URC

2025 Undergraduate Research Conference

April 19, 2025

UC San Diego
UNDERGRADUATE RESEARCH HUB

Contents

Welcome Message

Welcome to the 38th Annual UC San Diego Undergraduate Research Conference.

For nearly four decades, the Undergraduate Research Hub has provided UC San Diego faculty members an opportunity to recognize students who have conducted outstanding mentored research by nominating them to present at this conference.

This year, over 250 students will present findings from the work their research performed in programs stretching from summer 2024 to this quarter. We have presenters from all major areas of academic inquiry, from a variety of backgrounds, and with unlimited aspirations.

We always warmly acknowledge the support of the students' faculty mentors, postdoctoral fellows, graduate students, and other research mentors. This conference would not exist without the commitment of these advanced scholars guiding our undergraduates.

As always, we are grateful for the support of our campus leadership – Chancellor Pradeep Khosla, Executive Vice Chancellor Elizabeth Simmons, Vice Chancellor of Student Affairs and Campus Life Alysson Satterlund, Assistant Vice Chancellor of Student Retention and Success Maruth Figueroa, Vice Chancellor of Research and Innovation Corinne Peek-Asa, and many more supporters than we can name here.

Thank you for attending and demonstrating support for Undergraduate Research at UC San Diego.

Conference Schedule

8:15 - 8:45 AM	Check-in, Attendee Registration, & Breakfast
8:45 – 9:15 AM	Welcome & Opening Remarks
9:30 – 10:30 AM	Morning Session I
10:45 – 11:45 AM	Morning Session II
11:45 AM – 1:00 PM	Lunch
1:00 – 2:00 PM	Afternoon Session I
2:15 – 3:15 PM	Afternoon Session II
3:30 – 4:30 PM	Afternoon Session III
4:30 – 5:00 PM	Closing Remarks & Group Photos - Cohort and ALL at Sun God - Meet: Faculty Club Courtyard

Panel Presentation Schedule

Morning Session I, 9:30 – 10:30 AM

Panel #	Panel Name	Location
1	Social Behavior and Stress in Animals	FC – Cnf 1-3
2	Advances in Plant Research	FC – Cnf 4-5
3	Student Experiences and Success	Seuss Library
4	Molecular Biology and Biotechnology	Atkinson Pavillion
5	College Affordability and Student Success	Cecil's Lounge
6	Drug Discovery	Peterson 102
7	Neuroscience and Behavioral Biology	Peterson 103
8	Cancer Research and Modeling	Peterson 104
9	Language and Brain Function	Solis 109
10	Social Interactions and Anxiety	Solis 110
11	Cognitive Aging, Neuroplasticity, and Speech Processing	Solis 111
12	Machine Learning in Biological Studies	CSB 004
13	Computer and Data Sciences	CSB 005

Morning Session II, 10:45 – 11:45 AM

Panel #	Panel Name	Location
14	Identity, Culture, and Belonging	FC – Cnf 1-3
15	Social Impact and Community Engagement	FC – Cnf 4-5
16	Human Thought and Action	Seuss Library
17	Cell Biology and Biochemistry	Atkinson Pavillion
18	Student Well-being and Financial Security	Cecil's Lounge
19	Microbiome Research and Immunology	Peterson 102
20	Arthritis Research	Peterson 103
21	Genetics and Genomics	Peterson 104
22	Developmental Psychology and Cognitive Science	Solis 109
23	Veterans' Health and Cognitive Function	Solis 110
24	Soft Robotics and Haptics	Solis 111
25	Materials Sciences	CSB 004
26	Computer Science and Engineering	CSB 005

Afternoon Session I, 1:00 – 2:00 PM

Panel #	Panel Name	Location
27	Language, Culture, and Identity	FC – Cnf 1-3
28	People, Places, and Social Systems	FC – Cnf 4-5
29	Culture Across Border Lines	Seuss Library
30	Life Stories	Atkinson Pavillion
31	Social-Emotional Learning and Intervention	Cecil's Lounge
32	Pregnancy and Developmental Biology Research	Peterson 102
33	Sensory Perception and Processing	Peterson 103
34	Cardiac Cell Biology and Development	Peterson 104
35	Topics in Physics	Solis 109
36	Understanding Alzheimer's Disease	Solis 110
37	Neuroscience and Addiction Research	Solis 111
38	Materials Sciences and Engineering	CSB 004

Afternoon Session II, 2:15 – 3:15 PM

Panel #	Panel Name	Location
39	Language and Heritage	FC – Cnf 1-3
40	Politics of Identity and Social Justice	FC – Cnf 4-5
41	Culture, Identity, and Feminism	Seuss Library
42	Moving Images	Atkinson Pavillion
43	Children's Learning and Development	Cecil's Lounge
44	Muscle Biology and Regeneration	Peterson 102
45	Environmental Microbiology and Ecology	Peterson 103
46	Chronic Pain and Neuropathy	Peterson 104
47	Robotic Controls and Control Theory	Solis 109
48	Neural Networks and Cognitive Science	Solis 110
49	Neurodegenerative Disease Mechanisms	Solis 111
50	Innovations in Science and Engineering	CSB 004

Afternoon Session III, 3:30 – 4:30 PM

Panel #	Panel Name	Location
51	Entomology and Bee Biology	FC – Cnf 1-3
52	Social Justice, Policy, and Human Rights	FC – Cnf 4-5
53	Economics, Policy, and Social Behavior	Seuss Library
54	Cancer Biology and Metastasis	Atkinson Pavillion
55	Opening the Classroom	Cecil's Lounge
56	Neonatal Health and Development	Peterson 102
57	Neurodevelopment and Mental Health	Peterson 103
58	Animal Communication and Social Pain	Peterson 104
59	Audio Signal Processing and Data Science	Solis 109
60	Memory and Learning	Solis 110
61	Neural Mechanisms of Cognition and Behavior	Solis 111
62	Medical Applications of Computer and Data Science	CSB 004

Panel Details

Morning Session I

9:30 AM – 10:30 AM

Panel 01: Social Behavior and Stress in Animals

Room: Faculty Club - Conference Room 1-3
Moderator: Christina Acosta

Ruby Munoz - Neurobiology

Mentor: Matthew Lovett-Barron

Effects of hunger on social behavior in schooling fish

Yazmin Ortega - Cognitive Science with a Specialization in Neuroscience

Mentor: Dr. Lara Rangel

The Impact of Social Interactions on Behavioral and Neurophysiological Stress Responses in Rats

Kayanne Tran and Breanna Fraire - Data Science and Cognitive Science - DSGN&INT

Mentor: Monique Smith

Social Behavior Dynamics Following Food Deprivation in Mice

Panel 02: Advances in Plant Research

Room: Faculty Club – Conference Room 4-5
Moderator: Jennifer Reiswig

Tyler Bashor - General Biology

Mentor: Jose Pruneda-Paz

Unraveling the molecular mechanisms underlying the regulation of on Plant Growth and Development by the Circadian Clock

Sarah Huynh - Microbiology

Mentor: Julian Schroeder

Investigating new approaches to improving water use efficiency of crops

Bianca Lopez - Molecular and Cell Biology

Mentor: Andrew Muroyama

Designing Genetically Encoded Tools for Local Cytoskeletal Disruption

Panel 03: Student Experiences and Success

Room: Faculty Club – Seuss Library
Moderator: Libby Butler

Ginger Smith - Computer Science

Mentor: Gerald Soosairaj

Retention of Women in Computing at UCSD

Shivani Sharma - Human Developmental Sciences

Mentor: Cheryl Anderson

Behaviors and Perceptions of Mental Health Among South Asian College Students

Avery Charneski - Sociology, Mathematics

Mentor: Kevin Lewis

UC Socially Dysfunctional: Investigating a Trend of Social Dissatisfaction at UCSD by Examining the Network Ties of its Students

