inhibitory neurons. Further analysis indicated that the protein configuration was likely altered by fixation, affecting the antibody's epitope recognition. Therefore, I utilized a citrate buffer for antigen retrieval and co-immunostained for GABA and GAD 65. This allowed detection of GAD 65 in spinal cord inhibitory neurons. To express functional GABA receptors, I injected mRNA encoding the α1-GFP, β2, and $\boldsymbol{\gamma}$2 subunits into embryos. The α1-GFP only injections served as the control as this subunit alone does not form functional receptors and remains in the cytoplasm. Immunostaining for GABA, GAD 65 and GFP in Xenopus larvae now showed that GABAergic motor neuron processes innervating the muscles expressing the GABAARαβ$\boldsymbol{\gamma}$ receptor but not α1-GFP-only also expressed GAD 65. Thus, postsynaptic GABAARs stabilize the expression of both GABA synthetic enzymes - GAD 65 and 67 - in presynaptic motor neurons.

Megan Hackbarth

Molecular and Cell Biology, Marshall

Mentored by Omar Mesarwi, MD - Assistant Clinical Professor

Effect of Obesity in Combined Sustained and Intermittent (Overlap) Hypoxia

COPD/OSA overlap is associated with high mortality, correlating with the severity of nocturnal hypoxemia. Patients with severe COPD/OSA overlap may have sustained hypoxemia from COPD, and nocturnal intermittent hypoxemia from OSA. Combined sustained and intermittent hypoxia (overlap hypoxia) in lean mice mimicking severe COPD/OSA overlap increases LDL cholesterol, shifts glucose metabolism toward glycolysis, increases hepatic oxidative stress, and causes both systemic and pulmonary hypertension. We aimed to determine whether these findings are impacted by obesity. Male C57BL/6J mice were fed either a chow diet or a high fat diet (HFD). After 11 weeks, they were subjected to one of three hypoxic profiles for four weeks: Room air (RA, FiO2 0.21), intermittent hypoxia (IH, FiO2 0.21 during dark phase and fluctuating between 0.21 and 0.06 once per minute for 12 hours during light phase), or overlap hypoxia (OH, FiO2 0.13 during dark phase and fluctuating between 0.13 and 0.06 once per minute for 12 hours during light phase). HFD improved glucose tolerance in IH, but not in RA or OH. Body fat percentage was higher in HFD-fed animals, though the difference between chow and HFD was highest in OH. Serum LDL was elevated in OH, and this effect was accentuated in HFD. HFD increased right ventricular pressure in all groups, but was highest in OH, corresponding with increased pulmonary artery p-ERK protein. Different hypoxic profiles result in highly variable effects on metabolic and pulmonary vascular outcomes. Deleterious effects of OH may be accentuated in mice fed a HFD.

Somalea Hayward

Sociology, Seventh

Mentored by Professor Kelly Gates

Bumble as a Feminist Dating App: Inclusion, Safety Discourse, and Surveillance

The location-based dating app Bumble is self-described as a feminist dating app. It reportedly seeks to change the face of dating apps by creating a safer and more inclusive environment in the midst of dating app misogyny and harassment. Through an analysis of Bumble's terms and conditions I examine the privacy and surveillance practices of the app, as well as the relationship that these practices have with the app's purported and actual goals. As a result, I challenge the notion of Bumble as a feminist app because it does not employ feminist data ethics and utilises a problematic safety and inclusion discourse to justify these harmful data practices that are rooted in neoliberal capitalism. In order for Bumble to actually operate as a feminist app it should employ meaningful and negotiable practices of transparency and consent within it's terms of use and privacy policy.

Veronica Hernandez

Psychology with a Specialization in Clinical Psychology, Muir

Mentored by Dr. Lisa Eyler

Impact of COVID-19 Related Anxiety in Adults with Schizophrenia

The COVID-19 pandemic has led to heightened anxiety in many segments of society, but little is known about pandemic-induced anxiety among individuals with serious mental illness such as schizophrenia. People with schizophrenia (PwS) suffer from symptoms such as hallucinations and delusions as well as apathy and asociality; inflammation is also elevated in the disorder. These symptoms might exacerbate the psychological impact of COVID-19, but relatively few studies have examined the impact of the COVID-19 pandemic or associate anxiety in PwS. With data from a longitudinal study of PwS and non-psychiatric comparison (NC) participants collect in 2021 and 2022 using the COVID-19 Anxiety Scale (CAS) and COVID-19 Impact Scale (CIS), we will examine whether PwS had higher COVID-19 related anxiety and impact than NC, and, within the PwS, which people were more likely to report higher anxiety and impact. The

CAS was completed by 128 participants; the CIS by 120 participants. We hypothesize that PwS will have higher COVID-19 related anxiety and report greater impact than the NC participants. In addition, we will explore how demographics, clinical symptoms, and inflammation levels of PwS relate to their CAS and CIS scores. Results from this analysis will be important to better understand the effects of the pandemic and its related anxiety on PwS and which PwS were most vulnerable. This could suggest possible ways to increase quality of life of people with serious mental illnesses in the face of stressful health crises.

Cameron Hicks

Psychology, Muir

Mentored by Karen Dobkins PhD

Measuring effects of "Learning Sustainable Well-Being" on Mental Health and Resilience

Our society is facing an unprecedented mental health crisis, with nearly one in two people being affected by mental health issues over their lifespan. In response to this mental health crisis, UCSD psychology Professor Karen Dobkins created a workshop-style course, “Learning Sustainable Well-being” (LSW), which guides students to explore, improve, and sustain their mental health. In order to measure the efficacy of this LSW course on college students’ well-being, 6 standardized and 1 in-house measure focused on well-being, mindfulness, and compassion were given before (baseline) and after the LSW course, and data were compared to a control group consisting of students interested in taking a well-being course. Significant improvements (with moderate to large effect sizes) were found in 6 of the 7 measures, with the one not showing improvement resulting from students starting near “ceiling” at baseline. Along these lines, we observed a clear negative association between baseline and effective size of improvements, which provides an important reminder that the calculated effectiveness of any intervention will be largely affected by the group's starting point before the intervention.

Valerie Hsu

Neurobiology, Warren

Mentored by Dr. Maripat Corr

Microglial TLR4 contribute to signs of inflammation in a mouse model of inflammation

Rheumatoid arthritis is a systemic autoimmune disease driven with joint manifestations. By definition autoimmune disease is driven by the adaptive immune system, but the innate immune system is an integral part of disease initiation and progression. The Toll-like receptors (TLRs) are a key part of the innate immune system. We tested a series of mice that were deficient in individual Toll-like receptors in a mouse model of arthritis. The K/BxN model passive serum transfer model of arthritis is penetrant in strains that are not deficient in critical elements need to develop clinical signs of arthritis. TLR4 deficient mice developed swelling on par with wild type mice; however male and female mice had rapidly recovering tactile allodynia similar to wildtype female but not male mice. Utilizing conditional strains with cre drivers for cell restricted Tlr4 expression we examined which cell types may account for these differences. The mice with Tlr4 excision in microglial cells had the most significant impact on clinical measures in both male and female mice. One caveat is that there may have been cre expression in other cell types that also contributed to variable degrees.

Daphne Huanca Vargas

General Biology, Revelle

Mentored by Nan Hao

Single-cell dynamics of FcγRI expression during IFN-γ activation of mouse macrophages

Macrophages are one of the most important cellular players in the immune system during the fight against an infection. Interferon gamma (IFN-γ) is a cytokine produced by T-Helper 1 cells and Natural Killer cells used to activate macrophages to their proinflammatory state. Once activated to their proinflammatory state they often perform phagocytosis to neutralize the antigen. Here an antigen is marked with antibodies which are recognized by surface receptors, such as FcγRI, of the macrophage that will perform phagocytosis. The goal of this project is to first create a stable macrophage cell line with an endogenous FcγRI transcriptional reporter via CRISPR/Cas9 genome editing. Using this cell line, we will observe the single-cell dynamics of FcγRI expression during IFN-γ activation of mouse macrophages. While many studies observe bulk cells at single timepoints, it is beneficial to observe the same single cell over the course of the whole infection to determine if heterogeneity exists.

Talyn Hughes

Cognitive and Behavioral Neuroscience, Marshall

Mentored by Giordano de Guglielmo, PharmD, PhD

Rat strain differences in opioid addiction-like behaviors

In the past two decades, an increase in the prescription of opioid medications to treat pain led to the misuse of both prescription (e.g., oxycodone) and illicit opioids, contributing to a national epidemic.

Development of better treatments for opioid addiction is urgently needed, which requires a better understanding of its biological basis. Genetic variations are important factors that may contribute to individual differences in susceptibility to opioid use disorder (OUD) and have implications for clinical practices. We performed a behavioral screening in four inbred rat strains (ACI/N, BN/ NHsd, WKY/N, and F344/N) to identify strain differences in oxycodone metabolism and oxycodone-related behavioral measures. To model OUD, we used extended access to intravenous oxycodone self-administration (12 h/day, 0.15 mg/kg/inj). We measured escalation of oxycodone self-administration and motivation for drug intake using fixed ratio and progressive ratio schedules of reinforcement, respectively. We also evaluated tolerance to the analgesic effects of oxycodone (tail immersion test), withdrawal-induced hyperalgesia (von Frey test), and oxycodone-induced respiratory depression (pulse oximeter). Finally, we measured oxycodone seeking during protracted abstinence (4 weeks) by re-exposing the animals to the same environment and cues previously associated with oxycodone self-administration. The results showed strain differences in most of the behavioral measures including oxycodone metabolism. Interestingly, BN/NHsd and WKY/N had levels similar drug intake and escalation, but significantly differed in oxycodone and oxymorphone metabolism. Overall, these findings offer a foundation for the identification of genetic and molecular variants that underlie different aspects of the opioid addiction process.

Tyler Hurlimann

Human Biology, Revelle

Mentored by Dr. Zoran Radic

Interactions of Bis-Oxime Antidotes with Fenamiphos Inhibited Acetylcholinesterase In Silico and In Vitro

Acetylcholinesterase (AChE) is a vital enzyme in the human body responsible for the hydrolysis of acetylcholine, a neurotransmitter

involved in numerous physiological processes to include muscular function and central and peripheral nervous system functions. The inhibition of AChE can lead to various physiological symptoms such as neurological damage, hormonal issues, cardiac arrest, and even death. One class of inhibitors that can affect AChE are organophosphates (OP), which work by covalently binding an organophosphate group to the active site serine of the enzyme, blocking its activity, and preventing the hydrolysis of acetylcholine. An OP of interest to this study is fenamiphos, an insecticide used worldwide, which can be harmful to humans exposed to it. Fenamiphos is unique in that the structure of the OP group contains a nitrogen directly attached to the phosphorous atom. This substituted nitrogen results in greater difficulty for antidotes to remove the inhibitory OP group from the AChE active site and restore catalytic activity. In this study, six novel bis-oxime antidotes were analyzed by monitoring reactivation kinetics of fenamiphos-inhibited hAChE using a spectrophotometric Ellman Assay. The resulting reactivation constants were used as criteria for comparison and rank-ordering of the tested antidotes in order to nominate best candidates for further testing in fenamiphos-exposed mice in a round of in vivo experiments to be performed in the future.

Zara Irshad

Communication, ERC

Mentored by Professor Thomas Scmidt

Stand-up to stardom: navigating brown comedy and its social repercussions

The vilification and conflation of brown identities in the wake of 9/11, and subsequent sentiments of fear that are generated, have contributed to stand-up comedy serving as the primary entry point for brown people to break into the broader entertainment industry. Stand-up allows brown creatives to combat these sentiments by presenting themselves as non-threatening to audiences and mining the parts of their cultures that

people fear or don't understand and making them laughable. The development and impact of brown stereotypes in television lies at the heart of this phenomena, contributing to misconstrued perceptions of brown people and shaping the minds of the American public. Thus, in an effort to further explore the question "why comedy?" this project analyzes how certain racially-driven stereotypes came to develop in US television history as well as how they have been implemented into brown stand-up comedy, measuring their influence and impact on audiences. In order to do so, this research relies on audience interviews, a long historical survey, and a media analysis of the following three brown comedy specials: Mo Amer's "Allah Made Me Funny," Kumail Nanjiani's "Beta Male," and Russell Peters' "Notorious."

Mohini Iyer

Neurobiology, Revelle

Mentored by Giordano de Guglielmo, PharmD, PhD

Relationship Between Addiction-like Behaviors and Gut Microbiome and Metabolomics in Alcohol-dependent Rats

Nearly 30 million Americans have Alcohol Use Disorder (AUD), but individual differences leading the development of problematic drinking are poorly understood. The microbiome has been implicated as a potential source of variation in AUD due to its regulatory role and high susceptibility to alcohol. We aimed to investigate the link between individual microbial compositions and individual differences in alcohol addiction-like behaviors. This was accomplished using male and female HS rats, which were trained to self-administer ethanol (10% v/v) daily, then were made dependent using the chronic intermittent ethanol vapor exposure (14 hours/day x 4 weeks, achieving blood ethanol levels of 150-250 mg%), and evaluated for their addiction-like behaviors during acute withdrawal (6-8 hours after vapor) from alcohol. We computed an Addiction Index to classify rats with high- or low-addiction-like behaviors and evaluated differences in microbial and metabolomic composition. We

found that female rats had higher levels of ethanol intake before and after induction of dependence, escalated faster, and had greater motivation to drink alcohol. Females were significantly less sensitive to ethanol in the loss of righting reflex task. Microbiome analysis showed lower SR1 bacteria levels in high-addicted rats compared to low-addicted rats. Our results show that there were microbial differences present among addiction groups, suggesting HS rats exhibit diverse AUD-related phenotypes that are likely related to microbial factors influencing the development of AUD. These findings highlight the importance of individual differences and microbial composition, and suggest potential implementation of precision medicine when treating AUD.

Daniel Ji

Computer Science, ERC

Mentored by Niema Moshiri

GEMF Online Tools: web applications for accessible and intuitive epidemic simulation

GEMF is a command line tool for simulating epidemic-scale transmission networks along unchanging contact networks, and GEMF_FAVITES is a Python wrapper that makes GEMF simulation definition and execution more user-friendly, but still within the command line. However, the target userbase includes epidemiologists and public health officials who may not have computational training to install and execute command line tools. Further, even if one installs and executes the tool, designing a complex transmission model to better capture reality is non-trivial. We developed GEMF Designer, an interactive React.js web application that visualizes the states and state transitions of transmission models and allows users to design and define their own novel transmission models. GEMF Designer contains an interactive, real-time graph alongside form input for users to create, upload, edit, and download state transition graphs customizable in structure and design. We also developed GEMF_FAVITES_WASM, a serverless React.js website that executes

GEMF_FAVITES entirely in the browser by compiling GEMF C code and GEMF_FAVITES Python code into WebAssembly. While GEMF Designer visualizes the state transition rates file, GEMF_FAVITES_WASM ports GEMF_FAVITES and GEMF entirely over to the browser. GEMF_FAVITES_WASM preserves GEMF_FAVITES source code, making code management straightforward. A form interface replaces command line arguments and output files are summarized and downloadable. The combination of the two web apps provides non-computational researchers a fast, setup-free solution for designing and running epidemic simulations without the need for local installation or the use of an external server.