Autumn Pedranti - Sociology - Science & Medicine

Mentor: Christena Turner

Bridging the Gap to Success: Humanistic Dynamics of Pre-Medical Students and Organizations in Scientific-Based Medical Education

Panel 04: Molecular Biology and Biotechnology

Room: Faculty Club – Atkinson Pavillion
Moderator: Sam Landry

Nishant Sharma - Bioengineering: Biotechnology

Mentor: Geoffrey Chang

UnaG Protein-based ligand-gated fluorescent system for small molecule biosensing

Ruman Das - Molecular and Cell Biology

Mentor: Gene Yeo

Profiling mRNA Translation with RNA Editors

Pooja Parthasarathy - Biology w/ Bioinformatics

Mentor: Eugene Yeo

Measuring translational efficiency across diverse mRNA coding sequences using RiboSTAMP

Elijah Khalil Rosales - Biochemistry

Mentor: Gene Yeo

Benchmarking differential mRNA translation efficiency using RiboSTAMP

Panel 05: College Affordability and Student Success

Room: Faculty Club – Cecil's Lounge
Moderator: Nancy Binkin

Michelle Griffith and Jessica Jatiram - Public Health and Psychology and Public Health with a concentration in Epidemiology

Mentor: Dr. Nancy Binkin

What it Takes to Pay the Bills: The Impacts of Student Employment on Academic Performance and Well-Being

McKayla Dasha Sarmiento, Jackie Aviles, and Derrick Cha - Human Biology/Public Health, Public Health w/ Concentration in Community Health Sciences, and Public Health Concentration in Biostatistics

Mentor: Nancy Binkin

Making Ends Meet: How UC San Diego Students Pay for their Education and Overcome Financial Gaps

Melissa Lupian, Leanne Liaw, and Melanie Gallegos - Public Health with concentration in medicine sciences, Neurobiology and Public Health (concentration in Medicine Sciences), and Public Health

Mentor: Nancy Binkin

Safety Net or Tightrope? Assessing Basic Needs Resource Support for Undergraduates at UC San Diego

Panel 06: Drug Discovery

Room: Peterson 102
Moderator: Hector Chavez

Brina Nguyen - Bioengineering: Biotechnology

Mentor: Miguel Lopez-Ramirez

Artificial intelligence and high-content screening identified FDA-approved drugs for the long-term treatment of cerebral cavernous malformation disease

Nehme Lahoud - Human Biology

Mentor: Justin Meyer

Evolving Phage Antibiotic Synergisms

Connie Tran and Dyllan Mead - Bioengineering: Biotechnology

Mentor: Dr. Elizabeth Winzeler

Malaria Drug Discovery Pipeline

Panel 07: Neuroscience and Behavioral Biology

Room: Peterson 103
Moderator: Chengbiao Wu

Sophia Trujillo - Molecular and Cell Biology

Mentor: Dr. Jill Wildonger

Investigating the Effects of Microtubule Acetylation on Neuronal Development and Behavior in Drosophila Melanogaster

Andrea Melendez - Cognitive science with a specialization in Neuroscience

Mentor: Nicola J. Allen

Astrocyte GLT-1 and GLAST in Rett syndrome

Moumen Gabir - Neurobiology and Cognitive Science

Mentor: Kay Tye

Investigating Anhedonia in Chronic and Acute Stress Models Reveals Distinct Behavioral Patterns in Depression-like Responses

Katelyn Rode - Neurobiology

Mentor: Miranda Koloski

Utilizing a Neurofeedback Paradigm to Modulate High Frequency Activity in Rats

Panel 08: Cancer Research and Treatment

Room: Peterson 104
Moderator: Isabella Maita

Lan Gao - Molecular and Cell Biology

Mentor: Jing Yang

The Role of TWIST1-mediated Mechanotransduction in Breast Cancer Metastasis

Margaret Jones - Biology with a Specialization in Bioinformatics

Mentor: Ida Deichaite

The Role of TSC2 Variant rs1800720 in Head and Neck Cancer: Implications for Prognosis and Treatment

Omar Mokhashi and Nomy Xin – Neurobiology and Molecular and Cell Biology

Mentor: Weg Ongkeko

Evaluation of Alcohol, Tobacco, and HPV's Synergistic regulation of HNSCC's Potential Treatment Response to PD-L1 Checkpoint Inhibitor Treatment

Panel 09: Language and Brain Function

Room: Solis 109
Moderator: Seana Coulson

Nathen Lee - Data Science

Mentor: Seana Coulson

Multimodal Semantic Representations in the Brain: Predicting EEG Responses with CLAP

Jorge Ramos - Cognitive Science Specialization in Machine Learning and Neural Computation

Mentor: Seana Coulson

Visual Context Facilitates Multimodal Continuous Speech Processing: A Study in Monolingual and Bilingual Speakers

Sam Roxas - Cognitive and Behavioral Neuroscience

Mentor: Sarah Creel

A Window On The Perception-Production Relationship Across Accent Differences

Ian Zane - Cognitive Science

Mentor: Lara Rangel

Behaviorally Dependent Hippocampal Interneuron Entrainment to Multiple Rhythms

Panel 10: Social Interactions and Anxiety

Room: Solis 110
Moderator: Amy Bintliff

Sanjana Paul - Psychology

Mentor: Charles Taylor

Investigating the Impact of Cannabidiol on Discrepancies Between Self-Rated and Observer-Rated Performance in a Social Stress Task in Individuals with Social Anxiety Disorder

Olimpia Carrioli - Cognitive Science/Machine Learning

Mentor: Jason G. Fleischer

Decoding Preadolescent Anxiety with Machine Learning Insights from Neuroimaging Data

Amy Nguyen and Danielle Wiedefeld - Cognitive & Behavioral Neuroscience and Clinical Psychology and Psychology

Mentor: Dr. Leslie Carver

Exploring Stimulus Preceding Negativity in Anticipation of Social vs. Non-Social Stimuli in Neurotypical and ASD Toddlers

Panel 11: Cognitive Aging, Neuroplasticity, and Speech Processing

Room: Solis 111
Moderator: Diane Jacobs

Nathalie Gider - Cognitive Science

Mentor: Tyler Bell

Association of Hearing Loss and Cognitive Decline in the Advanced Cognitive Training for the Independent and Vital Elderly (ACTIVE) Study

Leena Kang - Applied Mathematics

Mentor: Dr. Christian Cazares

Reduction of broadband neural activity measures are associated with acute periods of aging in healthy adults

Kate Ruiz - Neurobiology

Mentor: Diane Jacobs

Diagnosing dementia in Spanish-Speaking U.S. Latinos: Potential implications of using self-reported education vs. grade-equivalent reading level for normative referencing of cognitive tests

Doanh Nguyen - Math-Computer Science

Mentor: Dr Sarah Creel

Extracting Probabilites from ASR Models

Panel 12: Machine Learning in Biological Studies

Room: CSB 004
Moderator: Karcher Morris

Ifunanya Okoroma - Data Science

Mentor: Justin Meyer

Machine Learning to Identify Key Interacting Mutations During Phage-Bacteria Coevolution

Yang Han - Bioengineering: Bioinformatics

Mentor: Reem Khojah

AI-based Detection and 3D Imaging of Suspended Organoid Culture

Yifei Ding, Sivagunalan Thamilarasan, and Varsha Mani - Bioengineering

Mentor: Bernhard Palsson

A Machine Learning Model of Bacterial Translation Efficiency from DNA Sequence for Protein Production Applications