Brooke Johnson

Global Health, ERC

Mentored by Dr. Fabian Rivera Chavez

Phage susceptibility of Vibrio cholerae under cholera toxin-inducing conditions

Cholera is a diarrheal disease caused by Vibrio cholerae, a human pathogen that uses cholera toxin (CT) to cause illness. Investigating potential preventative therapeutics is imperative to reduce the disease burden of cholera. Bacteriophages are viruses that infect bacteria and are promising candidates for treating cholera/other bacterial infections. Unlike antibiotics, phages can target bacteria with excellent specificity and co-evolve with their bacterial hosts, potentially allowing them to overcome evolved phage resistance. However, to fully assess the potential of phages as tools in preventative treatment, it is necessary to study their interactions with their hosts. V. cholerae bacteriophage N-4 is a known phage that can infect and kill V. cholerae. Interestingly, CT is expressed by a filamentous bacteriophage, known as (CTXϕ), which can integrate into the genome of V. cholerae strains using its co-expressed receptor, the toxin-coregulated pili (TCP). In order to infect and kill their host, bacteriophages such as N-4 must bind to the bacterial surface. We

hypothesize that expression of TCP (and CTXϕ) modulates the susceptibility of V. cholerae to killing by bacteriophage N-4. To test this, we will assess the susceptibility of V. cholerae to N-4 under TCP-inducing conditions vs. non-TCP-inducing conditions. These studies will help shed light on the relationship between predatory phage infection and CT-encoding CTXϕ V. cholerae, which may have implications on how this pathogen causes disease during outbreaks in the presence of predatory phage.

Gaya Kalyan

Global Health B.S., Seventh

Mentored by Dr. Robert J Sah

Structure of the Rabbit Anterior Cruciate Ligament Analyzed by Micro-Computed Tomography

The anterior cruciate ligament (ACL) is a crucial stabilizer of the knee, but is one of the most commonly injured ligaments, with injury markedly increasing the risk of osteoarthritis. While rabbit models are commonly used to study knee injury and repair, structural information on the rabbit ACL remains limited. Micro-computed tomography (μCT) provides high-resolution three-dimensional images using contrast agents to highlight soft tissue structures. This study's aim was to elucidate the structure of the rabbit ACL by (1) determining the applicability of phosphotungstic acid (PTA) staining, (2) assessing macroscopic geometrical quantities, and (3) examining its microstructure. The bone-ACL-bone compartment was harvested from post-mortem rabbits' knees and stained with 0.3% w/v PTA in water overnight while maintaining the knee in its resting position. μCT imaging was performed at (9 μm)3 isotropic voxel size at an electrical potential of 50 kV and current of 200 μA using a 0.5mm aluminum filter with beam hardening and ring artifact correction algorithms applied during image reconstructions. PTA staining penetration of the ACL was measured, and ACL dimensional properties and fascicle orientation were assessed. Macroscopic measurements are expected to indicate a length of

~5mm, semi-minor and semi-major axes of ~2mm, and a cross-sectional area of ~3.5 mm^2. High-resolution images revealed three distinct bundles and sub-structures consistent with fascicles aligned in different longitudinal axes. This information advances the understanding of rabbit knee biomechanics, which can aid in developing diagnostic procedures, setting design objectives for reconstructive tissues, and devising more efficient treatment plans.

Leena Kang

Applied Mathematics, Sixth

Mentored by Professor Niema Moshiri

Exploratory and Predictive Analytics for Precision Medicine

As evident in the Covid-19 pandemic, vaccines and treatment plans have varied in effectiveness across different individuals. Ineffective treatment may prolong the prevalence of a variant and lengthen the curing process, which raises the attention toward individualized healthcare. Precision Medicine is an emerging field in Biomedical Sciences that seek to target a personalized treatment plan using an individual's information (e.g., biomarkers, environment, family history, personal habits, and dietary patterns). In this project, we utilize women's health data from the Women's Healthy Eating & Living (WHEL) study to measure relationships between metrics and assess the predictive power of patients' data regarding the recurrence likelihood of breast cancer events. In our exploratory analysis, we generated in-depth multivariate visualizations to identify correlations, particularly patterns involving variables of interest, such as quality of life, tumor type, recurrence status, and demographic variables that may reveal biases in data collection due to systemic socioeconomic factors. We found that (1) patients with more role limitations due to physical/emotional problems reported answers reflecting higher quality of life and mental health; (2) larger increases in alpha-carotene are associated with stable quality of life over time; and (3) the patient group with missing data points at study conclusion has

markedly lower numbers of individuals with at least a college education. We then select learning features for our Machine Learning models using a binary breast cancer recurrence status as the target variable. We achieved 89% recall, 87% accuracy and precision, with resampling being the best approach to our imbalanced dataset.

Macey Keung

Media, Sixth

Mentored by Michael Trigilio

Antifragile Zine Issue Four: Anachronism

Antifragile Zine is an independent magazine and youth artists collective run by all queer women of color and non-binary people of color. We, Antifragile Zine, exist because there is a lack of creative communities and opportunities led by youth, for youth, especially spaces dedicated to marginalized creatives. We believe that by bringing together youth, art, and community, we can catalyze radical change. In the past two and a half years, we have cultivated a tight-knit community of over 15,000 people from all over the world, worked with over 200 artists globally, with a diverse team of around 60 young women of color and non-binary people of color. We have published three print issues, and hosted live music, art, and community events with turnouts of over 250 people. We are currently working on our fourth issue titled: ANACHRONISM. As a generation immersed in rapid technological advancements, Gen Z has taken a surprising interest in items of nostalgia: vintage goods, thrifting, analog photography, retro aesthetics, and even print media/zines. Issue Four is a physical manifestation of these fears and desires related to connection and reality. It is a collective diary and time capsule of Generation Z. It is an analysis of our generation, our values, feelings, escapism, and our relationship with social media and time. The final product will be 8.5” x 11” with 140+ pages and feature work from 70+ Gen Z creatives.

Elysia Kim

Clinical Psychology, Marshall

Mentored by Lindsey Powell

Infants' Understanding of Helping Actions

This project examines the basis for infants' positive evaluations of helpers. Previous research has shown that infants prefer agents who help someone achieve a goal, compared to agents that hinder, and to neutral agents. However, it is unclear what about helping leads infants to positively evaluate helpers. There are two hypotheses that may explain infants' positive social evaluations. The first hypothesis is that observations of helpful actions allow infants to infer helpers are generally "good" or nicer (i.e., dispositional inference), and therefore are more likely to provide help to most other social agents. Alternatively, infants may infer a helper is demonstrating the ability to engage in and maintain a specific social relationship (i.e. relationship inference), and therefore should only be more likely to help a specific target with whom they have positively interacted with previously. This study explores whether 14 & 15-month-old infants expect helpers to act in a way that is consistent with dispositional or relationship based motivations.

Jerick Kim

Neurobiology, Revelle

Mentored by Dr. Melinda Owens, Assistant Teaching Professor

Multiple Effects of Scientist Spotlights Assignments in an Introductory Biology Course

The Scientist Spotlight is a homework assignment that features the personal and scientific stories of a counter-stereotypical scientist (Schinske et al., 2016). They have been shown to decrease students'

stereotypes about scientists, increase student perceptions of how relatable scientists are, and increase course grades (Schinske et al., 2016; Yonas et al. 2020). Previous research on Scientist Spotlights has tended to either use close-ended questions or focus on student responses generated as part of the Scientist Spotlight assignments themselves. We hypothesized that any additional effects could be found by analyzing open-ended student responses from the end of the term, as the students were reflecting on what they have learned from the course as a whole. We asked what ideas related to science identity, self-efficacy, or diversity were evoked by the Scientist Spotlights. We also asked whether these ideas appeared more frequently in students from minoritized groups. We found that 47% (98/208) of all students mentioned the Scientist Spotlights as part of their Final Reflection. When comparing students from minoritized groups to their non-minoritized counterparts, we found no significant differences in the prevalence of mentioning Scientist Spotlights or in mentioning any of the themes. Our study adds to the literature examining the myriad effects of Scientist Spotlight assignments on student ideas about diversity in science, self-efficacy, and humanizing scientists and provide further support for introducing Scientist Spotlights or similar assignments into courses.

Isabel Koeppen

Communication, ERC

Mentored by Professor A.B. Boateng

Black Women's Experience at Predominately White Institutions with a Focus on Intersectionality and Racial Projects

The topic I have chosen to research is Black women’s experience at Predominantly White Institutions or PWIs and how the lack of support present at these institutions creates an unequal experience for students. Black women enroll at universities at a higher rate and at these universities they excel in comparison to their peers, but the lack of support present at these universities impacts access to opportunities that

would further boost their professional and social success. Being a woman at an institution of higher learning is in itself difficult, however, in this presentation I want to take an intersectional viewpoint of the female experience in college and examine the racial projects at play that impact Black Women at PWIs and then look at what would need to be done to improve support present at these universities to further boost Black women's professional and social success. This brings up not only the importance of Black community in college campuses, but also a community of women – both of which provide an important level of support. By looking at involvement in the National Pan-Hellenic Council, historically Black fraternities and sororities, it can be proven that strong support systems at PWIs can change Black women's experience at universities and show why it is important to look at the topic of feminism and inclusion at colleges from an intersectional lens.

Athena Leisching

Cognitive Science, Revelle

Mentored by Dr. Lara Rangel

Rhythmic Dynamics of the Rat Dentate Gyrus during Associative Spatial Memory Task

The dentate gyrus (DG), a subregion of the hippocampus, is thought to provide unique representations for similar experiences to aid in both the encoding and retrieval of distinct memories. Despite this long-standing hypothesis, little is known regarding the local circuit interactions within DG that support the recruitment of these unique representations and at what critical intervals these interactions may occur. To further investigate this, we acquired in vivo electrophysiological recordings of single cell and local field potential (LFP) activity from rat DG as rats perform a spatial delayed-match-to-sample task. The task requires the rats to associate a location in an arena with a reward during an encoding phase, and return to the previously rewarded location in the presence of foil location during a subsequent retrieval phase. We have observed several behaviors that

indicate rats critically leverage cues outside of the arena to perform the task. Specifically, rats scan (pause at the base of the arena at the start of the task to view possible reward locations in the context of environmental cues from distance), push over objects, and rear (stand on hind limbs to view environmental cues at a reward location). We investigate the frequency and duration of each behavior during encoding and retrieval phases before correct or incorrect performance, and characterize dynamic neural oscillatory activity during these behaviors. In this manner, we will determine whether the DG exhibits distinct rhythmic states during each behavior that changes across encoding and retrieval phases and across successful and unsuccessful performance.

Ryan Li

Bioengineering: Biotechnology, Revelle

Mentored by Professor Robert Sah

Biaxial tensile testing apparatus to determine tensile strength of small soft tissue samples

The mechanical properties of connective tissues change with maturation, aging, and disease. The biaxial tensile properties of small tissue samples are often of interest. The objective of this study was to design a method and device that allow uniaxial and biaxial stretch of small tissue samples that can be used to determine biaxial tensile properties. The method made use of resin-printed templates to guide the cutting of cross-shaped test coupons. These were attached via metal pins fixtures that allowed application of displacement and measurement of load. Tensile properties are then determined as the slope of linear regression fits of stress vs. strain profile. With this apparatus, the tensile properties of a variety of tissues such as cartilage, meniscus, tendon, ligament, intervertebral disk, skin, and fascia should all be feasible. Ongoing studies are finalizing the application of the device and method.

Brandon Liu

Data Science, ERC

Mentored by Terry Sejnowski

Directed Graph Neural Networks for Classifying Mental Illness in MRIs

Graph Neural Networks have been growing in popularity amongst deep learning circles, with new use cases being found for all fields including neuroscience. An emerging popular use case has come from helping those suffering from mental illness get an accurate diagnosis through Magnetic Resonance Imaging scans (MRI) of their brains. Currently, experts improve diagnoses through creating questionnaires for certain illnesses, to be given and scored for patients to determine the severity of mental health issues. In using deep learning to classify mental health illnesses, professionals can save time in diagnosing patients and find new patterns that the human eye alone cannot see, shifting their focus to providing the correct treatment and medication for each case. Deep learning literature in MRI classification over time tends toward 3-dimensional convolutional neural networks (CNNs) and undirected graph neural networks built through correlation-relative edge connections as their main models. Directed graph neural networks applied to MRI scans can improve the current deep learning landscape by being faster than traditional CNN architectures, as well as maintaining brain structure and connections between regions of interest over multiple layers much more efficiently than traditional CNNs or undirected graph networks. In this project, I present MRI data over time in a directed graph format and use various newly designed graph neural networks with attention and transformer architectures such that we can improve classification through detecting connectivity between both short-range, adjacent regions and long-range, more distant regions of the brain.

Lillian Liu

Human Biology, Sixth

Mentored by Cory Root Assistant Professor

Toward Understanding How Sensory Processing Informs Reward-Associated Decisions: Feed-Forward Inhibition in the Olfactory Circuit

Though many of the neural components involved in generating reward-mediated behaviors have been identified, the mechanisms by which different brain nuclei work together to transform sensory information into motor output are poorly characterized. Previous work in the Root lab has shown that neuronal activity patterns in the olfactory tubercle (OT), which receives monosynaptic primary sensory input, correlate with odor identity. Furthermore, activity in the ventral pallidum (VP) strongly correlates with odor valence, whether an odor is associated with a reward, revealing a loss of identity information in the VP. How this dimensional reduction from odor identity to odor valence occurs is still being investigated. Feed-forward inhibition is a common motif in neural circuits that is used for gain control and the scaling of input-output relationships. A pilot study showed that both the OT and VP receive input from brain areas such as the piriform cortex (PC) and basal lateral amygdala (BLA). Thus, we hypothesized that feed-forward inhibition may be the mechanism behind how neuronal activity signaling odor identity is transformed into valence signaling and, eventually, reward-mediated behavior. Here, we sought to confirm the presence and location of collateralizing neurons projecting to both the OT and VP in order to determine the validity of the feedforward inhibition model. Preliminary results from retrograde tracing show collateralizing neurons in the PC, cortical amygdala (CoA), and agranular insular cortex (AI), supporting the existence of a feed-forward inhibition circuit motif between the OT and the VP.

Bernice Lozada

Bioengineering: Biotechnology, Revelle

Mentored by Dr. Ester Kwon, Assistant Professor of Bioengineering

Targeting Lipid Nanoparticles to the Blood Brain Barrier for Traumatic Brain Injury

Traumatic brain injuries (TBI) affect over one million people annually in the US, many of whom are permanently impaired. The blood-brain barrier's dysfunction contributes to the pathophysiology of TBI. After an injury, proinflammatory cytokines trigger the BBB's endothelial cells to produce more cell adhesion molecules, increasing the BBB's permeability and chronic neuroinflammation as immune cells infiltrate. Gene therapy can potentially treat TBIs by regulating gene expression at the BBB to reduce oxidative stress and neuroinflammation. Lipid nanoparticles (LNPs) are the most advanced non-viral RNA vector. Active targeting of LNPs can reduce off-target effects by only delivering the therapeutic to specific cells. Antibodies have successfully targeted immunoliposomes and LNPs to overexpressed cell-adhesion molecules like VCAM-1 and E-selectin. More recently, peptides have also successfully targeted LNPs to specific cells, though not to brain endothelial cells. This project assessed the most effective way to use peptides to target LNPs to inflamed endothelial cells in the BBB. First, we examined E-selectin or VCAM-1 as potential targets for LNPs using a Western blot to compare their expression in non-inflamed and inflamed cells. Then, we formulated LNPs with luciferase mRNA and DSPE-PEG lipids conjugated to each peptide of interest. Luminescence indicated the luciferase mRNA's expression and the LNPs' delivery efficiency. Future work can determine the most effective cargo for LNPs to treat TBIs, such as downregulating neuroinflammatory factors or expressing neuroprotective substances. Engineering particles that effectively deliver mRNA to the BBB will provide a drug delivery vehicle for TBIs and other conditions whose pathophysiology involves neuroinflammation.

Wilson Lubeck

Chemistry, Warren

Mentored by Dr. Bradley Moore

Mechanism of nitrile formation in the biosynthesis of aetokthonotoxin

Aetokthonotoxin (AETX) is a polybrominated bis-indole cyanobacterial neurotoxin known to kill eagles in the American Southeast. The biosynthesis of AETX involves the formation of a nitrile group via a novel mechanism, catalyzed by a new-to-science di-iron enzyme, AetD. My research project aims to elucidate the mechanism of AetD-catalyzed nitrile formation using a combination of traditional synthetic chemistry, chemoenzymatic synthesis, and spectroscopic methods.

Annabella Macaluso

Computer Engineering, ECE, Seventh

Mentored by Assistant Professor, Xiaolong Wang

Policy Adaptation from Foundation Model Feedback

Recent progress on vision-language foundation models have brought significant advancement to building general-purpose robots. By using the pre-trained models to encode the scene and instructions as inputs for decision making, the instruction-conditioned policy can generalize across different objects and tasks. While this is encouraging, the policy still fails in most cases given an unseen task or environment. In this work, we propose Policy Adaptation from Foundation model Feedback (PAFF). When deploying the trained policy to a new task or a new environment, we first let the policy play with randomly generated instructions to record the demonstrations. While the execution could be wrong, we can use the pre-trained foundation models to provide feedback to relabel the demonstrations. This automatically provides new pairs of demonstration-

instruction data for policy fine-tuning. We evaluate our method on a broad range of experiments with the focus on generalization on unseen objects, unseen tasks, unseen environments, and sim-to-real transfer. We show PAFF improves baselines by a large margin in all cases.

Harriet Mak

Molecular and Cell Biology, Marshall

Mentored by Gene Yeo

Synaptic activity and network synchronization in 16p11.2 CNV cortical organoids

16p11.2 is a copy number variation (CNV) that has been explored by scientists for its link to autism. Deletions and duplications of this region are associated with varying autistic characteristics in patients, but the exact function of 16p11.2 on synaptic activity and neuronal synchrony hasn't been entirely clear. Thus, this project will be using calcium imaging to see how neuronal function is affected in 16p11.2 deletion and duplication lines cortical organoids. Doing this with 3D stem cell models would provide a clearer picture of the progression of autism development in specific cell types. Autism spectrum disorder is usually detected in childhood and consists of repetitive behaviors and lack of social interaction as well as several comorbidities (GI problems, intellectual disability, seizures, etc.). Knowledge of the 16p11.2 region's function on neuronal activity and autistic traits could lead to more personalized treatment in the future. We injected the calcium sensor GCAMP7S in 6 month old organoids prior to calcium imaging, and used the signal intensities to measure firing rate and peak amplitude. In comparing heatmaps and correlation coefficient values, the 16p11.2 duplications and deletions had less firing and less network synchronization compared to the wildtypes. Additionally, the duplications and deletions had lower peak amplitudes that indicate lower firing intensity in the cortical organoids. Our data thus observes lower synaptic activity and neuronal

synchronization in 16p11.2 deletions and duplication cortical organoid lines.

Isabella Martinez

Chemical Engineering, Warren

Mentored by Farhat Beg, Shao-Chi and Lily Lin Chancellor's Endowed Chair in Engineering Science Department of Mechanical & Aerospace Engineering, Director, Center for Matter Under Extreme Conditions Center for Energy Research, Senior Editor, IEEE Transactions on Pla

Using Matlab as a tool to analyze and measure the Magneto-Raleigh Taylor Instability during Gas puff Z-pinch Experiments.

Gas puff Z-pinches are excellent sources of x-rays and can be used for thermonuclear fusion. Experiments allow us to explore astrophysical phenomena and fusion energy. Instabilities arise during confinement, thus reducing effectivity of the Z-pinch due to what is known as the magneto-Rayleigh Taylor instability (MRTI). In order to optimize fusion yield during experiments, MRTI must be mitigated by imposing an axial magnetic field and using “jets”and shells that aid mitigation. The parameters of interest, notably instability amplitude is measured over time to understand how the magnetic field strength and number of shells affect mitigation of MRTI. A Matlab code is used to analyze experimental data from experiments conducted at Cornell university using 1 Mega ampere pulsed power generator. This code is designed to convert each frame to grayscale, and pixel by pixel, trace the growth of the MRTI with respect to time per shot. The outline generates data regarding the previously described parameters. We are able to measure the growth rate of the instability under various conditions, and compare shots to determine the optimal parameters for generating the most effective shot that successfully mitigates MRTI. It is expected that introducing more jets, 3 as opposed to 2, and increasing the axial magnetic field will best mitigate MRTI and yield a better Z-pinch. Finding conditions that

successfully mitigate MRTI leads to consistently better results for future gas puff Z-pinches that will generate better fusion output.

Tate McFadden

Writing and Literature, Revelle

Mentored by Associate Teaching Professor Geraldine Fiss

Carmen Maria Machado & Topographies of Trauma and Archival Silence in Queer Literatures

In this paper I aim to illuminate how archival violence has silenced queer traumas in history and literature through a close reading of Carmen Maria Machado's memoir-essay In the Dream House. Machado's work, which examines the physical, historical, and psychological nature of trauma, is a seminal work of contemporary literature in writing depicting queer traumas and abuse. I will argue that Machado's book asserts physical form to the traumatic past of abusive queer relationships in an attempt to give voice to a silenced experience and presence to a reality made violently invisible. Machado's portrayal of queer abuse interrogates how an archive of such experiences hides even as it illuminates, and silences even as it claims to give voice.

Lilyan Mendez

Biochemistry, ERC

Mentored by Assistant Teaching Professor Claire Meaders

Effect of a Chemistry Learning Intervention on Introductory Biology Students' Performance and Sense of Belonging in Biology

Chemistry concepts are foundational to introductory biology courses, but students often struggle with them. If inequities exist in student comfort with and understanding of these topics, they may persist throughout their

education. In a large introductory biology course at a public R1 university, we designed and assessed a targeted chemistry intervention to determine its effect on student attitudes, course performance, and equity gaps. The intervention was a module on Canvas with a pre-quiz, post-quiz, short videos, and practice problems on specific chemistry topics. We collected survey data and exam scores from two-course sections pre-intervention (n=719) and post-intervention (n=983). For student attitudes, thematic analysis was used to analyze an open-ended survey question about how experience learning chemistry topics affected students' identities as biologists. Both pre- and post-intervention, positive course experiences with chemistry were often associated with a positive impact on student identity in biology, whereas negative course experiences were often associated with negative impacts. For equity gaps we looked at grades from Exam 1, which heavily emphasizes chemistry, using a linear regression analysis with exam grades as the dependent variable and prior self-reported chemistry experience and demographic characteristics as predictors. Pre-intervention, we found significant equity gaps for Latinx and first-generation students. Post-intervention, we found that doing our modules positively correlated with Exam 1 scores and equity gaps for first-generation and Latinx students decreased. We hope this curriculum could be adapted for other institutions and disciplines to help minoritized students persist in STEM and all students understand challenging topics.

Mayra Mendiola

Human Biology, Marshall

Mentored by Susan Ackerman

Sequence variation upstream of a cytoplasmic tRNA modifies expression

Through genome-wide association studies, it is understood that most complex disease risk loci are located in non-coding regions containing single nucleotide polymorphisms (SNPs) within regulatory elements. Additionally, sequence variation at these non-coding risk loci can have an epistatic interaction with other risk loci which can then lead to the

emergence of a complex disease. Transfer RNAs (tRNAs) are responsible for physically bringing the proper amino acid, based on the nucleotide sequence of an mRNA (messenger RNA, the template for the creation of proteins), to ribosomes (macromolecular complexes that generate proteins from amino acids) during protein synthesis. On a sensitized mouse background with ribosome stalling (which occurs when ribosomes stop translating and assembling the protein), our lab found SNPs upstream of a cytosolic tRNA gene, known as n-Tr22, that differentially regulate its expression by regulating RNA Polymerase III recruitment. Furthermore, these SNPs interact epigenetically to enhance neurodegeneration induced by ribosome stalling. Thus, we decided to investigate the molecular basis for this neurodegeneration caused by these SNPs. That is, we asked, could these SNPs upstream of n-Tr22 affect its expression and lead to neurodegeneration? Here, we show that, indeed, SNPs flanking the tRNA gene n-Tr22 reduces its expression in central nervous system tissues. Interestingly, regions directly upstream of tRNAs in humans are found to be highly susceptible to genetic variation, yet the consequences of sequence variations on tRNA expression and function are not fully understood to date.

Mariel Micael

Cognitive & Behavioral Neuroscience, Revelle

Mentored by Dr. Nicola Allen

Disease Progression of Alzheimer's Disease Mouse Models by Sex

Astrocytes are a type of glial cell in the brain that regulates the formation, function, and elimination of neuronal synapses. In Alzheimer’s Disease (AD), there is a loss of synapses in the hippocampus, making astrocytes a candidate cell type to target for therapeutic treatments aimed at slowing or preventing synaptic loss. However, astrocytes are difficult to target in vivo with current genetic tools. We created a breeding scheme where Cre-dependent viruses can be targeted to astrocytes using ubiquitous promoters to drive the construct, but astrocyte specificity is achieved

through Cre recombination driven by the astrocyte-specific promoter Aldh1L1. We crossed two common AD mouse models, APP/PS1 and Tau*P301S, to Aldh1L1-Cre. The APP/PS1 and Tau*P301S mice have previously been characterized for the onset and progression of amyloid plaque and neurofibrillary tangles (NFT) pathology. However, given the complicated and multivariable nature of AD pathology, we now want to characterize the time of onset and progression of gliosis, plaque and NFT pathology in the APP/PS1xAldh1L1-Cre and Tau*P301SxAldh1L1-Cre mice to determine if the onset and progression of disease is similar to uncrossed APP/PS1 and Tau*P301S mice. To do this, we use immunohistochemistry and confocal microscopy to visualize astrocytes, plaques, and tangles in the hippocampus and frontal cortex in male and female, WT and MUT mice at 4 months, 6 months, and 9 months. This data will ultimately help us as we move forward with testing Cre-dependent viruses targeting astrocytes to slow the onset and progression of AD.

Maddie Mitchell

Human Biology, Revelle

Mentored by Sreekanth Chalasani

Understanding Autism-Associated Changes to Gut Health in C. Elegans

Autism is diagnosed in the clinic based on behavioral observations, however individuals with autism often suffer from chronic gut health issues. Little is understood how risk genes for autism play a role in these other comorbidities. In the Chalasani lab, we have found that changes to the expression of one such gene, neurexin, results in altered gut health in the small transparent roundworm Caenorhabditis elegans. C. elegans animals with loss of neurexin show deterioration to gut health, with increase gut leakiness as well as prolonged defecation timing. In this proposal, I aim to better understand how neurexin affects gut health by identifying important neurons in the animal's nervous system that influence the intestine. I will learn how to re-express neurexin in specific neurons in C. elegans and then monitor changes to intestinal leakiness

and defecation. Furthermore, I will also help develop a more quantitative approach to studying gut leakiness by optimizing fluorescent dye filling of the intestine and observe its timecourse, in order to better understand how leakiness develops and what factors may impact it. These studies will help further our understanding of how an autism risk gene can impact other aspects of an animal's health and physiology, as well as further establish C. elegans as a model for studying the impact of the brain on the gut.

Jana Mitrevska

Neurobiology, Seventh

Mentored by Dr. Lena Gerwick

Nutrimental modifications lead to alterations in cytotoxic metallophore production in an Indonesian marine cyanobacterium

Cyanobacteria have been identified as a promising group of microorganisms that produce natural products with potential pharmacological applications and whose chemical richness remains largely unexplored. These natural products and their reported bioactivities have inspired numerous drug discovery investigations, with a strong focus on the identification of cytotoxic anticancer metabolites. Understanding the mechanisms of metabolite production, as well as their potential applications, could provide new insights into marine organisms and improve our ability to control disease. Copper (Cu), as well as other trace metals, are vital to the growth of photosynthetic species in marine environments. However, high Cu concentrations can be toxic and inhibit cell growth, which is why certain cyanobacteria employ mechanisms for minimizing metal concentrations in the extracellular environment. A new metallophore, known as leptochelin A, has been isolated from an Indonesian Leptolyngbya sp. Its structure is still being elucidated, but it has been studied for its reactivity and binding behaviors with a variety of metals, and has further demonstrated potent cytotoxicity in two cancer cell lines. The relationship between chelator and trace metal

concentrations can be explored in the context of leptochelin by nutrimental factor manipulations of universal SWBG11 media. These recent insights into the bioactivity of leptochelin have inspired further exploration of its chemical structure and metal binding behavior, which in turn can deepen our understanding of its potential pharmacological applications.

Aaron Morales

History, Sixth

Mentored by Lecturer Mary Klann

1892: Cabrillo, Historical Memory, and Indigenous Resistance

The 1892 Cabrillo Festival was a multi-day festival in San Diego held to commemorate the 150th anniversary of the landing of Spanish explorer, Juan Rodriguez Cabrillo, off Point Loma in 1542. This event provides a remarkably insightful case study into the impact that the popular romanticized memory of Southern California's Spanish history had on local indigenous peoples affected by the public policies this historical memory rationalized. The assimilation of the Kumeyaay and their many adjacent tribes via cultural erasure was figured by White Americans not only as a noble part of San Diego's Spanish history, but as a guide for the city's future, enacted by boarding school officials following in the footsteps of their Spanish missionary progenitors. Resisting this narrative, the Kumeyaay at the Cabrillo Festival told their history as they saw it: a history that celebrated their culture and traditions in open defiance to assimilationist ideology. Despite their resistance, the historical memory of San Diego's Spanish period still bears much of the same romantic tendencies to this day, a reality which continues to downplay the impacts of the Spanish period on the Kumeyaay’s culture and history.

Ramina Mortazavi

Neurobiology, Muir

Mentored by Shelley Halpain, PhD.

ER F-Actin in the somatodendritic compartments of hippocampal neurons and its role in excitotoxicity

Filamentous actin (F-actin) is a cytoskeletal protein that is highly concentrated in the dendritic spines of neurons. However, when ischemic stress is simulated by the over-activation of NMDA receptors, F-actin disassembles in the dendritic spines and reassembles within the dendritic shaft. This is a pro-survival response known as actinification. Actinification is dependent on the actin nucleating protein inverted formin-2 (INF2), which can be both cytosolic and endoplasmic reticulum (ER) -resident. Therefore, in order to properly assess whether ER F-actin starts at the ER in the dendritic shaft and whether ER F-actin has a role in the NMDA-induced assembly and organization of somatodendritic F-actin, fluorescent genetic tools were used to either monitor the early phase of actinification or to prevent the assembly of F-actin near the ER. Preliminary findings indicate that ER F-actin is essential for this pro-survival mechanism. This suggests that an important role of actinification may be to protect the ER during ischemic stress.

Banso Nguyen

Cognitive Science w/ specialization in Machine Learning, Marshall

Mentored by Adena Schachner, Professor

Children's understanding of others' visual perspectives over video chat

In real life, people see using their eyes. In contrast, video chat users see through a webcam, though their eyes are on-screen. Also, most video chat software shows a "self-view", which displays what the other person sees.

Can children adjust their understanding of visual access, and learn that people over video chat do not see through the eyes on-screen? In two experiments, 4-year-old children were asked to block an experimenter from seeing them (Exp 1, N=40, Meanage=4.5 years) or show them toys (Exp 2, N=68, Meanage=4.5 years) over videochat. If children use the self-view to learn about their partner's visual perspective, then when the self-view is on, they should more often succeed in blocking their view (Exp 1) and showing them toys (Exp 2), instead of e.g. showing objects to their partner's eyes on screen. In Exp. 1, we found that some but not most children spontaneously succeeded in blocking their partner's view by covering the webcam (16%). In Exp. 2, children more often succeeded in showing toys to the webcam when the self-view was on (27% of the trials) vs. when self-view was off (4.5%). This shows that children use the self-view to guide their interactive behavior. Older 4-year-olds also performed better, with younger children showing the toy to the partner's eyes on-screen (67%). These data shows evidence of developmental change in children's understanding of vision over video chat, and suggest that the self-view may play an important role in this learning process.