Panel 13: Computer and Data Sciences

Room: CSB 005
Moderator: Afraz Hameed

Katelyn Wong - Mathematics and Economics

Mentor: Prof. Hidalgo-Gonzalez

Optimizing Electricity Tariff Structures to Minimize Market Inefficiencies and Promote Equity and Sustainability

Eamon Lee - Electrical Engineering

Mentor: Hanh-Phuc Le

Integrated Vertical Power Delivery for High-Performance Computing

Almog Bar-Yossef - Mathematics - Computer Science (MA30)

Mentor: Jeff Tully

Crashcart: building an alternative network to support a hospital under a ransomware attack

Milo Nguyen – Computer Science

Mentor: Karcher Morris

Inflatable Multi-Chambered Dilator for Treating Vginal Stenosis

Morning Session II

10:45 AM – 11:45 AM

Panel 14: Identity, Culture, and Belonging

Room: Faculty Club – Conference Room 1-3
Moderator: Christina Acosta

Megan Hsu - International Studies - International Business

Mentor: Munseob Lee

South Korean Beauty Standards and their Economic Impacts

Suqi Jiang - Psychology

Mentor: Piotr Winkielman

Do Ratings of Biracial Individuals Depend on How We Categorize Them?

Sophia Bell - Sociology

Mentor: Christena Turner

Half, Whole, and Home: Family and the Making of Mixed Japanese Identity

Caroline Terry - Communication

Mentor: Elana Zilberg

A Garden in the Desert: The Influence of Collective Memory on Japanese American Identity and Environmental Placemaking at the Manzanar National Historic Site

Panel 15: Social Impact and Community Engagement

Room: Faculty Club – Conference Room 4-5
Moderator: Amy Bintliff

Cameron Manard - Psychology B.S. with a Specialization in Clinical Psychology

Mentor: Leslie Carver

Autism Community Outreach Project: What is the US Autism Community's Opinion on the Current Trajectory of Autism Research

Andrea Balcan - Pharmacological Chemistry

Mentor: Borsika Rabin

Ethnographic assessment of a theory of change process involving academic-community partnerships across California focusing on increasing capacity for social service organizations

Cara Chan - Human Developmental Sciences

Mentor: Gail Heyman

Burden of Secrecy: A Naturalistic Investigation of Secret-Keeping

Zoe Decatur - B.S. Education Sciences and B.S. Psychology

Mentor: Amy Vatne Bintliff, PhD., Assistant Teaching Professor

Wellbeing Intervention on Ugandan Adolescents Amid COVID-19

Panel 16: Human Thought and Action

Room: Faculty Club – Seuss Library
Moderator: Libby Butler

Amy Park - Psychology

Mentor: Celeste Pilegard

Do Lapses in Lesson Coherence Lead to a Negative Cascade of Mind Wandering?

Deborah Hughes - Psychology with a Specialization in Clinical

Mentor: Caren Walker

The Influence of Normality on Causal Judgment: Can Mechanism Information Elicit Abnormal Selection in Children?

Amy Nguyen - Business Psychology

Mentor: Adena Schachner

When walls can talk: People make social inferences from towns' protective features

Jessica Sauceda - Clinical Psychology

Mentor: Charles Taylor

Does a Positive Mindset Predict the Treatment Process for Depressed or Anxious Populations?

Panel 17: Cell Biology and Biochemistry

Room: Faculty Club – Atkinson Pavillion
Moderator: Sam Landry

Rebecca Tseng - Bioinformatics

Mentor: Kyle Gaulton

Determining the role of pancreatic beta cell stress responses in type 1 diabetes

Julianna Vega Perez - Biochemistry

Mentor: Eric Bennett

RIOK3 Ubiquitin Binding Capacity is Necessary for 40S Ribosomal Subunit Degradation

Meghana Krishnan - General Biology

Mentor: Karl Willert

Characterizing Wnt5a: Biochemical Insights into Robinow Syndrome-correlated Mutation

Panel 18: Student Well-being and Financial Security

Room: Faculty Club – Cecil's Lounge
Moderator: Nancy Binkin

Andrea Mota - Sociology

Mentor: DR. Harvey Goldman

**For Love of the Game: Examining the Weight
the Business of College Sports Places on Collegiate Athletes**

**Karla Garcia and Mark Lee - Public Health and
Public Health w/ Concentration in Health Policy and Management**

Mentor: Dr. Nancy Binkin

Bridging the Gap: The Impacts of Financial Insecurity on Student Wellbeing at UC San Diego

**Jiawei Yao, Shiv Puliady, and Sarah Plummer - Public Health – Biostatistics,
Public Health, and Public Health**

Mentor: Nancy Binkin

Financial Literacy among UCSD Undergraduates

Panel 19: Microbiome Research and Immunology

Room: Peterson 102
Moderator: Hector Chavez

Leilani Rivera - Microbiology

Mentor: Matthew Daugherty

CARD8 homologs serve as host- and virus-specific innate immune sensors of viral deubiquitinases

Nitya Yerabandi - Human Biology

Mentor: Lars Bode

Exploring the Functional Diversity of the Yanomami Gut Microbiome through HMO and Bile Acid Metabolism

Julie Tran and Arlene Grace Nagtalon - General Biology and Molecular & Cell Biology and Community Research, Education, and Well-Being (Individual Studies Major)

Mentor: Dr. Erika Cyphert

Validating a reproducible in-vitro microbiome culture for high throughput drug screening

Panel 20: Arthritis Research

Room: Peterson 103
Moderator: Chengbiao Wu

Michaela Goodman - Molecular and Cell Biology

Mentor: Maripat Corr

MyD88 as master regulator in a murine model of arthritis

Madison Wong - General Biology

Mentor: Maripat Corr

Symptom severity monitoring by unprovoked behavioral testing in a murine model of arthritis

Louie Zhao - Bioengineering

Mentor: Dr. Miguel Lopez-Ramirez

Genetic Regulation of Endothelial KRIT1 Ameliorates Inflammatory Arthritis

Saee Jadhav - Neurobiology

Mentor: Dr Tony Yaksh

Understanding Widespread Pain in Rheumatoid Arthritis: The Role of the Trigeminal Ganglion

Panel 21: Genetics and Genomics

Room: Peterson 104
Moderator: Isabella Maita

Saloni Dangre - Molecular and Cell Biology

Mentor: Douglas Bartlett

Investigating the Genetic Mechanisms Behind Pressure Tolerance in a High Pressure- Evolved E. coli strain

Davi Salles Leite - Bioengineering: Biotechnology

Mentor: Alexis Komor

Genome Editing for Precision Cell Line Generation in Radiogenomics Applications

Alessandro Cirulli - Biochemistry

Mentor: Kevin Corbett

Chromosome cross-over architecture: investigating chromatin binding of HORMAD ASY1

Nhi Tran - Human Biology

Mentor: Marygorret Obonyo

Expression of Type I Interferon-Stimulated Genes in Gastric Cancer Patients in San Diego County

Panel 22: Developmental Psychology and Cognitive Science

Room: Solis 109
Moderator: Seana Coulson

Naomi Esparza - Cognitive Science with Neuroscience Specialization

Mentor: Gedeon Deák

The Effects of Multimodal Sequences on Eliciting Joint Attention in Infants

Matthew Young - Neurobiology

Mentor: Gedeon Deak

Impact of Extraneous Motions on Joint Attention Bids in Caregiver-Infant Interactions