Tiffany Nguyen

Psychology, Sixth

Mentored by Gail Heyman

How Adolescents Balance Performance Goals With Academic Integrity

The vast majority of students cheat in high school even though nearly all high school students recognize cheating as something they should not do. Previous research has shown that the extrinsic motivation of students is often correlated with those who have committed academic dishonesty. Extrinsic motivation is the drive to perform an action in order to receive an external reward (e.g., higher grades). However, there is not as much work done on how academic pressure can be directly related to a student's extrinsic motivation and can cultivate a higher rate of cheating in high schools. First, I will review previous research that suggests

students who hold higher rates of extrinsic motivation in a course due to an environment that pushes them to perform may cause higher rates of cheating. Next, I will present a project I have been working on with local high schools to study the reasoning behind why students cheat and their observed rates of cheating. My project will help us understand high school students' attitudes on cheating and the findings can be used to support how academic pressure can affect a student's extrinsic motivation and in turn lead to increased rates of cheating.

Kristine Olvera

Molecular and Cellular Biology, Revelle

Mentored by Omar Mesarwi, Assistant Clinical Professor

Intermittent hypoxia is associated with increased mortality in a moue model of COVID-19

During the COVID-19 pandemic, several studies demonstrated that obstructive sleep apnea (OSA) is a risk factor for worse outcomes in COVID-19, such as increased ICU admission, use of mechanical ventilation, and death. We established a mouse model of COVID-19 using SARS-CoV-2 spike protein instilled intratracheally into K18-hACE2 mice (transgenic mice expressing humanized ACE2 in epithelial cells). We hypothesized that intermittent hypoxia (IH) modeling severe OSA would worsen lung injury in this model. 12-week-old K18-hACE2 mice were split into two equal groups (n=24/group); half were exposed to IH and the other half to room air (RA). After four weeks, half from each group were then instilled with either SARS-CoV-2 spike protein, or saline as a control. The mice were returned to their respective IH or RA conditions. After 48 hours, the mice were anesthetized and cannulated to measure bronchoalveolar lavage (BAL) and lung compliance. Lung tissue was also collected. Mice given spike protein lost more weight, and had worse lung compliance, increased BAL neutrophil count, and higher lung wet:dry ratio (suggesting excess pulmonary edema) compared to those given saline. Lung histology also indicated increased inflammation.

Importantly, there appeared to be an interactive effect of IH to worsen mortality with spike protein instillation, with death rates of 65% in the IH-spike group compared to 9% in the RA-spike group. There was no death observed in either saline group. IH antecedent to spike protein in this COVID-19 model thus appears to worsen outcomes, though mechanisms need further clarification.

Lucas Owens

Neurobiology, ERC

Mentored by Sharon Nichols, Ph.D.

Potential Mechanisms and the Relationship Between Cannabis Use and Anxiety in Youth With and Without HIV

Cannabis use continues to increase following legalization in certain states and one of the most common reported motives for cannabis use is stress relief. Thus the aim of this project is to better understand how cannabis affects anxiety and potential physiological mechanisms. To answer these research questions I analyzed a data set comprising 44 male individuals between the ages of 18 and 24, 28 of whom are HIV positive, from a 2016 pilot study focused on how cannabis affects the brain in individuals with HIV. Analysis was conducted using a standardized self-report scale of anxiety problems (ASEBA), self-reported cannabis use, and a panel of nine blood plasma biomarkers representing stress, immune activation, and inflammation. HIV diagnosis was included in the analysis due to its expected effect on biomarkers of inflammation and immune activation, but also due to the fact that individuals with HIV may be more prone to anxiety due to social factors. The association of higher cannabis use with anxiety was more pronounced in the HIV positive group. As expected, certain biomarkers were significantly altered by HIV status, but only Dehydroepiandrosterone Sulfate (DHEA-S) was significantly negatively correlated with anxiety. DHEA-S was negatively correlated with anxiety and the relationship was more pronounced in HIV positive compared to HIV negative individuals. The findings in this data set suggest higher levels

of cannabis use may be associated with increased anxiety, that DHEA-S may play an anxiolytic role in the brain, and that both these relationships may differ with respect to HIV diagnosis.

Isabella Panagiotou

General Biology, Muir

Mentored by Trey Ideker

Improving upon Prime Editing via Co-selection

The CRISPR/Cas9 system is a widely-used platform for genome editing. Disrupting gene function with CRISPR is straightforward, but making specific edits to genes has remained more challenging. Prime editing has recently emerged as a general technique to quickly make specific genetic changes with clinical relevance. Prime editing requires that at least two components be expressed in a cell line to make a given genetic edit: an enzyme called PEMax, and the engineered prime editing guide RNA (epegRNA) that specifies the location of the desired genetic edit and the desired final DNA sequence at that location.
However, prime editing efficiency remains too low for pooled screens. To improve upon prime editing efficiency, we have employed a “co-selection” strategy that relies on the principle that some single cells are inherently more efficient than others at prime editing. Through co-selection, we were able to isolate cells with successful repairs to a fluorescent marker in order to enrich for edits in a gene of interest. For cells in which the co-selection strategy was employed, the editing efficiency increased by ten-fold. Because this strategy provides high editing efficiency, its scope can be widely used in pooled screens to study mutations of clinical relevance.

Anne Parnell

History; Political Science-International Relations, Warren

Mentored by Dr. Mary Klann

Seeking Justice: Limited Tribal Jurisdiction in Cases of Sexual Violence

The Indian Civil Rights Act of 1968 (ICRA) nationalized protections in the Bill of Rights to Indigenous people in the United States. Its stated aim was to expand individual freedoms for people in tribal areas. However, the ICRA added procedural mandates to Tribal Judicial systems that essentially deprived them of the right to try criminal cases. In Oliphant v. Suquamish Indian Tribe, the Supreme Court ruled that Indian tribes do not have inherent jurisdiction to try and to punish non-Indians. These two factors limited judicial autonomy of tribal governments in the United States and created crucial gaps in the judicial system. To illustrate these lapses in the judicial process, my research traced the steps a woman could take to pursue justice in a case of domestic violence in Coconino County, Arizona. These steps include Domestic Violence Restraining Orders, Civil Protection Orders, the filing of police reports, as well as extra-legal actions. In many cases, the ICRA prohibits survivors of sexual and domestic violence from attaining justice. Thus, prevailing narratives about the nationalization of the Bill of Rights through the ICRA warrant refinement to provide a new perspective on how this legislation harms indigenous women.

Salma Parra Pulgarin

Public Health With A Concentration in Epidemiology and Latin American Studies, Muir

Mentored by Corinne McDaniels-Davidson

Contrasting the Social Needs and Circumstances of Hispanic/Latino and Non Hispanic White Patients in Southern California

Societal inequities exacerbate the cancer health disparities between Hispanic/Latinos (H/Ls) and non-Hispanic whites (NHWs) in the United States. Thus, we compared the social and systemic life circumstances of H/L and NHW patients undergoing treatment at an NCI-designated cancer center in the southwest US. Social needs were compared between H/L and NHW patient respondents with Pearson Chi-Square tests using data weighted to the cancer center population. A greater proportion of H/L patients reported household income <$50,000 than NHW patients ($p<0.05$). A lower proportion of H/L patients reported living comfortably on present income compared to NHW patients ($p<0.05$). Food insecurity indicators confirmed income disparities; 37% of H/L, compared to 7.6% of NHW, patients reported often or sometimes being worried their food would run out before they got money to buy more in the last 30 days ($p<0.05$). Likewise, in the last 30 days, 29.1% of H/L compared to 6.1% of NHW patients reported often or sometimes the food they bought just didn't last, and they didn't have the money to get more ($p<0.05$). On a five-point Likert scale a lower number of H/L patients rated their physical and mental health to be very good or excellent compared to NHW patients ($p<0.05$). It is imperative that cancer centers address the causes of inequities through the provision of culturally appropriate care, improving access to resources, and eliminating barriers to care.

Berns Piffard

Sociology - Social Inequality, ERC

Mentored by Gershon Shafir, Distinguished Professor

When David Becomes Golaith: How Cryptocurrency Came to Reflect the Financial Market it Meant to Dismantle

My project attempts to answer the question of why Bitcoin has a wealth disparity that reflects real world economies. By placing Bitcoin in the Sociological conversation around money, I show that Satoshi Nakamoto's revolutionary tool failed to challenge the financial institution because

they conceived of money as a thing and not a social process. By creating a financial instrument open to the use of all, Bitcoin was left open to be co-opted by the financial institutions it was meant to challenge. By using data on Bitcoin price history, rates of firm ownership, prevalence of centralized exchanges, and large data mining firms, I show the extent of the fictionalization of the Bitcoin market.

Gino Prasad

Biology w/ Specialization in Bioinformatics, Muir

Mentored by Vineet Bafna, Professor

Automated image analysis to identify patterns of amplification in cancer cells

Single-molecule fluorescent in-situ hybridization (smFISH) is a powerful imaging technique to determine the location and sequence of DNA within the cell. I am a member of the Bafna lab, which researches the link between extrachromosomal DNA and cancer. The primary question of my project was this: can smFISH imaging data provide sufficiently descriptive information for a diagnostic tool to quantify extrachromosomal DNA in cancer? While visualizing the smFISH images, we discovered that the extrachromosomal DNA clusters in smFISH can be modeled using a normal distribution. I then created a new algorithm for peak detection using image convolution to break up the images, thereby separating FISH peaks from noise. This answered my initial question, by providing a method for accurately quantifying extrachromosomal DNA within the cell. Using this tool, I then compared the distribution of amplifications between intrachromosomal (HSR) and extrachromosomal (ecDNA) genes.

Sirasit Prayotamornkul

Bioengineering: Bioengineering, Revelle

Mentored by Lingyan Shi, Ph.D.

Super-resolution DO-SRS and 2PEF Bioimaging of Subcellular Metabolic Dynamics Regulated by Excess L-Methionine in Amyotrophic Lateral Sclerosis

Amyotrophic lateral sclerosis (ALS) is a type of progressive neurodegenerative disease that affects motor neurons, resulting in paralysis and death due to the deterioration of upper and lower motor neurons. Emerging studies have proposed that the disease could be caused by the overexpression of the transactive response DNA-binding protein 43 (TDP-43) in the nucleus. If misfolded and aggregated, TDP-43 could translocate into the mitochondria and disrupt the mitochondrial respiratory complexes. As a consequence of this abnormal phenomenon, the excessive production of reactive oxygen species (ROS) in the mitochondria is induced in addition to an inefficient antioxidant defense mechanism. L-methionine (Met), an essential amino acid, is crucial in the regulation of cellular metabolism and the activation of endogenous antioxidant enzymes. Therefore, we hypothesized that excess methionine treatment can help restore an efficient antioxidant defense mechanism in ALS patients. Here, we apply an optical bioimaging approach that combines deuterium oxide (D2O)-probed stimulated Raman scattering (DO-SRS) and two photon excitation fluorescence (2PEF) microscopies to visualize the in vitro effects that methionine-enriched diet has on cellular metabolism and oxidative imbalance in neurodegenerative cells. Our preliminary data has revealed that excess methionine actually increases the synthesis of lipids and unsaturated lipid membranes. Meanwhile, the same treatment causes a decrease in oxidative imbalance and protein synthesis. Our study suggests that excess methionine can help establish a protective mechanism against oxidative imbalance and promote membrane regeneration in cells that express distinguishable features of amyotrophic lateral sclerosis.

Cade Pretorius

Sociology, Sixth

Mentored by Professor Michel Estefan

The Tragedy of Conformity: Gender Construction in an Online Transgender Community

The transgender community has been subjected to increasingly violent rhetoric and political scrutiny from the Right and has been made the focus of an ongoing culture war. In light of this, they have been forced to negotiate their identity in relation to these threats and increasing marginalization. I explore constructions of gender identities using qualitative content analysis of an online community that heavily features transgender people, and which plays an oversized role in shaping discourse surrounding identity among transgender youth. As people for whom the veil of gendered existence has been lifted, yet are still subject to the same social pressures, it is instructive to look at transgender people's understanding of gender. What is revealed is that liberal platitudes, e.g. "trans women are women", fail and don't play along with many trans people's conceptions of gender identity, which are often far more nuanced, and indeed their perceptions of the nature of binary gender categories as well. At the same time, trans people are complicit in upholding hegemonic gender norms, and frequently exclude themselves and other trans people (as well as cis people) from the binary categories. This is executed through the construction of a complex set of gender identities that are entirely separate from the binary and serve to categorically distinguish those who don't meet a set of stringent standards imposed by the binary, keeping it pure, and also to construct a hierarchy outside of the binary according to how well an individual approaches those standards.

Kailey Ramsing

Marine Biology, Muir

Mentored by Dr. Jennifer Smith

Understanding changes in algal community dynamics on coral colonies following bleaching events

Algae on coral reefs are highly diverse, morphologically and functionally. Turf algae are fleshy, fast-growing, and competitive. Crustose coralline algae (CCA) are slow-growing, calcifying, and active reef-builders. There have been recent phase shifts from calcified to fleshy algae dominance. The relative abundance of calcified to fleshy organisms may be indicative of the health of a reef. The purpose of this study was to observe algal overgrowth on branching and massive coral colonies during and following bleaching events. We used a yearly photoquadrat time series taken between 2009-2019 on the remote, uninhabited Palmyra Atoll in the central Pacific at two habitats: the fore reef (10m depth) and reef terrace (5m depth). In Photoshop, we extracted planar areas of live coral, CCA, turf algae, macroalgae, or other benthic organisms within borders of individual coral colonies and tracked their changes over time. We found that algal communities on coral colonies were dominated mostly by CCA and turf, as well as Halimeda and Peysonnelia. CCA was the most abundant on branching colonies and the fore reef, whereas turf was the most abundant on massive colonies and the reef terrace. Overall, calcified algae increased over time and showed overall stability through bleaching events. Since algae are common on reefs and are expected to become more abundant with climate change, understanding patterns of benthic algal community dynamics is useful for predicting changes in reef health. This will be critical for protecting these ecosystems, especially as oceans warm and bleaching becomes prevalent, possibly leading to reef degradation.

Sonia Rivero

Bioengineering: Biotechnology, Revelle

Mentored by Professor Karl Wahlin

Gene-editing Safe Harbor Sites for Stable Expression in Differentiated Stem Cells

Genomic safe harbor sites allow for the insertion of genetic cargo for transgene expression, however, such sites are prone to epigenetic silencing, thus limiting their utility in stem cell research. To identify genomic safe harbor sites with enhanced utility in stem cell biology we used CRISPR-Cas9 gene editing technology to stably express fluorescent reporters into several previously identified safe harbor sites. Gene cassettes containing red and green fluorescent proteins were developed and inserted into the ROGI1, ROGI2, and GULOP1 sites. Fluorescent protein expression was then detected in each safe harbor site and after clonal isolation, we were able to isolate pure populations of fluorescent protein-expressing cells. These stably integrated cells will allow us to monitor whether safe harbor sites maintain gene expression during stem cell maintenance and during differentiation into neurons, cardiac and hematopoietic cells.

Jasmine Robinson

Interdisciplinary Computing And The Arts, Sixth

Mentored by Boatema Boateng, Associate Professor at UC San Diego

The Representation of Black Women Fashion Designers in The Music Industry

This research focuses on challenging the underrecognition of Black women fashion designers' influence on the music and fashion industries. Black women fashion designers are often overlooked in the fashion

industry, but many Black female musical artists are using their platforms to challenge this underrepresentation. Style is often used by Black female artists as a storytelling tool to expand the portrayals of African-American and African culture in mainstream media. These artists are now recognizing the importance of including Black fashion designers in their approaches to more authentic representations. I wondered how including Black woman fashion designers in these narratives might concurrently amplify the visibility of their work. This information is collected through scholarly articles, digital interviews with popular media sites, music videos, and Black feminist literature. This research will show how established Black women artists have used their voices to recognize Black fashion designers' influence on expanding the controlling images of Black women in popular culture. By wearing these designs in music videos and tours, Black fashion designers gain direct exposure to wider audiences who trust the opinions of the musical artists they adore. When public understandings of Black womanhood are skewed by the narrow representations spotlighted in mainstream media, this research will highlight how Black creatives challenge these narratives through the intersection of music and style.

Nadine Rosete

Bioengineering: Bioengineering, ERC

Mentored by Dr. Karsten Zengler

Determination of Microbial Guilds and Niches Enable Targeted Modifications of the Skin Microbiome

The skin microbiome is a diverse and complex ecosystem whose conditions are constantly changing.Various members of the skin microbial community exhibit co-abundant behavior to perform specific ecological functions in what are referred to as guilds. Such guilds are also dependent on specific niches, or environmental conditions, suited and developed from a specific member. Here we show that the determination of microbial guilds and niches enable targeted modifications of the skin

microbiome.We accomplish this by assembling 9 species of skin bacteria based on their growth rate. After culturing for 5 days under acidic, basic, and neutral media conditions, we performed metagenomic and metatranscriptomic sequencing. Our initial results demonstrate that the growth conditions changed the growth composition of this assembled skin community. From this, we can further define specific species and conditions which promote or inhibit the growth of selected strains of interest in the community. This, in turn, can aid in determining reliable means to discourage growth of more pathogenic strains in the larger skin microbiome.

Srimaye Samudrala

Human Biology, Revelle

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

The Association of the Post Illumination Pupillary Response to Seasonal Mood Variation Shows Diurnal Variation

Season changes in light cause many people to experience mild winter depression or seasonal affective disorder (SAD). Those who suffer depressive symptoms also experience disrupted circadian rhythms in sleep, activity, and appetite. By virtue of later activity schedules and less light exposure, people with evening chronotype may face an even greater risk for SAD. To coordinate circadian and seasonal rhythms, light information is transmitted from the eye to the brain through intrinsically photosensitive retinal ganglion cells (iPRGC). The post-illumination pupillary response (PIPR) is an observable physiological proxy measure of iPRGC activity in humans. Past work has shown that sensitivity of iPRGC to light measured by PIPR is associated with chronotype and SAD. However, the relationship of diurnal light sensitivity to these phenotypes remains unstudied.

Shaila Sarathy

General Biology and Global Health, Sixth

Mentored by Claire Edington

Understanding the mental health of Rohingya Refugees in Bangladesh through a historical and cultural lens

The Rohingya refugee crisis has been going on for multiple generations and in this paper, the author aims to examine the impact that this had on the mental health of these Rohingya refugees. This paper will be focusing on the integration phase in a refugee crisis and the mental health issues the refugees face after they have reached refugee camps with a specific focus on Bangladeshi refugee camps. By placing a focus on the history of the refugee crisis and how intergenerational trauma impacts the mental health of refugees this paper aims to explore public health interventions through a historical and cultural lens. The paper discusses various public health interventions that have been implemented including guides for mental health issues in humanitarian contexts and tools to reduce stigma surrounding mental health. The paper also discusses what the gaps are and what needs to be changed in order to fill those gaps for example changing the mental healthcare infrastructure offered in these refugee camps and by reducing the language barriers between refugees and healthcare professionals.

Avni Sardana

Speculative Design, ERC

Mentored by Michael Trigilio, Teaching Professor

Antifragile Issue Four: Anachronism

Antifragile Zine is an independent magazine and youth artists collective run by all queer women of color and non-binary people of color. We,

Antifragile Zine, exist because there is a lack of creative communities and opportunities led by youth, for youth, especially spaces dedicated to marginalized creatives. We believe that by bringing together youth, art, and community, we can catalyze radical change. In the past two and a half years, we have cultivated a tight-knit community of over 15,000 people from all over the world, worked with over 200 artists globally, with a diverse team of around 60 young women of color and non-binary people of color. We have published three print issues, and hosted live music, art, and community events with turnouts of over 250 people.
We are currently working on our fourth issue titled: ANACHRONISM. As a generation immersed in rapid technological advancements, Gen Z has taken a surprising interest in items of nostalgia: vintage goods, thrifting, analog photography, retro aesthetics, and even print media/zines. Issue Four is a physical manifestation of these fears and desires related to connection and reality. It is a collective diary and time capsule of Generation Z. It is an analysis of our generation, our values, feelings, escapism, and our relationship with social media and time. The final product will be 8.5” x 11” with 140+ pages and feature work from 70+ Gen Z creatives.

Celina Shen

Molecular and Cell Biology, ERC

Mentored by Christina Towers

Mitochondrial-Derived Vesicles in Cancer Cells

Healthy mitochondria are essential to cancer cell survival through functions such as biomolecule synthesis and cell signaling. Damaged mitochondria are degraded in lysosomes via autophagy and the products may be recycled. Several cancer cell lines are dependent on autophagy for survival. However, some autophagy-dependent cells can develop resistance to autophagy inhibition and instead utilize mitochondrial-derived vesicles (MDVs).

MDVs are a recently observed method of mitochondrial quality control that shuttle oxidized mitochondrial proteins to the lysosome independently of phagophores which characterize canonical autophagy. MDVs are significantly upregulated in cells resistant to autophagy-inhibition, demonstrating the dynamic nature of these structures and their strength in compensating for the loss of core metabolic pathways. Despite these important functions, much has yet to be elucidated about MDVs, including their mechanism of formation. In our group's studies, we investigate potential MDV machinery to better characterize their formation and release. For example, DRP1 is a GTPase responsible for mitochondrial fission events during mitochondrial autophagy (mitophagy), but genetic deletion of DRP1 does not inhibit MDV formation. These studies additionally improve methods of studying MDVs by blocking other mitochondrial quality control processes to pinpoint MDV functions and machinery in isolation.

Scott Skalak

Bioengineering: Biosystems, Warren

Mentored by Dr. Adam Engler, Professor and Chair of Bioengineering

Preservation of Cardiomyocyte Lamin Reduces Age Dependent Decline of Cardiac Function

During our lifespan one of the most notable declines in our health, and more specifically within organ function, is the decrease in cardiac function. To study this age-dependent decline, we used the model of the Drosophila melanogaster which has a short lifespan, a cardiac proteome, age-dependent cardiac dysfunction similar to that of humans, and presents a simple heart tube for ease of study. We have previously shown that age-dependent Lamin C loss in the heart induces downregulation of critical cardiomyocyte transcription factors. Here, we showed that if Lamin C is preserved in adult flies, so will cardiac transcription factors and heart function, which together will extend lifespan.

Hei Yu Annika So

Biochemistry/Chemistry, Muir

Mentored by Professor Alexis Komor

Elucidating the mechanisms behind base editing outcomes through CRISPRi screens

C to T base editors allow for the precise installation of point mutations in target DNA, making them useful for disease modelling and genetic therapeutic applications. However, they often suffer from low editing efficiency, and little is known about the biochemical pathways governing editing outcomes. Understanding which biochemical mechanisms base editors use to make an edit can inform development of more efficient DNA editing technologies. We used a CRISPR inhibition (CRISPRi) screen to repress gene expression of a pool of genes involved with DNA repair, and quantified which genes up- or down-regulate base editing. Our findings show it is possible to regulate gene expression of relevant genes to manipulate base editing outcomes.

Sirius Song

Physics, Seventh

Mentored by Prof. Tenio Popmintchev

Generation of Extreme UV and Soft X-ray Light with Orbital Angular

The optical orbital angular momentum is a quantum property of light that a laser beam can carry and is associated with the helical or twisted shape of its phase wavefront. This angular momentum is characterized by its topological charge which is an integer number representing the number of intertwined helical surfaces. Beams with high orders of orbital angular momentum have important applications from telecommunication to nanometer-scale microscopy. Recent developments in the efficient, UV-

driven high harmonic generation opens up the possibility of generating soft X-ray beams with extremely high topological charge. In this work, we investigate the process of high order harmonic generation driven by a strong femtosecond 400 nm laser with a topological charge of 4 generated by a spiral phase plate in the driving laser to achieve harmonics up to the 31st order with topological charge up to 121st which, to the best of our knowledge, is the highest ever generated.

Christina Song

Education Abroad Reciprocal Exchange Program, Marshall

Mentored by Aram Grigoryan, Assistant Teaching Professor

School Admission Reforms and Housing Markets: Empirical Evidence from New York City

This study examines the impact of admission policy reforms on New York City's housing market. The objective of these reforms is to promote diversity and equity in education by reserving seats for disadvantaged families. I use a difference-in-differences approach to analyze the causal relationship between admission priority changes and housing price fluctuations. Additionally, I utilize a regression model to extend the analysis to the linkage between school quality, measured by test scores, and changes in housing prices. By shedding light on the interdependence between education policy and the broader housing market, this study offers insights into real estate investment strategies and property tax policies.

Anjali Srinivasan

Bioinformatics, Warren

Mentored by Cole Ferguson, Assistant Professor of Pathology

Histone ubiquitination is associated with activating chromatin modifications in the developing brain

Chromatin and epigenetic modifications represent the major mechanisms by which cells enact context specific gene regulation. Modification of histones by the Polycomb Repressor Complex (PRC) is known to play an essential role in repressing transcription at loci found within facultative heterochromatin. The PRC1 ubiquitinates histone 2A at lysine 119 to generate H2AK119ub, after which the PRC2 methylates histone 3 at lysine 27 to generate H3K27me3. While H3K27me3 is unequivocally associated with gene repression, our data indicate that the PRC1 product H2AK119ub could additionally contribute to gene activation during mammalian brain development. We used CUT&RUN (Cleavage Under Targets and Release Using Nuclease), a high-throughput genomics assay that quantitatively maps histone modifications and chromatin factors, to detect H2AK119ub during the development of the mouse cerebellum. Using a variety of computational analyses, we observed that a subset of H2Ak119ub overlapped with markers of enhancers (H3K4me1), active promoters (H3K4me3 and H3K9ac) and active enhancers (H3K27ac). After cerebellar maturation, H2AK119ub appears to be enriched at active regulatory elements, while there was no change in heterochromatin-associated H2AK119ub. Finally, micro-C detection of chromatin loops, which represent long-range regulatory interactions such as enhancer-promoter contacts, showed that a significant number of loops were associated with H2AK119ub peaks. Together, these findings suggest that histone ubiquitination, in addition its established role in gene repression, may also be required for gene activation. Future studies will examine how histone ubiquitination controls enhancer function and gene transcription.

Gwendalynn Stilson

Human Biology, Muir

Mentored by Dr. Maripat Corr

Toll-like Receptors 7 and 9 Govern Sex Differences in a Mouse Model of Inflammatory Arthritis

Autoimmune diseases like rheumatoid arthritis result from aberrant regulation of the adaptive immune system. Although the adaptive immune system is key in the development of rheumatoid arthritis the cardinal signs of inflammation are governed by the innate immune system. Toll-like receptors (TLRs) are a key part of the innate immune system. We tested a series of mice that were deficient in individual Toll-like receptors in a mouse model of arthritis. The K/BxN model passive serum transfer model of arthritis confers paw inflammation and lasting allodynia in wild-type mice. However, the allodynia in male wild-type mice persists whereas it partially resolves in female mice. In Tlr7-/- and Tlr9-/- mice the swelling and there is reduced allodynia in both males and females; however, the doubly deficient mice (Tlr7-/- .Tlr9-/-) had markedly reduced allodynia in both the early and the late phases. Interestingly, in the Tlr7-/- Tlr9-/- mice the females had minimal paw swelling differing from the males. These results demonstrate that there are sex differences in the reliance of these two Toll-like receptors in disease manifestation and symptoms.

Chloe Sun

Literature/writing, Sixth

Mentored by Geraldine Fiss, Associate Teaching Professor in Inter-Asia and Transpacific Studies: China Focus

The Strength of Restraint: A Comparative Analysis of Still Life and A City of Sadness

This research essay explores the similarities and differences between acclaimed Asian filmmakers Jia Zhangke and Hou Hsiao-Hsien: despite their different cultural and historical backgrounds, both directors use restrained cinematic techniques to expose the struggles of the marginalized. Jia employs long takes and documentary-style recordings to showcase the lives of disoriented immigrants in Still Life, while Hou uses long takes with deliberate interruptions to evoke empathy for ordinary people in A City of Sadness. Through the interruption of peaceful scenes by external forces and a sense of insecurity and bewilderment, Hou immerses the viewer in the vulnerability of those trapped in their fate. Still Life showcases scenes of destruction and ruins to show a hidden side of society, opposite to the government's emphasis on progress and prosperity. A City of Sadness subverts the dominant discourse of influential bureaucrats by deconstructing governmental announcements and incorporating individualized experiences, inspired by Walter Benjamin's fragmentary understanding of historical knowledge. The film also features a female narrator, who embodies benevolence and tenacity, challenging the patriarchal society's assumptions. This research essay reveals how Jia and Hou use their artistic talents to reveal the truth of their respective societies and to expose the struggles of the marginalized through a unique and restrained cinematic approach.

Shagun Taneja

Clinical psychology - BS, ERC

Mentored by Dr. Colin Depp

Loneliness, Belongingness, and Burdensomeness in Individuals with serious mental Illness

Past literature indicates that individuals with serious mental illness (SMI; i.e., schizophrenia, schizoaffective disorder, bipolar disorder with psychotic features) experience higher rates of suicide ideation and behavior compared to the general population. People with SMI also experience greater loneliness. The interpersonal theory of suicide suggests that thwarted belongingness and perceived burdensomeness strongly correlates with suicidal behavior and suicidal ideation, however it is unclear if loneliness is associated with these constructs or suicide ideation. It is also unclear how the association between positive and negative symptoms of psychosis varies across these constructs. We analyzed data from a longitudinal multi-site study with 304 participants with SMI. The Positive and Negative Syndrome Scale (PANSS) was administered to assess positive and negative symptoms in psychosis; the Interpersonal Needs Questionnaire (INQ) assessed thwarted belongingness and perceived burdensomeness, and the UCLA Loneliness Scale version 3 assessed loneliness. We found that loneliness ($t(259)=3.8$, $p<0.001$) and burdensomeness ($t(259)=7.3$, $p<0.001$) were higher among people with SI, and belongingness ($t(259)=3.7$, $p<0.001$) was lower among people with SI. As predicted, loneliness was also found to be strongly correlated with burdensomeness ($r=0.558$, $p=0.001$) and belongingness ($r=0.756$, $p=0.001$) for all participants. However, There were no statistically significant correlations between loneliness, burdensomeness, and belongingness with positive or negative symptoms in psychosis. Although cross-sectional, our study indicated that loneliness is tightly correlated with interpersonal risk factors for suicide in psychosis, independent of psychotic symptoms. Pending further research, interventions targeting loneliness may be useful in suicide prevention in psychosis.

Alexander Tang

Math/Applied Science, Revelle

Mentored by Professor Curt Schurgers

Smartfin: The Smart Surfboard that Tracks Data on the Ocean

Ongoing climate change has caused an increased need to study our ocean's marine ecosystems and dynamics. In particular, studying nearshore regions can provide insight into overall ocean health in coastal areas. Currently, there are several methods to collect data on the ocean, but the main method of collecting such data relies on a singular offshore buoy on San Diego's coastline that only produces low spatial density measurements, leaving the rest of the coast vastly understudied. By equipping recreational surfers with our Smartfin, a surfboard fin that collects data through an inertial measurement unit (IMU), GPS, and temperature sensor, the goal of studying our coastline becomes more efficient and comprehensive. Our current goal is to accurately determine wave height through the IMU sensor, however noisy data produced by the sensors used in the Smartfin can cause our data to be inaccurate. This challenge has caused us to implement various machine learning algorithms into our Smartfin in hopes of reducing this noise. In this study, we evaluate and compare different machine-learning algorithms to determine which algorithm most accurately filters out the noise produced and explain the methods used to implement such algorithms into the Smartfin.