John Schwarz-torres - Human Biology

Mentor: WIlliam Pelham III

Expectation Violation, Learning via Punishment, and Parental Discipline

Panel 23: Veterans' Health and Cognitive Function

Room: Solis 110
Moderator: Diane Jacobs

Cynthia Deng - Psychology

Mentor: Elizabeth Twamley

Correlates of Cognitive Compensatory Training (CCT) adherence among unstably housed Veterans with mental health conditions

Amelia Orgill - Molecular and Cellular Biology

Mentor: Cynthia Hsu

Early detection of liver disease in patients with alcohol use disorder improves long-term abstinence

Kelsey Schilling - Clinical Psychology

Mentor: Dr. Victoria Merritt

Traumatic Brain Injury, Environmental Exposures, and Subjective Cognition in Post-9/11 Veterans Enrolled in the VA Million Veteran Program

Kathy BA Nguyen - Neurobiology

Mentor: Christine Smith

Use of a Retrograde Memory News Events Test to Characterize Memory Impairment in a Veteran with History of Traumatic Brain Injury and Epilepsy

Panel 24: Soft Robotics and Haptics

Room: Solis 111
Moderator: Karcher Morris

Gio Torres - Aerospace Engineering

Mentor: Michael Tolley

Design of a Waterproof Enclosure for an Untethered Underwater Soft Robot

Emily Huang - Mechanical Engineering

Mentor: Michael Tolley

Volumetric Control System for Fluidic Soft Robots

Nina Sediki, Kaitlyn Lavarias, and Hannah Lim - Mechanical Engineering, Mechanical Engineering, and Bioengineering: Biotechnology

Mentor: Tania Morimoto

HaptOGrasp: A Soft Haptic Origami Grasper for Rendering Grip Force Feedback

Panel 25: Materials Sciences

Room: CSB 004
Moderator: Katya Evdokimenko

Colin Stengle - NanoEngineering

Mentor: Tod Pascal

All-atom MD simulations to model the stress-strain response, degree of crystallinity, and thermomechanical properties of biodegradable, bioderived thermoplastic polyurethane polymers.

Amy Nguyen - Chemical Engineering

Mentor: David Fenning

Identifying Optimal Processes for Developing Materials & Future Scalability

Gabriella Ching, Elysa Loraine Lebig, and Griffin Hurst - Chemical Engineering

Mentor: Justin Opatkiewicz

Formulation and Materials Study of Early-stage Lip Glosses

Panel 26: Computer Science and Engineering

Room: CSB 005
Moderator: Afraz Hameed

Venkataram Sivaram - Computer Science

Mentor: Ravi Ramamoorthi

Projective Shape Metamorphosis Using Optimal Transport

Eagan Kaminetz - Mathematics-Computer Science

Mentor: Robert Webber

Low-Rank and Sparse Preconditioners for Kernel Learning

Serena Chen and Molly MacLaren - Computer Science and Computer Engineering

Mentor: Michael Coblenz

A Rust-Based Comparison of Functional and Imperative Programming

Afternoon Session I

1:00 PM – 2:00 PM

Panel 27: Language, Culture, and Identity

Room: Faculty Club – Conference Room 1-3
Moderator: Christina Acosta

Jewel Fulmore - Literature and Writing

Mentor: Elizabeth (Libby) Butler

Challenging Linguistic Discrimination: Anti-Racist Writing Pedagogy in First-Year College Courses

Ananya Giri - Ecology, Behavior, and Evolution

Mentor: Aniket De

The Divergence of Hindi and Urdu: Evolving Ideas of Nationhood and Religious Identity in Colonial and Partitioned India

Tairan Liu - CG35

Mentor: Jason Fleischer

Gender Inequality in English Textbooks around the world: An NLP approach.

Ber Al Jaibaji - Human Biology

Mentor: Melinda Owens

Identity and Impact: Do Students Engage Differently with Scientist Spotlights Who Reflect Their Backgrounds?

Panel 28: People, Places, and Social Systems

Room: Faculty Club – Conference Room 4-5
Moderator: Shawn Khalifa

Charlie Luthi - Sociology

Mentor: Michel Estefan

From Farm Fields to Lecture Halls: Agrarian and Academic Socialist Consciousness in America

Rain Lins - Urban Studies and Planning

Mentor: Amy Lerner

Facilitating Food Sovereignty Through Sustained Land Access for Urban Agriculture: Barriers, Mechanisms, and Opportunities in the City of San Diego

Jarvis Tran - Urban Studies and Planning

Mentor: Amy Lerner

Something's Wrong with the Neighborhood: The Implications of Urban Planning and Design on Resident Socialization in the North University Neighborhood

Natalee Chin - Sociology - International Studies

Mentor: April Sutton

Defining Change for Chinatowns in California

Panel 29: Culture Across Border Lines

Room: Faculty Club – Seuss Library
Moderator: Andrew deWaard

Elizabeth Ju - Communication

Mentor: Andrew deWaard

"They are Mine!": The Dangers of Kpop Music Videos and Fandoms at the Extremes: Sexualization, Objectification, and How Kpop Companies Use Music Videos to Reinforce Parasocial Behaviors at the Expense of Both Fans and Artists

Mak Gonzales - Communications

Mentor: Andrew deWaard

Is This Town Big Enough for the Two of Us?: Reconsidering how the Portrayal of Women in TV Shows of the Western Genre Reinforces and Challenges Gender Norms, using industrial, textual, and audience reception, and analysis

Grace Gomez - Communication

Mentor: Andrew deWaard

In a Moment It Could All Go Boom: An Extreme Western Government, How Netflix's Arcane Uses Solidarity, Power, and Family to Shape Class and Gender Struggles of Minorities in Political Conflict Using a Feminist, Marxist, and Stylistic Analysis

Gabriel Soberón Nelson - Music and Theatre

Mentor: Karola Obermüller

Universal Aesthetics Theorem

Panel 30: Life Stories

Room: Faculty Club – Atkinson Pavillion
Moderator: Dino Dinco

Sophie Zhang - ICAM

Mentor: Dino Dinco

Demonic: A Continuous Archive

Lauren Taylor - Literatures in English

Mentor: Andrea Mendoza

Permeating Racial Boundaries: The Multiracial's Deconstruction of Colonial Racialization Via the Third Space

Grace Smith - Media

Mentor: DINO DINCO

Mending Distance

Amanda Salatino - Interdisciplinary Computing and the Arts Major, Psychology B.A

Mentor: Dino Dinco

The Eccentric Subconscious

Panel 31: Social-Emotional Learning and Intervention

Room: Faculty Club – Cecil's Lounge
Moderator: Amy Bintliff

Ray Yin - Psychology

Mentor: William E. Pelham III.