Annie Tang

Psychology, Seventh

Mentored by Dr. Celeste Pilegard

An eye movement analysis of the spatial contiguity principle based on expertise

The spatial contiguity principle is a multimedia learning phenomenon where learning improves when corresponding text and images of a lesson are located close to each other, rather than far away. Previous research has demonstrated that while spatial contiguity improves learning in low-knowledge learners, its effectiveness is reduced for experts. This is known as the expertise reversal principle.
Eye tracking has been used to study the underlying cognitive process of the spatial contiguity principle; however, there remains a gap in the literature for understanding how expertise influences this process. Thus, the purpose of this project is to use eye-tracking measures to gain understanding of the processes involved in the expertise reversal principle in relation to the spatial contiguity principle. Specifically, in addition to comparing learning outcomes, the study seeks to analyze if experts and novices have different eye movement patterns when viewing spatially contiguous versus noncontiguous lessons.
In the study, participants will view a lesson with either a spatially contiguous (integrated diagram and text) or spatially noncontiguous (separated diagram and text) design. Expertise information will be collected and learning outcomes will be measured based on participants' performance on retention and transfer tests about the lesson. Eye movement (integrative transitions) will be compared between experts and novices. We predict that novices will benefit more from spatially contiguous lessons and have more integrative transitions in the integrated condition, while experts will perform similarly across both conditions, but present an overall difference in number of integrative transitions.

Yuhan Tao

Psychology, ERC

Mentored by Dr. Celeste Pilegard

Video Introductions from Scientists to Help Students See What's Behind the Research

A growing body of work addresses students' perceptions of science and scientists, including science identity, relatability to scientists, sense of belonging, and science epistemology. Previous research suggests that interventions in a classroom setting can shape these perceptions and consequently impact students' interest in STEM (science, technology, engineering, math). In this study, we randomly assigned each section of a research methods class to either the control group, in which participants (n = 70) completed a scientific reading each week, or the experimental group, in which participants (n = 70) not only completed the reading but also watched a 1-2-minute video of the author (predominantly counterstereotypical (non-white/non-male)) introducing the research. All students took a quiz on the reading material at the end of each week. After the course ended in December 2022, we evaluated both students' grades on the quizzes and their responses to the beginning- and end-of-course questionnaires. We hypothesize that seeing videos of scientists would significantly enhance students' science identity, relatability to scientists, sense of belonging, and science epistemology, and consequently improve their academic performance. If seeing videos of scientists has an effect, then the experimental group should first show significantly more positive and less stereotyped perceptions in their responses to the second questionnaire, and secondly, score significantly higher on the quizzes. This would suggest that, first, seeing counterstereotypical representations of scientists in a classroom environment changes students' perceptions of science and scientists, and second, these changes have an impact on students' academic performance.

Matthew Tate

Molecular and Cell Biology, Sixth

Mentored by Nathan Shaner, Associate Adjunct Professor

Engineering Red Fluorescent Proteins

Red fluorescent proteins (RFPs) are important biological tools used in live-cell imaging. However, existing monomeric RFPs are limited by several properties such as low brightness, low photostability, and tendency to form low-affinity oligomers. We aim to improve these properties by evolving a mutant mCherry with directed evolution. This engineering process uses alternating random and directed libraries coupled with selection for the desired RFP properties such as brightness, photostability and monomeric behavior. The latest red version is three times brighter than mCherry, and as bright as mScarlet but more photostable. This improved RFP will enable imaging at higher time resolution and minimize the risk of photobleaching. It's high photostability allows for long-term fluorescence imaging experiments in living cells.

Megan Tavares

Psychology, Marshall

Mentored by Dr. Celeste Pilegard

Can the Testing Effect Help Protect Students Against Stereotype Threat?

Stereotype threat is a threat that something a person does or someone's features that conform to a negative stereotype could make that stereotype more plausible. Research has shown that academic performance declines when a situation diverts attention onto another concern. Specifically, a concern about confirming a negative stereotype. The testing effect refers to learners performing better on tests after

studying by taking practice tests rather than restudying the material. The current study is a 2x2 between-subjects design with the stereotype threat condition and testing condition being manipulated. College students will watch a video lesson and be randomly assigned to rewatch the video or take a practice test. Two days later they will be randomly assigned to get a stereotype threat message or a nullified threat message. Finally, participants will answer free-response and multiple choice retention and transfer test questions. Results will be analyzed using a factorial ANOVA with the between-subjects factors being testing condition and stereotype threat condition and the outcome variable being test performance. We predict a positive main effect of the testing condition and a negative main effect of the stereotype threat condition. We also predict an interaction where there will be a smaller difference in test scores between the stereotype threat condition and the no stereotype threat condition for participants in the testing condition than the restudy condition. Some predicted limitations are a floor effect on free-response questions and a high dropout rate. This study hopes to discover a new way to protect students against stereotype threat.

Kavitha Thirumaran

Molecular and Cell Biology, ERC

Mentored by Dr. Karl Wahlin

Growth Factor Production and Mediation of Stem Cell Differentiation

Growth Factors have the ability to influence stem cells to differentiate or proliferate and are vital to their survival. In this project, human stem cell derived retinal organoids and retinal neuronal cells can be stimulated and maintained with the addition of growth factors into the microenvironment. With the high cost of growth factors like FGF, BDNF, CNTF, and GDNF, long term stem cell survival is not studied as much. Plasmids were created and transformed into E. coli to encode various growth factors. With different bacterial cell lines, growth media, and growth conditions, recombinant protein production will be optimized.

Protein collection and purification parameters will be established using Fast Performance Chromatography and the AKTA Start. Bioassays with stem cells in culture will test the function of these different growth factors. FGF2-G3 signals the RAS/MAP pathway and the Wnt-beta catenin pathway, both involved in cell fate determination. FGF2 induces Yamanaka factors OCT4, SOX2, KLF4 and c-Myc that maintain the pluripotency of stem cells. A bioassay using immunohistochemistry to mark these transcription factors will assess FGF2 protein function. BDNF protein function will be tested with CREB phosphorylation of induced neurons, as BDNF is implied in neuronal growth and maintenance. CNTF will be assessed by measuring STAT phosphorylation as it activates the JAK/STAT pathway.

Neha Thiyagarajan

Cognitive Science, Revelle

Mentored by Matthew S. Panizzon. Associate Adjunct Professor, Psychiatry

Parity, MMSE, and memory: the hormonal drivers of late-life cognitive sex differences

While women suffer from higher rates of Alzheimer's disease and dementia than their male counterparts, the cause(s) of this relationship are unclear. Reproductive factors specific to women have been proposed as possible contributors to this sex difference. Specifically, during pregnancy and birth, women experience extreme hormonal changes, which cause lasting impacts on brain structure and function. Studies that have explored the relationship between the hormonal effects of parity and cognitive functioning have contradicting conclusions. This study explores the effects of parity and its effects on late-life cognitive status as defined scores on the Mini-Mental State Examination (MMSE) and verbal memory tests. This study conducted a preliminary random effects meta-analysis of three studies examining the partial correlation between parity and MMSE as well as three studies examining the partial correlation

between parity and verbal memory. The results of the meta-analysis for MMSE indicated that there was marginally significant between-study heterogeneity (Q(2) = 4.80, p = 0.09) and that parity was significantly negatively associated with MMSE performance (b = -0.11, p = 0.001). The analysis for verbal memory indicated that parity was not significantly associated with immediate verbal memory recall performance (b = -0.02, p = 0.80), but was significantly negatively associated with delayed recall performance (b = -0.03, p = 0.04). Overall, this study provides evidence supporting that parity affects MMSE performance and delayed verbal memory. A complete meta-analysis will be conducted to further elucidate the nature of the association between parity and cognitive functioning.

Ashley Thorshov

Physics w/Specializ Astrophys, Seventh

Mentored by Professor Henry Abarbanel

Analyzing the Variation in Earth's Magnetic Field

From protecting against radiation in solar winds to supporting complex navigation systems, Earth’s magnetic dipole field plays an important role in our society. Dynamo Theory analyzes the idea that Earth’s magnetic field is generated by the flow of conducting fluids, composed of Fe and Ni, in the outer core. Based on the conditions of this fluid at a given time, the strength and orientation of the magnetic field will vary. Paleomagnetic studies of the polar signatures in geological sites across the world have provided data on these changes in the magnetic field that spans back millions of years. Our group is working to produce a predictive model for these changes using a machine learning algorithm called data driven forecasting. We have analyzed both a 2 million year time series of the intensity and sign of the magnetic dipole moment constructed using paleomagnetic data and a 150 million year time series constructed from numerical solutions of dynamo magnetohydrodynamic equations. Techniques such as standard nonlinear time series analysis help us narrow down the number of dimensions we need to consider in a

predictive model and learn more about the dependence among our parameters. Once constructed, we plan to use our algorithm to gain a better understanding of the physical systems that impact Earth's magnetic field, such as the conducting material's density and the fluid's velocity. Understanding the physics behind Earth's geodynamo will help us gain a better understanding of our planet's history and the stability of our magnetic field.

Jenny To

Cell and Molecular Biology, Sixth

Mentored by Dr. Gene Yeo

Binding-Proteins discovered to be novel regulators of aberrant subcellular localization of CHMP7 via image-based pooled CRISPR screens

Amyotrophic lateral sclerosis (ALS) is a devastating neurodegenerative disease caused by the degeneration of upper and lower motor neurons, resulting in loss of movement, respiratory failures, and death. Nuclear pore complex (NPC) injury in sporadic ALS (sALS) patient-derived neurons (iPSNs) seemingly results in the loss of nuclear TDP-43 and its RNA metabolism function, as well as degradation via an ESCRT-III pathway. However, the molecular events that lead to these pathologies remain unknown. Recent work has identified aberrant nuclear accumulation of the ESCRT-III protein-charged multivesicular body protein 7 (CHMP7) as an early prominent initiating event in ALS pathogenesis. Nuclear CHMP7 pathology triggers NPC injury and deficits in active nucleocytoplasmic transport (NCT). Functionally, NPC injury impacts NCT, nuclear TDP-43 function and localization, and overall neuronal survival. However, the proteins that regulate CHMP7 nuclear import and/or retention remain elusive. To address that, we have employed genome-wide CRISPR-based automated imaging screen technologies to identify genes that, when knocked down, lead to CHMP7 nuclear mislocalization. RNA Binding Proteins have been identified to highly regulate CHMP7 nuclear localization and can ultimately result in NPC injury in iPSNs. We further

disrupted these newly identified CHMP7 – protein interactions using screening techniques and small molecules, connecting enhanced nuclear recruitment of CHMP7 to ALS-associated nuclear accumulation of CHMP7. Collectively, our work dissects the heretofore unknown mechanisms that regulate CHMP7 and has identified novel proteins that contribute to CHMP7 nuclear localization in human motor neurons in health and disease. This can potentially serve as new therapeutic targets for ALS pathology.

Lu Tong

Economics and Critical Gender Study, Revelle

Mentored by Yến Lê Espiritu, Distinguished Professor

Gender, Class, and Immigration: Perceptions of Sham Marriage by Chinese International Students

This research examines how sham marriage--a fraudulent marriage entered into as a means of getting U.S. permanent residence--is viewed within the Chinese community, specifically among Chinese international students, many of whom also seek to immigrate to the United States. The study recruited 20 current and former Chinese international UCSD students and conducted semi-structured interviews to gather their perceptions of sham marriages. Using a grounded theory approach and thematic analysis, the study identified key themes and patterns in the students' attitudes toward sham marriages. The results of the study suggest that Chinese international students use gender and class language to construct Chinese women in sham marriages as fake and undesirable and the marriages as unfair and fraudulent.

Khoa Tran

Biochemistry, Warren

Mentored by Colleen McHugh, Assistant Professor

The long non-coding RNA DUBR regulates human colon cancer cell growth through direct interactions with NuRD complex proteins and DNMT1

Non-coding RNAs greater than 200-nucleotides are termed long non-coding RNAs (lncRNA) and have been shown to contribute to cellular regulation by controlling gene expression. Mis-regulation of lncRNAs is present in cancer. The lncRNA DUBR (DPPA2 Upstream Binding RNA), has been identified to be mis-regulated in several types of cancer including human colorectal carcinoma. However, the functions of DUBR in normal and diseased cells have not been well explored. High expression of DUBR in human colon cancer is predictive of poor patient outcome by Kaplan-Meier survival analysis. Previous research in the McHugh Lab has shown that DUBR is required for normal colon cancer cell growth. RNA Antisense Purification coupled with Mass Spectrometry (RAP-MS) experiments were conducted and showed that DUBR endogenously bound to epigenetic regulators - proteins in the nucleosome remodeling and deacetylase (NuRD) complex and DNA methyltransferase 1 (DNMT1). RNA immunoprecipitation experiments were conducted to confirm the protein binding partners of DUBR and In Vitro RNA pull-down experiments will be used to identify the region(s) of DUBR in which these epigenetic regulators are binding. qPCR analysis after DUBR KD showed upregulation of the neighboring gene B and T lymphocyte attenuator (BTLA). Furthermore, exogenous overexpression of BTLA caused cell death in HCT116 cells. We hypothesize that DUBR regulates colon cancer cell growth by fine tuning epigenetic protein function at nearby gene loci. This study will expand our understanding of this functional lncRNA DUBR.

Andrea Tran

Neurobiology, Muir

Mentored by Kay M. Tye, Ph.D

Examining the effects of social exclusion on physical pain behavior

Social pain is defined as the pain one may experience following aversive experiences associated with one's social group, such as social rejection, loss, isolation, and exclusion. Various clinical and preclinical studies have shown that physical pain can be modulated by aversive social experiences that induce social pain. However, it is unclear what are the neural substrates for how social pain can enhance physical pain, and how this aversive social state can drive changes in pain behavior. In this study, we generated a novel social exclusion paradigm to investigate how social exclusion, a subtype of social pain, affects subsequent physical pain behavioral and neural readouts in a mouse model. We have found that after social exclusion, there is a trend towards increased physical pain behavior, as well as increased representation of physical pain stimuli within the brain. Together these findings suggest that the experience of social exclusion can be represented distinctly within mice and can be used as a paradigm to study the overlap between social and physical pain.

Ruby Tseng

Neurobiology, Muir

Mentored by Zoran Radic

Expression of human Acetylcholinesterase, Affinity Purification and Characterization of Novel Bis-oxime Antidote Interaction

Without Acetylcholinesterase (AChE), the body fails to hydrolyze acetylcholine into acetate and choline, leading to the lethal accumulation of the ACh. Novel bis-oxime antidotes are currently synthesized to further

understand and improve antidotes that target the AChE inhibited gorge, such as 2-PAM (2-pyridine aldoxime methyl chloride).
The objective is to understand novel antidotes that target AChE inhibition through analysis and observation of their chemical structures within the enzyme through Virtual Reality program, Nanome where bis-oxime antidotes arms are compared and analyzed. In order to study catalytic mechanism and structure it is crucial to isolate and purify this enzyme to homogeneity. HEK293 cell line (Human Embryonic Kidney Cells) are utilized to express the enzyme for the preparation of protein purification through affinity chromatography. It is shown that in five available X-ray structures of antidote*AChE complexes the three bis-oxime antidotes, LG703, LG823, and RS194B have 9 conformers and 14 arms variations. The arm structures are revealed to be cis-trans, trans-trans, and cis-cis. Each of the 14 arm variations has their RMSD (root mean square deviation) calculated in pairs within their individual arm structure. The cis-cis group (0.278) shows the smallest RMSD value then trans-trans (0.34) and with 0.48 RMSD for the cis-trans. The average bond distance between nitrogen and oxygen of the antidote arms, critical for the nucleophilic reactivation reaction, shows an average of 7.56±0.623 for smaller distance Nitrogen and 10.3±0.855 for the longer-distance Nitrogen. Cis-cis short (7.35±0.81)and long distance (10.27±1.24), trans-trans short (7.62±0.40) and long distance (10.52±0.01), and trans-cis short (7.56±0.83) and long distance (10.33±0.94) values suggests that a single compound can adjust its geometry to the geometry of target and thus broaden reactivation specificity against different organophosphates.