Intervening to Address Discouragement and Dropout in Therapy: An Application to Behavioral Parent Training

Itzel Gonzalez Velazquez - Cognitive Science w/specialization in Neuroscience

Mentor: Dr. Amy Vatne Bintliff

Family Engagement through Out-Of-School Time: A Community Engaged Study

Ainsley Gibson - Psychology

Mentor: Amy Bintliff

Healing & Learning: Trauma-Informed social-emotional learning for Refugee Youth in Uganda

Carolina Zarate Calleros - General Sociology

Mentor: Christena Turner

Bridging Restorative Practices and Social-Emotional Learning: Implications for School Climate and Academic Achievement

Panel 32: Pregnancy and Developmental Biology Research

Room: Peterson 102
Moderator: Hector Chavez

Vivian Chen - Human Biology

Mentor: Pamela Mellon

Bmal1 Regulation of RNA Degradation During Oocyte Development

Irum Hasan - Human Biology

Mentor: Marianna Alperin

The Effect of Pregnancy-Associated Systemic Milieu on Muscle Stem Cells in Vitro

Robert Nasanbat - Neurobiology

Mentor: Kathleen Fisch

Developing In Vitro Models of Pregnancy Disorders Using Human iPSCs

Panel 33: Sensory Perception and Processing

Room: Peterson 103
Moderator: Brendan Prendergast

Kabir Arora - Neurobiology

Mentor: Tim Gentner

Optical modulation of context-dependent categorical perception in avian auditory cortex

Zach Weiner - Biophysics

Mentor: Andrea Chiba

No Free Lunch: A Proposition to Revitalize Audio-Centric Machine Learning with Classical Mathematical Methods

David Ngan - Neurobiology

Mentor: Matthew Lovett-Barron

The Timescales and Neural Basis of An Odor-Evoked Persistent Internal State in Larval Zebrafish

Panel 34: Cardiac Cell Biology and Development

Room: Peterson 104
Moderator: Max Neal

Thu Nguyen - Human Biology

Mentor: Alice Zemljic-Harpf

In Cardiac Myocytes SGLT2 Inhibition Induces Connexin 43 Re-localization, and Cytoskeletal Reorganization: A Novel Mechanism for Reduced Cytosolic Ca2+ Peaks after Adrenergic Stimulation

Ethan Lu - General Biology

Mentor: Robert Ross

The characterization of the resulting phenotype of dual loss of ZO1 and ZO2 in cardiac myocytes in embryonic mouse development

Angela Wang - Biochemistry

Mentor: Xi Fang

The role of AGK in the heart and cardiomyopathy

Matthew Nunes - Molecular and Cell Biology

Mentor: Deborah Yelon

osr1 acts synergistically with hand2 to promote cardiomyocyte production in zebrafish

Panel 35: Topics in Physics

Room: Solis 109
Moderator: Adam Burgasser

Ashley Thorshov - Physics w/Specializ Mtrls Phys

Mentor: Alex Frañó

Fabricating and Characterizing Hybrid Thin-Film Magnet-Superconductor Patterned Nanowires

Leo Megliola - Physics, Computational

Mentor: Professor Benjamin Grinstein

mg5qs: Integration Tools for HEP MCMC Simulations

Connor Stratman - Physics

Mentor: Tongyan Lin

Daily modulation of low-energy nuclear recoils from sub-GeV dark matter

Momei Fang - Physics and Cognitive Science

Mentor: Tongyan Lin

Dark Matter Direct Detection Through Phonon Creation

Panel 36: Understanding Alzheimer's Disease

Room: Solis 110
Moderator: Catherine Tallman

Amber Lawrence - Neurobiology

Mentor: Kim Dore

Sex Differences in Amyloid Plaques and Astrocyte Migration in an Alzheimer's Disease Mouse Model

Nicole Castro - Biochemistry

Mentor: Kim Dore

Metabolomics of mouse plasma reveals sex differences in lipids and sugars metabolism in Alzheimer's disease model mice

Alanna Sun and Elizabeth Kim - Human Biology and Business Psychology

Mentor: Jessica Wang-Rodriguez

The Interaction of Alzheimer's Disease Risk Factor Treatment Drugs on Alzheimer's Disease Incidence and Progression

Panel 37: Neuroscience and Addiction Research

Room: Solis 111
Moderator: Justin Trotter

Daria Kouzminova - Cognitive Science

Mentor: Lieselot Carrette

Ilastik Interactive Supervised Image Classification to Improve Whole-Brain Cell Counting

Julie Qian - Chemistry

Mentor: Olivier George

Chemogenetic Activation of Corticotropin Releasing Factor-Expressing Neurons in the Central Nucleus of the Amygdala Influences Cocaine-Related Behaviors in a Sex- and Session- Dependent Manner

Kathleen Bai - Neurobiology

Mentor: Olivier George

The emergency contraceptive, ulipristal acetate, does not alter cocaine self-administration in female and male Wistar rats

Panel 38: Materials Sciences and Engineering

Room: CSB 004
Moderator: Katya Evdokimenko

Parth Jha - Mechanical Engineering

Mentor: Professor Lisa Poulikakos

Tailored Filters as a Solution to Color Vision Deficiency

Marshall Hamon - Mechanical Engineering

Mentor: Olivia Graeve

Optimizing Red-Emitting Phosphors Through Host Lattice Composition for Advanced Lighting Applications

Jason Chang - Aerospace Engineering, Mathematics-Computer Science

Mentor: Dr. Nicholas Gravish

Phase Transitions of Active Robotic Materials

Marcus Velasquez - Aerospace Engineering

Mentor: Olivia Graeve

Immobilization of laccases on CuO and ZnO nanoparticles and their dye degradation applications

Afternoon Session II

2:15 PM – 3:15 PM

Panel 39: Language and Heritage

Room: Faculty Club – Conference Room 1-3
Moderator: Christina Acosta

Alexis Truman - Cognitive & Behavioral Neuroscience

Mentor: Anne Beatty-Martínez

Social Networks as a Measure of Bilingual Language Experience

Erik Glesne - Cognitive Science

Mentor: Sarah Creel

Using Forced Aligners to Analyze Perception Production Relationships in Native Mandarin Speakers

Calvin Chen - Sociology

Mentor: Harvey Goldman

Ni Hao I Speak English : Understanding the Definitions of the Identity of Chinese American

Tylar F. Kameda - Linguistics

Mentor: Gabriela Caballero

Principles of grammatical gender assignment in San Juan Piñas Mixtec

Panel 40: Politics of Identity and Social Justice

Room: Faculty Club – Conference Room 4-5
Moderator: Shawn Khalifa

Kira Ruffner - Sociology - Law and Society

Mentor: Michel Estefan

Echoes of Exclusion: The Historical Continuity of Voter Suppression Tactics in Georgia

Nargiz Salmanova - Sociology & CGS

Mentor: Kevin M. Lewis

Personal and Political: Reproductive Justice and a Woman's Pursuit of Liberty in the United States

Alyssa Lim - Sociology: Law and Society and Political Science: Public Law

Mentor: Kwai Ng

Exclusion to Idealization: The Ideology of Model Minority for Asian Americans and Immigrants

Bella Ely - Sociology and Political Science

Mentor: Michel Estefan

Mapping the Chaos: How Organizations Respond to Shifting Political Contexts

Panel 41: Culture, Identity, and Feminism

Room: Faculty Club – Seuss Library
Moderator: Christine Hunefeldt

Sinatra De Quiroz - History

Mentor: Nancy Kwak

Finding Margret Robinson

Sierra Pohl - Sociology

Mentor: Kevin Lewis

Eras of Femininity: How Taylor Swift and Her Fans Embrace Womanhood

Daisy Zhang - Sociology

Mentor: Mary Blair-Loy

Fantasy as Resistance Chinese Feminism and the Subversive Appeal of the Romance Game Love and Deepspace

Panel 42: Moving Images

Room: Faculty Club – Atkinson Pavillion
Moderator: Alain J.-J. Cohen

Emily Yurkevich - Human Biology

Mentor: Alain J.-J. Cohen

Sequence 22, Fleeting Feigned Love, to Overall Interpretation of Jean-Luc Godard's "Le Mépris"

Mia Elliott - History

Mentor: Alain J.J. Cohen

Lost in Transposition: Female Agency in Roger Vadim's Les Liaisons Dangereuses

Devin Esser - Marine bio minor in film studies

Mentor: Alain Cohen

Color recurrence in Godard's Contempt

Hannah Drake - History & Ethnic Studies

Mentor: Nancy Kwak

The Rise of the Undead: The Racial and Gender Politics Present in 1929-49 Zombie Cultural Productions

Panel 43: Children's Learning and Development

Room: Faculty Club – Cecil's Lounge
Moderator: Libby Butler

Jaynne Quezada-Mares - Developmental Psychology

Mentor: Gail Heyman

"What is climate change and what can I do about it?" A survey and educational intervention with 10- to 13-year-olds

Shanthi Kuppa - Cognitive Psychology

Mentor: Caren Walker

Generalizing Causal Structures: Can causal category training support children's learning of scientific feedback loops?

Abby DeSpain - Psychology

Mentor: Celeste Pilegard

Developing Science Beliefs: Investigating the Role of Motivation on Nature of Science Instruction

Ray Yin - Psychology

Mentor: Adena Schachner

Laptops are for Learning, Tablets are for Fun: Children's Information Seeking Relates to Belief in Distinct Device Functions

Panel 44: Muscle Biology and Regeneration

Room: Peterson 102
Moderator: Gail Heyman

Sophia Jaberi Vivar - General Biology

Mentor: Shiri Gur-Cohen

Unveiling the Role of the Lymphatic Niche in Guiding Stem Cell Fate Decisions During Tissue Regeneration

Juliette Hamid - Chemistry

Mentor: Padmini Rangamani

Computational modeling demonstrates the role of store-operated calcium entry in modulating skeletal muscle force production

Katharine Sohn and Andrew Dallape - General Biology

Mentor: Ellen Breen

GGTA1 gene inactivation in mice: Effects on running endurance and muscle strength

Panel 45: Environmental Microbiology and Ecology

Room: Peterson 103
Moderator: Brendan Prendergast

Michael Janelle - Oceanic and Atmospheric Science

Mentor: Sarah Gille

Investigating Carbon Cycle Anomalies and Surface Dynamics in the Southern Ocean Using B-SOSE

Jonathan McGurrin - Marine Biology

Mentor: Lisa Levin

Macrofauna Invertebrates on Carbonates at the Newly Discovered Sanak Methane Seeps (2020m), Aleutian Margin Alaska

Megan O'Brien - Marine Biology

Mentor: Sara Jackrel

Spatio-temporal Variation in Free-Living and Host-Associated Bacteria of a Glacier System in the Sierra Nevada, CA

Riki Kataoka - Marine Biology

Mentor: William Fenical

Finding Antibacterial Compounds in Marine Bacteria in the Great Salt Lakes

Panel 46: Chronic Pain and Neuropathy

Room: Peterson 104
Moderator: Max Neal

Risha Sharma - Human Biology

Mentor: Maripat Corr

Sex Differences in a Murine Model of Arthritis

Daniella Bandari - Human Biology

Mentor: DR. Tony Yaksh

An Immunofluorescent Approach: HD10.6 Cells and their Nociceptive Neuronal Characteristics

Sebastian Gastelum and Nathanial Linstrom - Human Biology

Mentor: Nigel Calcutt

A KCC2 Potentiator Reverses Impaired Spinal KCC2 Expression and Rate Dependent Depression of the H Reflex and Alleviates Painful Neuropathy in Rodent Models of Type 1 Diabetes

Panel 47: Robotics Controls and Control Theory

Room: Solis 109
Moderator: Adam Burgasser

Fnu Anu - Computer Science

Mentor: Michael T. Tolley

Amphioxus Data Collection and Analysis

Matthew Kim - Computer Science

Mentor: Sylvia Herbert

DeepCBF: Learning Hamilton-Jacobi Solutions to Generate Smooth and Flexible Control Barrier Functions

Stephen Huang - Electrical and Computer Engineering

Mentor: Nikolay Atanasov

Robot Proving Grounds

Panel 48: Neural Networks and Cognitive Science

Room: Solis 110
Moderator: Catherine Tallman

Borngreat Omoma-Edosa - Data Science

Mentor: Bradley Voytek

Synthesizing human neuroimaging data with vision-language models

Manu Bhat - Math and Computer Engineering

Mentor: Rose Yu

AtlasD: Automatic Local Symmetry Discovery

Henry Xu - Data Science

Mentor: Lily Weng

Building Faithful and Interpretable Deep Neural Network models

Connie Xie - Clinical Psychology and Cognitive Behavioral Neuroscience

Mentor: Dawn M. Schiehser

Automated Mild Cognitive Impairment Detection (MCI-PDx) in patients with Parkinson's Disease

Panel 49: Neurodegenerative Disease Mechanisms

Room: Solis 111
Moderator: Justin Trotter

Zayne Yousef - Neurobiology

Mentor: Paula Desplats

Effects of a Circadian-Modulating Intervention in a Parkinson's Disease Mouse Model

Celeste Morales - Molecular and Cell Biology

Mentor: Kim Dore

Characterization of protein palmitoylation in the brain of Alzheimer's disease model mice

Reagan Hsu and Suravi Bajaj - Computer Science and Neurobiology

Mentor: Weg Ongkeko

Short-Read DNA Analysis in Alzheimer's Disease--APOE-Stratified Differential Expression and Predictive Modeling

Panel 50: Innovations in Science and Engineering

Room: CSB 004
Moderator: Boyu Meng

Kenneth Visk - Bioengineering: Biotechnology

Mentor: Kiana Aran

Microfluidic Device for Erythrocyte Analysis

Angel Gomez - Physics

Mentor: Dr. Boyu Meng

Developing a Clinical Quality Assurance procedure for Multiple Targets Stereotactic Radiosurgery

Julia Lee - Mechanical Engineering

Mentor: Patricia Hidalgo-Gonzalez

Evaluating Capacity Factors for Renewable Energy Integration in a Climate Resilient & Energy Equitable California Electricity Grid

Afternoon Session III

3:30 PM – 4:30 PM

Panel 51: Entomology and Bee Biology

Room: Faculty Club – Conference Room 1-3
Moderator: Christina Acosta

Kris Price - General Biology

Mentor: David Holway

Effects of interannual variation in precipitation on native bee body size

Gabriela Marcial - Environmental Systems: Ecology, Behavior, Evolution

Mentor: Professor James Nieh

Tracking infection in Apis Mellifera: understanding the progression of Nosema ceranae

Alex Beltran - Cognitive Behavioral Neuroscience

Mentor: James Nieh

Finding the Gene: Measuring changes in juvenile hormone genes in response to honey bee shaking signals.

Panel 52: Social Justice, Policy, and Human Rights

Room: Faculty Club – Conference Room 4-5
Moderator: Shawn Khalifa

Emma Starkey - Communication

Mentor: Elana Zilberg

The Ecology of Aid at Whiskey 8 and the Border Security Industrial Complex: Documenting Human Rights Violations and the Humanitarian Aid Response by American Friends Service Committee (AFSC) at the US-Mexico Tijuana River Valley Open-Air Detention Sites

Amber Fig - Sociology

Mentor: Harvey Goldman

All of which are American Dreams: Framing Theory in the US and its Effects on Pro-Palestinian Demonstrations On College Campuses

Jair Huerta and Sofia Morales - Political Science

Mentor: Erika Crable

Policy Surveillance & Political Rhetoric About Harm Reduction Services in Six States

Jin Johnson - History and Ethnic Studies

Mentor: Prof. Ross Frank

'Stochastic Terrorism': A Case Study of Online Extremism and anti-LGBTQ+ Activism

Panel 53: Economics, Policy, and Social Behavior

Room: Faculty Club – Seuss Library
Moderator: Christine Hunefeldt

Erlinda Fuentecilla - Sociology

Mentor: Richard Madsen

Volunteerism and Motivation

Anica Xie - Art History

Mentor: William Tronzo

Medieval to Contemporary: Economics and Participatory Spectatorship

Minh Tuan Nguyen - Economics

Mentor: Julie Berry Cullen

Accessibility to Firearms and Dynamics of Domestic Violence Homicides in the United States