Jacquelyn Tsui

Clinical Psychology, Marshall

Mentored by Assistant Adjunct Professor, Dr. Christine Smith

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

Individuals with Mild Cognitive Impairment (MCI) are at risk for developing Alzheimer's disease (AD). According to existing tests, MCI patients exhibit extensive impairment in remembering the past (retrograde memory, RM) concurrent with only mild impairment in new learning. This finding suggests that more sensitive RM tests could identify MCI closer to when subtle neural and cognitive changes begin, therefore improving earlier diagnosis and access to interventions. In older adults with either MCI (N=36) or normal cognition (NC) (N=34), we examined if a novel RM news events test (RM-NET) can significantly predict brain volumes of hippocampal subregions known to decline in AD (i.e., CA1 and subiculum). For comparison, we also examined associations between the subregions and composite scores for five domains of cognition derived from existing neuropsychological tests (Executive Function, Semantic Memory/Language, Episodic Memory, Attention/Processing Speed, Visuospatial Function). Only positive associations were tested. Episodic memory composite scores significantly predicted the volumes of the whole hippocampus, dentate gyrus, and subiculum (the effect in CA1 was only marginally significant) in the MCI group. No significant associations were identified with other domains of cognition. RM-NET scores significantly predicted the volumes of the whole hippocampus, subiculum, CA1, and dentate gyrus in the MCI group. No significant relationships were identified in the NC group for the cognitive domain composite scores or the RM-NET. The RM-NET holds promise for tapping into the brain structures that are known to decline early in AD.

Ramya Ukkan

Human Biology, Revelle

Mentored by Dr. Marianna Alperin

Comparison of Pelvic Floor Muscle Architecture Across Sexes

Though the pelvic floor muscles (PFMs) are critical to the everyday function of the pelvic organs, their architecture and how they differ between sexes is not well known. Muscle architecture is a significant predictor of muscle function and can be assessed in fixed samples. Therefore, it is imperative that these differences are investigated in fixed samples to better understand if there are important sex-based differences in PFMs that impact their structure and function. Our main goal is to determine if the Sprague-Dawley rat is an appropriate model for male PFMs and for studying sex differences in the PFMs. Our hypothesis is that our results will demonstrate that male rat PFM architecture is a good animal model for male human PFM architecture. We evaluated male and female human and rat PFM data. Male (n=10) and female (n=10) rats were 3 months old at the time of sacrifice. Male (n=5) and female (n=10) human PFM data were obtained from fixed cadavers. For each muscle, the mass, length, and volume are measured. Bright field microscopy was used to quantify sarcomere lengths. For each muscle, four size-independent skeletal muscle architectural parameters are analyzed, which are quantified from eight size-dependent measures.

Max Varley

Chemistry, Muir

Mentored by Jeffrey Rinehart, Associate Professor of Chemistry and Biochemistry

Intermolecular Dipolar Coupling as a Suppressor of Through-Barrier Relaxation in a Series of Single-Ion Magnets

Single-molecule magnets (SMMs) and single-ion magnets (SIMs) are a class of compounds characterized by their ability to retain magnetization after biasing with an external magnetic field. SMMs and SIMs have potential applications in technology, most notably in high-density information storage, quantum computing and molecular spintronic devices. These compounds undergo a process known as slow magnetic relaxation, whereby magnetic spins equilibrate sometime after an external field has been applied and then removed. In this work we present a method for controlling the magnetic relaxation of a given SIM by targeting the intermolecular dipolar coupling between magnetic units. To this end, we have synthesized a series of three SIMs, all featuring the same magnetic unit (bis(η8-cyclooctatetraenyl)erbate(III) or Er(COT)2-) and varying only the charge-balancing cation with the intent of altering the distances and angles between magnetic units. With the magnetic unit held constant in these compounds, variations in magnetic measurements can be attributed to differences in intermolecular dipolar coupling facilitated by each compound's distinct crystal packing. Magnetic measurements were collected with a superconducting quantum interference device (SQUID), and computational studies were undertaken as well. In our systems of choice, we show a suppression of magnetic relaxation via quantum tunneling of magnetization in a series of SIMs via targeted alteration of crystal structure parameters.

Lidia Vazquez

Bioengineering: Biotechnology, Revelle

Mentored by Olivia Graeve is a mechanical and aerospace engineer and Professor at University of California San Diego.

Europium-doped Hydroxyapatite for Bone Healing Applications

Hydroxyapatite (HAp) and β-tricalcium phosphate (TCP) are inorganic compounds that have shown great promise for biomedical applications such as bone regeneration. HAp and TCP have high biocompatibility and good bioaffinity. HAp porous properties lead to the promotion of osteoconduction and osteoinduction. These processes can enhance bone regeneration and help combat osteoporosis. In previous studies we have reported that the solubility of HAp can be monitored by the incorporation of rare-earth elements into their structures; these dopants modify and enhance the luminescent properties of the HAp. In this work, we study the formation in situ of TCP by thermal treatment of HAp and europium-doped HAp powders. Our preliminary results have shown that when HAp is treated with a higher temperature, the percentage of TCP increases as well as its particle size. Currently, we are conducting research on the luminescent properties of europium-doped HAp powders observed through thermal treatments. The thermal treatments range from 600 degrees Celsius to 1,050 degrees Celsius. The material properties of europium-doped HAp powders will be analyzed and characterized using dynamic light scattering (DLS) and x-ray diffraction (XRD). These discoveries will lead to the understanding of the presence of HAp and TCP through different thermal treatments leading to more tailored controls in cell adhesion and strength-bearing properties in scaffold materials. Ultimately obtaining more effective materials for prompting bone regeneration through implants can serve as an excellent regenerative therapy for osteoporosis.

Mya Verrett

Bioengineering: Biosystems, Muir

Mentored by Dr. Tina Ng

Improve the User Interface for Patient Hypertonicity Evaluation

Hypertonicity manifests as increasing muscle tone, usually prevalent in neuromuscular diseases such as cerebral palsy. If untreated, it may result in muscle deformation and disability. Muscle tone is evaluated by the doctors holding the affected limbs and moving them within the range of motion. The resistance the evaluators feel indicates hypertonicity severity. To objectify the assessment of hypertonicity, we developed a multimodal glove. The pressure sensors on the glove recorded the torque used to move the hypertonic limb and quantify the resistance felt. Currently in clinical practice, the glove's user interface only visualized the raw data in real time. The evaluators performed some maneuvers and the data organization and analysis were performed after the collection process. There was no indicator of when the muscle tone reaches equilibrium, or whether asymmetric tone was presented. To provide more insights to doctors, we added the analysis process into the current interface, such as principal component analysis, data segmentation and histogram plots. The statistical parameters of the torque like average, median and standard deviation are updated simultaneously. By comparing them, the doctors can decide their plan of action afterwards and when to stop collecting data on the current limb. This improves the data reliability as the muscle tone converges to a stable state and ensures the cycle number is enough. The updated interface facilitates a more efficient and more reliable data collection process for medical professionals. The subjective assessment of the hypertonicity enabled by the glove will be more practical with the updated interface.

Wendy Wang

Clinical Psychology/ Cognitive Behavioral Neuroscience, Sixth

Mentored by Christina Gremel, Associate Professor

Orbitofrontal-premotor circuit contribution to action and outcome information

Daily life involves making adaptive decisions to achieve desired goals. Adapting to ongoing task demands requires the ability to use information from one's prior actions to inform one's decisions. Lateral orbitofrontal cortex (lOFC) has been shown to be critical for signaling and updating changes relating to action and outcome information that guides adaptive behavior, however, which lOFC projections to downstream regions are important for this control volitional actions is unknown. The secondary motor cortex (M2) has been implicated in addiction and compulsive disorders characterized by repetitive actions, and lOFC sends projections to M2. Therefore, we hypothesized that M2 performs computations that contribute to the use of action history to guide adaptive behavior and that these computations are mediated by incoming lOFC activity. Here, we used a self-paced lever-press hold-down task in which mice infer prior lever-press durations to guide subsequent action performance. We show that activity of M2 subpopulations differentially instantiates current and prior action information during ongoing action execution. A chronic functional loss of lOFC circuit input activity results in how action-related information is represented in M2, and with lesions potentially increase the representation of prior actions in M2. Our results identify a novel role for the cortico-cortical integration and transfer of action information to guide adaptive behavior. Altogether, our findings provide mechanistic support for targeting OFC and downstream premotor region activity as a potential treatment for psychiatric disorders characterized by maladaptive and repetitive decision-making actions.

Ho-Hsin Wang

Communication and Political Science, ERC

Mentored by Thomas Schmidt

Lost in Transitions: The Power, Privilege, and Positionality of Sofia Coppola and her Films

"My research centers on Sofia Coppola, an acclaimed female director in Hollywood who explores topics of girlhood, feminism, and the male gaze in films such as The Virgin Suicides (1999), Academy Award-winning Lost in Translation (2003), and most recently On the Rocks (2020). Coppola is best known and praised for realistically depicting young women in eras of transition, yet these characters never seem to reach their destinations even as they achieve successes, milestones, and maturity. I use a combination of promotional auteur analysis(Corrigan, 1990), postfeminist analysis(Gill, 2007) and intersectional media analysis(Kearney, 2020), to argue that Coppola takes a postfeminist approach and uses traditional cinematic patriarchal tools, such as the male gaze, to embody the loss of girlhood as a transitional stage and the eternality of womanhood through the male gaze. She uses an excess of opulence and beauty as both the cause and the solution to late-capitalist existentialism. However, her failure to portray identities other than white upper-class individuals also illuminates the institutional failings of the Hollywood industry. This project is significant because a complex and realistic analysis of Sofia Coppola, one of the only successful female auteurs creating films for the female gaze, reveals the cultural and institutional constraints to representations of girlhood in late capitalism.

Tony Wang

Sociology, Communication, Marshall

Mentored by Gershon Shafir Distinguished Professor

The impact and changes brought to the Chinese youth group and society by Japanese anime - based on interviews with Chinese anime fans

The origin of Japanese anime is a social and cultural product produced by historical opportunities and social changes. However, Anime truly spread to China, which has a population of 1.4 billion, after China implemented the reform and opening up system. Anime has brought different responses and changes to Chinese youth groups and society. This research focuses on the influence and changes that Japanese anime brought to China after the 1980s and explores its historical causes and social dynamics through online and offline interviews with Chinese anime enthusiasts.

Tiffany Widjaja

Clinical Psychology, Warren

Mentored by Dr. Emma H. Geller (Ph.D.), Associate Teaching Professor

The Effects of Self-Explanation and Refutation on the Learning Styles Misconception

Refutational texts have been shown to facilitate learning in math and science concepts by countering widely held misconceptions. Despite the efficacy of refutation text on learning, refutation can sometimes backfire and further entrench our beliefs in misconceptions we might have emotional attachments to. Recent work in this area has explored additional interventions that may improve the effect of refutation while avoiding the “backfire” effect, such as self-explanation. In this study, we ask students to self-explain a refutation text about the learning styles

misconception. We speculate that students might have emotional attachments towards the learning styles misconception – a myth that advocates for individualized instruction tailored to the unique learning styles of students – because current literature suggests that individuals are more likely to be emotionally attached to a misconception(s) they believe to be particularly unique to them (Trevors et al., 2016). We hypothesize that participants who self-explain the refutation text, compared to participants who engage in non-guided note-taking (think aloud) and reread the passage, will display higher accuracy of post-test scores and change in learning style endorsement. We hope our investigation of misconceptions and how we can avoid the backfire effect through self-explanation and refutation extends educational psychology literature and contributes to the science of learning and instruction.

Allison Wiley

Sociology, Revelle

Mentored by Michel Estefan - Assistant Teaching Professor

The Longevity and Resilience of Meritocracy during a Crisis: How Students View the Value of a College Degree

The concept of meritocracy has been long praised as a fair and efficient way to allocate resources and opportunities. However, during a crisis, such as the Covid-19 pandemic, the longevity and resilience of it can be challenged. Meritocracy has many institutions that has functioned within it, higher education being the one in which this paper intends to focus on. The recent Covid-19 pandemic has created unprecedented disruptions in the higher education system, resulting in university wide closures, fully remote learning, and major shifts in the ways in which students interact with each other. Giving rise to fundamental questions about the role of college and a college degree in contemporary society and whether having a college degree still fulfills a particular function as a way for individuals to mobilize. This study takes an empirical look on these issues as a way to evaluate the strength of meritocracy and if it can still be praised for its fair

and efficient ways. Additionally, it will explore the ways in which the pandemic influenced how students view the value of a college degree in the current economic and social landscape.

Anna Wilke

Neurobiology, Sixth

Mentored by Dr. Cory Root

Intercalated Cells of the Amygdala: Insights into Connectivity and Behavioral Implications

The amygdala, a brain structure critical to emotion and olfaction, contains numerous subnuclei. One inhibitory neuron group, the intercalated cells (ITCs), is particularly understudied. ITCs specifically express FoxP2, allowing cell type-specific targeting via Cre recombinase. Using FoxP2 transgenic mice, we have revealed the connectivity and function of the ITCs. First, ITC input-output mapping identified multiple novel reciprocal connections with cortical, subcortical, basal, amygdalar, hippocampal, and thalamic structures. Given these connections, we hypothesized that ITCs may mediate amygdalar valence control by broadly integrating and disseminating information to and from these areas. To investigate the role of ITCs in olfactory aversion responses, we utilized chemogenetics to selectively activate or inhibit ITCs in response to a variety of neutral, appetitive, and aversive olfactory stimuli. Our results suggest that ITCs modulate innate olfactory behaviors, which could have broader implications and provide therapeutic strategies for anxiety and trauma-related psychiatric disorders.

Claire Williams

Molecular and Cell biology, Seventh

Mentored by Samuel Pfaff Adjunct Professor

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

A novel technology, RNA end-joining (REJ) is being used in the treatment of Duchenne Muscular Dystrophy (DMD) in two mouse models. DMD is caused by mutations in dystrophin, the largest gene in the human genome. Dystrophins length poses a problem during its attempted delivery using AAVs that can be remedied by using REJ. The efficacy is being tested in two mouse models and three different pathways for the clinical treatment of DMD.

Kristiana Wong

Molecular and Cell Biology, Revelle

Mentored by Professor Christina Towers

Autophagic Inhibition in Pancreatic Cancer Cells

Macroautophagy, otherwise known as autophagy, is a process of cellular recycling in which the lysosome degrades damaged cellular components to sustain metabolic pathways. Autophagy inhibition has been a focus for combination therapeutics for autophagy dependent cancers such as pancreatic ductal adenocarcinoma (PDAC), utilizing autophagic inhibitors such as chloroquine (CQ), hydroxychloroquine (HCQ), and more recent drugs such as ULK1/2 inhibitors. Clinical trials have shown that some patients are responsive to this therapy and show slowed disease progression. However, these results become mitigated, suggesting that cancer can become resistant to autophagy inhibition. The mechanisms behind this circumvention are not well understood.