Simon Roberts - Political Science - Public Law

Mentor: Pamela Ban

Marijuana and Policing: The impact of reform and partisanship on marijuana arrest practices

Panel 54: Cancer Biology and Metastasis

Room: Faculty Club – Atkinson Pavillion
Moderator: Max Neal

Arya Lalezarzadeh - Human Biology

Mentor: Jing Yang

The Role of IFNAR1 in Breast Cancer Metastasis

Sophia Xie - General Biology

Mentor: Jing Yang

The Role of TPM2 in Matrix Stiffness-Driven EMT and Metastasis in Breast Cancer

Hodaya Knafo - Human Biology

Mentor: Shiri Gur-Cohen

Microenvironmental and Cellular Influences of Angptl7 Expression in Cancer Models

Margaret Jones - Biology with a Specialization in Bioinformatics

Mentor: Jill Mesirov

Validating a mouse model of a pediatric brain tumor

Panel 55: Opening the Classroom

Room: Faculty Club – Cecil's Lounge
Moderator: Libby Butler

Seema Rida - Cognitive Science Spec. Machine Learning and Neural Computation

Mentor: Andrea Chiba

AI Classroom

Sarah Segall - Psychology, B.S.

Mentor: Gail Heyman

Developing Best Practices for AI Use in Education

Laura Avila and Yolanda Feng - B.S Psychology with Specialization in Clinical Psychology and General Biology

Mentor: Claire Meaders

Comparing the Use and Implementation of Classroom Observation Protocols from an Observer's Perspective

Panel 56: Neonatal Health and Development

Room: Peterson 102
Moderator: Sheri Thompson

Brandon Saiki - Molecular and Cellular Biology

Mentor: Eniko Sajti

Unraveling Myeloid Cell Response to Hyperoxia: Genetic Variation and Implications for Resilience Against Neonatal Lung Injury

Cadence Seymour - Molecular Synthesis

Mentor: Eniko Sajti

Neonatal hyperoxia exposure derails the normal development and the physiological aging of the lung

Darleen Salameh and Kamryn Conway – Neurobiology and General Biology

Mentor: Lindsay Burnett

Pain from Birth Trauma is Socially Transferred to Partners

Panel 57: Neurodevelopment and Mental Health

Room: Peterson 103
Moderator: Brendan Prendergast

Josh Lyman - Cognitive Behavioral Neuroscience

Mentor: Kelly Courtney

Associations Between Physical Activity and Structural Brain Volume Among Mid-Adolescents who Engage in Sports

Ashley Becker - Cognitive Science, Spec. Clinical Aspects

Mentor: Carolina Makowski

Associations between mental health, cognition, and brain imaging within the Adolescent Brain Cognitive Development Study

Alana Tamayo - Biochemistry

Mentor: Paula Aristizabal

Depression and anxiety in adolescents and young adults newly diagnosed with cancer; Prevalence and screening

Panel 58: Animal Communication and Social Pain

Room: Peterson 104
Moderator: Justin Trotter

Nathaniel Nono - Neurobiology

Mentor: Eiman Abdel-Azim

Investigating Endocannabinoid Influence on Social Pain and Its Neural Overlap with Physical Pain

Sophie Neale - Cognitive & Behavioral Neuroscience

Mentor: Lara Rangel

Ultrasonic Signaling in Rats: the 25 kHz Call

Alina Siddiqui and Marissa Todesco – Neurobiology and Cognitive and Behavioral Neuroscience

Mentor: Timothy Gentner

The Role of Motor-Auditory Communication in Vocal Flexibility Differences Across Songbird Species

Panel 59: Audio Signal Processing and Data Science

Room: Solis 109
Moderator: Adam Burgasser

Jose Enrique Siono Gutierrez - Electrical Engineering

Mentor: Karcher William Morris

Enhancing Music Education with the Fourier Transform: Mapping Sound into Color Patterns

Pranav Singh - Data Science

Mentor: Andrea Chiba

Using LLMs for Audio Analysis

Alisha Foster - Applied Mathematics

Mentor: Robert Webber

Comparison of Algorithms for Nonnegative Matrix Factorization for Automatic Drum Transcription

Panel 60: Memory and Learning

Room: Solis 110
Moderator: Catherine Tallman

Emma Kandel - Cognitive Behavioral Neuroscience, Psychology

Mentor: Anastasia Kiyonaga

The Power of Choice: Effects of Agency and Goal Cohesion on Working Memory

Philip Li - Business Psychology

Mentor: Timothy Brady

Understanding the Influence of Recent Perceptual Experiences on Current Memory Biases

Jasmin Rosato - Psychology

Mentor: Christine Smith

Retrograde memory for news events in epilepsy: examination of the temporal extent of retrograde amnesia

Manjot Kaur - Cognitive and Behavioral Neuroscience

Mentor: Erin Sundermann

Evaluating Preliminary Recruitment Strategies for Research Studies in Older Women at Higher Risk of AD

Panel 61: Neural Mechanisms of Cognition and Behavior

Room: Solis 111
Moderator: Marsida Kallupi

Naseem Moussa - Neurobiology

Mentor: Kay Tye

Analyzing the Effects of Social Relocation on Rodent Behavior and Medial Prefrontal Cortex (mPFC) Dynamics

Yifan Lou - Cognitive Science

Mentor: Andrea Chiba

Characterizing Homebase Dynamics in Free-Roaming Rats Through Behavioral, Neural, and Robotic Interaction Analysis

Ruby Tseng - Neurobiology

Mentor: Kay Tye

Neuromodulated mixture of experts: A prefrontal cortex inspired architecture for lifelong learning.

Bri Newton - Psychology: Cognitive and Behavioral Neuroscience

Mentor: Miranda J. Koloski

Investigating Flexibility Using Probabilistic Reversal Learning in Male and Female Rats Following Prefrontal Cortex Traumatic Brain Injury

Panel 62: Medical Applications of Computer and Data Science

Room: CSB 004
Moderator: Boyu Meng

Praharshitha Thumati - Biochemistry

Mentor: J. Andrew McCammon

Using Computational tools to find more optimized drug candidates to treat TB

Ricardo Amador - Data Science

Mentor: Christine Smith

Automation of Traumatic Brain Injury Neuroimaging Data Reconstruction, Using Python and Brain Imaging Data Structure (BIDS)

Carter Tran and Emily Xie - Data Science, Math-Economics and Mathematics-Computer Science

Mentor: Dr. Hoameng Ung

Fine-Tuning NeuroGPT for EEG-Based Real-Time Seizure Detection

Abstracts

Ber Al Jaibaji

Human Biology, Muir

Mentored By Melinda Owens

Identity and Impact: Do Students Engage Differently with Scientist Spotlights Who Reflect Their Backgrounds?

Increasing the number of diverse scientists can address longstanding inequities within STEM fields and foster innovation through inclusive perspectives. Representation matters because students from historically marginalized backgrounds face higher barriers to retention, potentially in part due to the limited visibility of relatable role models in science. One approach to improving representation in STEM education is Scientist Spotlight assignments. These assignments introduce students to diverse scientists through biographical narratives, aiming to influence students' perceptions of the field by humanizing scientists and demonstrating that people with diverse identities have successful scientific careers.

This study examines whether students engage differently with Scientist Spotlights depending on their perceived similarity to the featured scientist. Specifically, we investigate three forms of similarity: demographic similarity shared via survey (e.g., shared race or gender), self-reported identity in reflections (e.g., LGBTQ+ identity), and self-reported non-identity in reflections (e.g., shared personality traits).