With these findings in mind, we sought to model resistance to autophagy inhibition in PDAC and discover mechanisms by which cancer cells are able to bypass autophagy blockade. We deleted core autophagy genes such as Atg7 in murine PDAC cell lines to understand how cancer is able to survive and grow despite lacking canonical autophagy. After confirming knockout, we made the surprising discovery that these cells were equally sensitive to autophagy inhibitors HCQ and MRT68921 (a ULK1/2 inhibitor) as their wild-type counterparts. These results suggest that deleting Atg7 may not be representative of pharmacological autophagy blockade. We are now trying to understand whether other autophagy related genes can mimic the effects of HCQ or ULK1/2 inhibitors or whether the anti-cancer effects of HCQ and MRT68921 are autophagy-independent. These findings will help to better understand mechanisms of resistance to autophagy inhibition to better improve the efficacy of this therapeutic.

Abigail Wright

Literature/writing, Revelle

Mentored by Gloria Chacón, associate professor

Misogynistic Consequences of the Conquest: Representations of La Malinche and Chicana Lesbians as the 'Bad Women' of Mexico

Representations from Mexican and Spanish literatures of La Malinche, the Indigenous slave woman whose role in history transgressed from her cultural gender roles, perpetuate patriarchal ideals, as she is viewed within the context of her role as Cortés' translator. Her involvement in the conquest and the traitor rhetoric attached to her sign is further exacerbated by notable narratives such as Bernal Díaz del Castillo's "Doña Marina" and the anonymously printed novel "Xicoténcatl". Octavio Paz's "Sons of Malinche'' essay and his use of the phrase "hijos de la chingada" refers to Malinche's shameful status as the "violated mother" of the mestizos as well as the Mexican nation as a whole for being the result of that violation. In addition, her perceived relationship with Cortés reflects Aztecan gender roles that subsequently aligned with those of the

Spaniards' which pertained to the Catholic faith. Malinche thus becomes a cultural sign for the "bad woman" in Latin American society versus the religious figure Guadalupe who serves as the "ideal woman". Latin American gender dichotomies known as "machismo" and "marianismo" follow this binary of expected female and male behavior. A significantly marginalized group of "bad women" in Mexican society are the Chicana lesbianas, as they exist outside of these dichotomies and are referred to as "malinchistas" due to their feminist ideals and lifestyles that directly transgress these roles. Ultimately, the term "feminicidio", as it refers to misogynistically targeted violence against women, and this culture of normalized violence against women began with the vitriol for Malinche.

Celine Yang

Human Biology, Revelle

Mentored by Michael A. Taffe, Principal Investigator

Δ9-tetrahydrocannabinol effects on oxycodone intake via intravenous self-administration in rats

This study focuses on assessing the potential therapeutic efficacy of THC on oxycodone intake in rats. Male (N=17) and female rats (N=15) received oxycodone (0.15mg/kg/infusion) intravenously through an intravenous self-administration (IVSA) apparatus. One group of rats (N=9; N=7) was injected with THC (5mg/kg/ml, i.p.) while the other (N=8; N=8) was injected with a vehicle control solution (5mg/kg/ml, i.p.) 30 minutes prior to self-administering oxycodone infusions for a 6-hour access period across a 5-day period. Rats treated with the THC pre-treatment had decreased oxycodone infusions compared to rats treated with vehicle pre-treatment. Tolerance to the THC pre-treatment developed quickly, which required an increased dosage of the THC pre-treatment (10mg/kg/ml, i.p.) to maintain the effectiveness of THC. Pre-treatment conditions for each group were switched and demonstrates the same effects of THC pre-treatment on the previously vehicle pre-treatment group on oxycodone intake. To assess the reward threshold of decreased

oxycodone intake in rats treated with the THC pre-treatment, male rats (N=19) underwent an intercranial self-stimulation (ICSS) assessment after a 14-hour abstinence period per every 6-hour access period across a 5-day period. The ICSS assessment demonstrates the reduced oxycodone intake did not alter the reward thresholds.
This study demonstrates that the use of THC to decrease oxycodone intake is effective but requires increased dosages in THC to combat THC tolerance. However, reduced oxycodone intake does not affect the dysphoric states following oxycodone intake.

Luowen Yu

Cognitive and Behavioral Neuroscience, Marshall

Mentored by Dr. Lara Rangel

Rhythmic Dynamics of the Rat Dentate Gyrus during Associative Spatial Memory Task

The dentate gyrus (DG), a subregion of the hippocampus, is thought to provide unique representations for similar experiences to aid in both the encoding and retrieval of distinct memories. Despite this long-standing hypothesis, little is known regarding the local circuit interactions within DG that support the recruitment of these unique representations and at what critical intervals these interactions may occur. To further investigate this, we acquired in vivo electrophysiological recordings of single cell and local field potential (LFP) activity from rat DG as rats perform a spatial delayed-match-to-sample task. The task requires the rats to associate a location in an arena with a reward during an encoding phase, and return to the previously rewarded location in the presence of foil location during a subsequent retrieval phase. We have observed several behaviors that indicate rats critically leverage cues outside of the arena to perform the task. Specifically, rats scan (pause at the base of the arena at the start of the task to view possible reward locations in the context of environmental cues from distance), push over objects, and rear (stand on hind limbs to view environmental cues at a reward location). We investigate the

frequency and duration of each behavior during encoding and retrieval phases before correct or incorrect performance, and characterize dynamic neural oscillatory activity during these behaviors. In this manner, we will determine whether the DG exhibits distinct rhythmic states during each behavior that changes across encoding and retrieval phases and across successful and unsuccessful performance.

Jonathan Yu

Bioengineering: Biotechnology, Warren

Mentored by Dr. Robert Sah

Biaxial Tensile Testing Device Design

Constitutive modeling of biomaterials requires rigorous experimentation involving the characterization of biomechanical properties in order to accurately form a model. Accurate constitutive models are required to predict the behavior of tissue under loading conditions, especially tissue that exhibit anisotropic properties. When investigating the biomechanical properties of a material, uniaxial stretching with a clamp often results in the Poisson's effect, which causes complex boundary conditions; we seek to create a biaxial tissue stretching method that mitigates the Poisson's effect. A stretching device will be designed such that the test material can be stretched along one axis, while limiting movement along the perpendicular axis. Several ways of attaching to the test material will be investigated: clamps and grommets, all at different sizes, orientations, and locations. It is expected that limited movement along the perpendicular axis would effectively decrease the Poisson's effect on uniaxial stretching. Different attachment methods will also have different effects of local strains and stresses on the test material, as well as being able to grab onto the test material differently. The effects of these different attachment methods will be determined using visual markers made on the material being tested. The final design, if made with materials easily available, could be used to be integrated into the BENG1 curriculum.

Xingzhou Yu

Physics, Revelle

Mentored by Henry Abarbanel, Distinguished Professor

Symplectic Numerical Methods

Hamiltonian systems are critical in physics because we can find them in many sub-fields and therefore there are many applications. Sometimes, the dynamics cannot be solved analytically and hence we need to apply numerical integrator to our equations of motion. These numerical methods not always conserved energy and preserves the Hamiltonian structure of the system (they are non-symplectic) and therefore it is important to take and apply symplectic theory to numerical methods. In this work, we first briefly introduce Lagrange's and Hamilton's equation of motion (EoM), talk about symplectic integrators, and discusses 2 examples. The first example is the simple pendulum which gives us a nice understanding of the application of different symplectic and non-symplectic methods in a classical example of physics. The second example is symplectic integrator applied in high energy physics, we solved the reference trajectory of a charged particle in an electromagnetic field with the standard Runge-Kutta Fourth Order method (RK4), leapfrog method, and symplectic RK4 method.

Jonathan Zamora

Computer Science, Warren

Mentored by Xiaolong Wang, Assistant Professor

Graph Inverse Reinforcement Learning from Diverse Videos

Research on Inverse Reinforcement Learning (IRL) from third-person videos has shown encouraging results on removing the need for manual

reward design for robotic tasks. However, most prior works are still limited by training from a relatively restricted domain of videos. In our Conference on Robot Learning (CoRL) 2022 paper, we show that the true potential of third-person IRL lies in increasing the diversity of videos for better scaling. To learn a reward function from diverse videos, we propose to perform graph abstraction on the videos followed by temporal matching in the graph space to measure the task progress. Our insight is that a task can be described by entity interactions that form a graph, and this graph abstraction can help remove irrelevant information such as textures, resulting in more robust reward functions. We evaluate our approach, GraphIRL, by learning from human demonstrations for real-robot manipulation and via cross-embodiment learning in X-MAGICAL. We show significant improvements in robustness to diverse video demonstrations over previous approaches, and even achieve better results than manual reward design on real robot tasks.

Linghao Zhang

Mathematics, Warren

Mentored by Jiawang Nie / Professor of Mathematics

Polynomial Optimization Over Unions of Semialgebraic Sets

I am currently working on a research project about optimizing polynomial functions over unions of semialgebraic sets. Our research goal is to design a single convex optimization relaxation that can solve this optimization problem globally. This requires us to utilize mathematical knowledge from various fields including real algebraic geometry, convex optimization, and Moment-SOS hierarchies. In particular, one of the key tools we will use is semidefinite programming (SDP).

Chen Zhang

Sociology and Political Science, Sixth

Mentored by Professor Christena Turner

How do undergraduate Japanese, Chinese, and Korean international students at UC San Diego view World War II Imperial Japan differently and what shapes those differences?

This study examines "how do undergraduate Japanese, Chinese, and Korean international students at UC San Diego view World War II Imperial Japan differently and what shapes those differences?". Drawing on both qualitative interviews and quantitative surveys, I find that undergraduate Japanese, Chinese, and Korean international students at UC San Diego view World War II Imperial Japan differently regarding whether Japan committed war crimes and apologized. Their different attitudes toward World War II Imperial Japan are mainly influenced by the different education they received at school while also being significantly impacted by their family and another social context. Despite the different opinions they have, the extent of the differences between Japanese, Chinese, and Korean international students is less than the common public of these three countries because of the new information they obtained when studying in the US, which allowed a more objective perspective.

Andrew Zhang

Neurobiology, Muir

Mentored by Dr. Gulcin Pekkurnaz

Neurons Depend on O-GlcNAcylation for Energy and Stress Defense

Neurons are highly energy dependent cells and derive the majority of energy molecule ATP from glucose. Glycolysis and subsequently mitochondrial oxidative phosphorylation (OXPHOS) break down glucose

for ATP production while the pentose phosphate pathway (PPP) uses glucose to combat oxidative stress. Nutrient-sensing post-translational modification O-GlcNAcylation dynamically regulates glucose metabolism, sustaining neuron's normal physiological functions. O-GlcNAcylation of hexokinase 1(HK1), the first and rate-limiting enzyme of glycolysis, results in its anchoring to the mitochondrial surface. Anchoring of HK1 recruits other glycolytic enzymes to the mitochondrial outer membrane, forming a glycolytic complex, which allows the direct shuttling of glycolysis's product into mitochondria to power OXPHOS. The compartmentalization of glycolysis and mitochondrial OXPHOS via O-GlcNAcylation increases ATP production rates, supporting active neuron's high energy demand. However, OXPHOS generates ATP at the expense of reactive oxygen species (ROS) production. ROS accumulation leads to oxidative stress and cell death. Glucose metabolism through PPP combats oxidative stress. Glucose-6-phosphate dehydrogenase (G6PD), the first and rate-limiting enzyme of PPP, produces NADPH that facilitates ROS breakdown. G6PD is primarily expressed in neurons from cell culture derived from embryonic rat brains.O-GlcNAcylation increases G6PD activity and enhances NADPH production. Preliminary data also suggest that O-GlcNAcylation affects G6PD's localization in neurons.

Skyler Zheng

Cognitive Behavioral Neuroscience, Revelle

Mentored by Deanna J. Greene, Ph.D. / Associate Professor

Automated cortical and subcortical segmentation of brain MRI scans with manual intervention: examining anatomical differences in Tourette syndrome

Tourette syndrome (TS) is a developmental neuropsychiatric disorder that typically emerges in childhood and is characterized by repetitive, involuntary movements (motor tics) and sounds (vocal tics). Previous studies investigating structural brain metrics (such as cortical thickness) associated with TS have produced heterogeneous results. This project

aims to compare structural brain metrics in a group of participants with Tourette syndrome to an age-matched control group. Structural magnetic resonance imaging (MRI) data from 101 children and adult participants with TS (age=7.6 – 35.0, M=17.5) and 101 undiagnosed controls were matched for age, IQ, and in-scanner movement. Brain parcellation and segmentation was automatically conducted using FreeSurfer 6.0. To ensure measurement reliability, poor segmentation outputs containing inaccuracies underwent a manual quality control (QC) process, which involved the detection and correction or exclusion of mislabeled voxels. Common faults in segmentation, such as white matter misclassification, inclusion of dura mater in pial boundaries, and pial surface extension into the cerebellum can lead to regression attenuation and reduction of statistical power when comparing gray matter (GM) and white matter (WM) volume differences. The implementation of manual intervention optimized the output quality results. Univariate tests are conducted to analyze group differences in cortical thickness and subcortical structure volumes. The results of this study will contribute to our understanding of the anatomical differences of Tourette syndrome and may have implications for the development of more targeted interventions.

Lisa Zhou

Cognitive Science, ERC

Mentored by Manuel Shvartzberg Carrió

Inland Empire Militarization Project

The militarization of the Inland Empire in the twentieth century is a history of continued infrastructure building on Indigenous land but has not eliminated their presence on their land. The American government has enacted violent policies of Indigenous elimination, labor exploitation, and assimilation. Extractive and other colonial policies "directly attacked Indigenous people's identity and existence" (Akins & Bauer 3). Yet, Indigenous people never have fully separated from their land, rather, they have adapted to new circumstances and continue to fight for their land

(Milanovich 538; Akins & Bauer 4). California is a place where violent tactics are exemplified (Lindsay 140), as "the most important American example of the interface between business, government, the military, politicians, and scientists" (Lotchkin xv). In Southern California, settler development began along the coast, with the Spanish establishment of presidios, missions, pueblos and later Mexican ranchos. In the nineteenth century, American settlers focused on elimination and labor exploitation of Native people in areas surrounding Los Angeles and San Diego (Lindsay 136) through the completion of the Southern Pacific Railroad, establishment of Native reservations, water rights disputes, and agricultural development. In the twentieth century, coastal urban areas became so populated that defense industries moved to "wide-open spaces" inland (Lotchkin 190), like Palm Springs where Torney General Hospital and Palm Springs Army Airfield were created during World War II. I aim to explore how Indigenous tribes, such as the Agua Caliente Band of Cahuilla Indians, maintained their presence despite increasing settler colonial military development.

Hillary Zhou

Microbiology, ERC

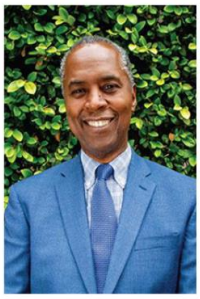
Mentored by Dr. Amanda Lewis

Understanding Gardnerella vaginalis biofilm formation on braided and monofilament sutures

Preterm birth causes one million deaths worldwide and results in additional health complications in the newborn babies. One risk factor for preterm birth in women is “short cervix” or early cervical ripening, which is associated with histories of prior pregnancy loss or preterm birth. As a preventative measure to hold the cervix closed, a cervical cerclage, circular stitches around the cervix made with surgical sutures, can be placed. Studies suggest women who receive certain types of sutures later

experience changes in the vaginal microbiome consistent with bacterial vaginosis, a condition linked with preterm birth and other adverse pregnancy outcomes. Certain anaerobic bacteria such as Gardnerella vaginalis and Atopobium vaginae increased by about 10-fold in the microbiomes of women with braided cerclages compared to those without braided cerclages. We use crystal violet staining to quantify the biomass of biofilms formed by Gardnerella on polystyrene surfaces, braided polyethylene terephthalate sutures, and monofilament polypropylene and nylon sutures. In our current in vitro studies, we observe greater biofilm formation of Gardnerella vaginalis on braided sutures compared to monofilament sutures.

URH Staff



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