Student responses were analyzed from a lower-division Biology course at a large, diverse, West Coast R1 university. Using a coding framework adapted from Rivera et al. (2024), responses were categorized into themes related to diversity, self-efficacy, and humanizing scientists. We examined whether students who identified more closely with the scientist provided longer responses, used a greater variety of codes, or expressed more reflections about identity, self-efficacy, and inclusivity.

If representation enhances self-efficacy in STEM, this study could provide valuable evidence-based recommendations for educators. By intentionally selecting diverse role models that reflect their student populations, educators can structure inclusive curricula that foster minority student persistence.

Ricardo Amador

Data Science, Muir

Mentored By Christine Smith

Automation of Traumatic Brain Injury Neuroimaging Data Reconstruction, Using Python and Brain Imaging Data Structure (BIDS)

We developed a Python-based pipeline to automate the transformation of raw neuroimaging data into the standardized Brain Imaging Data Structure (BIDS) format. The dataset involved structural neuroimaging data collected for adults with or without mild traumatic brain injury (mTBI) histories. The structural neuroimaging data types were the following: T1-weighted, FLAIR, high-resolution T2-weighted images of the hippocampus, diffusion imaging, and arterial spin labeling.

The automation process involved several steps, including 3D reconstruction, sorting, organizing, and renaming the files according to the BIDS specifications, which includes the addition of a JSON file that specifies information about the MRI scan. Additionally, the pipeline incorporates quality checks and validation steps to ensure data integrity throughout the conversion process. An intuitive, user-friendly interface was also developed to make this tool accessible to users without coding experience.

Fnu Anu

Computer Science, Marshall

Mentored By Michael T. Tolley

Amphioxus Data Collection and Analysis

Marine animals exhibit diverse locomotive strategies that optimize maneuverability and propulsion in aquatic environments. Amphioxus employ body undulations similar to those observed in eels to generate thrust and navigate efficiently. Understanding these movement dynamics can advance bio-inspired robotic control by enhancing our comprehension of marine biomechanics. Traditional video-based motion analysis lacks standardized, automated pipelines for tracking and quantifying these complex movements efficiently. This research aims to analyze amphioxus locomotion using video-based tracking and machine learning models to develop a robust data pipeline for behavioral modelling. We maintained amphioxus specimens under controlled conditions, monitoring water quality (PH and salinity) and culturing algae for their nutrition. Additionally, we recorded high-resolution videos of amphioxus specimens to capture and model their undulatory swimming behaviors. Overall, this work contributes to creating a scalable approach to extracting and modeling amphioxus swimming behaviors using AI-driven video analysis. These insights contribute to marine biomechanics research and bio-inspired robotics by refining our understanding of natural swimming.

Kabir Arora

Neurobiology, Revelle

Mentored By Tim Gentner

Optical modulation of context-dependent categorical perception in avian auditory cortex

How does our current situation influence our perception of the world—how does context get integrated into behavior? To understand this, my research aims to investigate the perceptual circuitry of the song bird brain. Having evolved highly specialized brain regions for the reception and encoding of auditory information, song birds offer a perfect model for the targeted measurement of the auditory-perception process. Many areas relevant to this question have been well established, though particularly interesting is the caudomedial mesopallium (CMM). CMM is at the interface of the perception of a stimulus and a premotor area that uses perception to organize vocalizations. Probing CMM may yield how context gets integrated into behavior, and I accordingly plan to use optogenetics—a technique that allows for light-activated suppression of activity—to disrupt activity in CMM during performance of a categorical perception task. This task builds off previous work from our lab showing that context influences future auditory perception through a narrowing attention on the region of stimulus space associated with that cue. Using this same paradigm but now with introduced optogenetics, I hope to see if the effect of this cue-induced attention gets reduced upon suppression of CMM activity. Uniquely, optogenetics allows for precise and time-controlled suppression of activity, and I can explore how different timings of suppression differentially effect task performance. Ultimately, the goal is to better understand the role of CMM within its broader perceptual-to-motor circuit context, as well as to get a closer understanding of where and how context-integration occurs in the brain.

Laura Avila

B.S Psychology with Specialization in Clinical Psychology, Seventh

Mentored By Claire Meaders

Comparing the Use and Implementation of Classroom Observation Protocols from an Observer's Perspective

Classroom observation tools quantify teaching and learning activities and they offer instructors constructive feedback to enhance their instructional practices. In this study, two undergraduate research assistants (URAs) were trained to apply three observation protocols - COPUS, CDOP, and PAITE - simultaneously in STEM classrooms where each of these protocols measures a different aspect of teaching. The URAs received formal training in each protocol and conducted observations across multiple STEM classrooms. Data analysis focused on evaluating the type and depth of information each tool offered, along with the time investment and ease of implementation. Results showed that each protocol provides instructors with useful and varied feedback on their teaching practices. Moreover, the process of analyzing classrooms differed between protocols where the undergraduate observers encountered distinct benefits and challenges between COPUS, CDOP, and PAITE. These classroom observation tools provided an additional way for instructors to receive feedback on their teaching. Additionally, the comparison of each protocol may provide the Teaching and Learning Commons with important insights on how to effectively implement them. This may lead to the wider use of classroom observation protocols as a method for providing feedback to college instructors.

Jackie Aviles

Public Health w/ Concentration in Community Health Sciences, Sixth

Mentored By Nancy Binkin

Making Ends Meet: How UC San Diego Students Pay for their Education and Overcome Financial Gaps

While financial aid packages provide grants and scholarships, they often include loans. To learn more about student loan attitudes and practices, we conducted a survey to assess the number of students who were offered and who accepted loans, anticipated total debt, the extent to which the loans alleviate financial insecurity, and concerns about their impact. In February 2025, a multi-purpose Qualtrics survey that included a debt module was administered to undergraduate Public Health and Economics students at UCSD. EpiInfo 7.2.6 was used to calculate frequencies and prevalence rate ratios. The response rate was 80%. Of the 774 respondents, 440 (57%) received a financial aid package, of whom 35% were offered Federal loans. Of those offered loans, 74% accepted. Forty percent of students with loans believed they will accumulate loan debts > $20,000 by graduation. Despite the additional funds that loans provide, students with loans were still 1.3 times more likely to face financial difficulties than students with other forms of financial aid (53% vs. 41%; $p < 0.01$). Common reasons among respondents for rejecting loans are fear of accruing debt (27%) and insufficient knowledge of student loans (14%). Many students rely on loans to meet rising attendance costs, although students are reluctant to take out loans, and current loans are not adequate to prevent financial insecurity. To ensure student needs are met, additional aid and resources on loan repayment and long-term financial wellness should be implemented.

Kathleen Bai

Neurobiology, Revelle

Mentored By Olivier George

The emergency contraceptive, ulipristal acetate, does not alter cocaine self-administration in female and male Wistar rats

Rationale: Sex differences in the physical effects and cravings associated with cocaine are influenced by sex hormones. Estrogens are associated with vulnerability to cocaine while progesterone plays a protective role against cocaine pathology. We sought to test the hypothesis that ulipristal acetate (UPA), an emergency contraceptive that antagonizes progesterone receptors, would promote vulnerability to cocaine in female rodents alone.

Objectives: We aimed to investigate the role of UPA on cocaine self-administration in rats in an operant paradigm to investigate if acute antagonism would promote cocaine-related behaviors.

Methods: Following intravenous catheter surgery, male and female rats self-administered cocaine in an operant paradigm under short access (ShA) and/or long access (LgA) conditions. Rats then received

UPA treatment (vehicle, 0.3, 1, or 3 mg/kg) before LgA sessions. Progressive ratio sessions were conducted with rodents receiving vehicle or 3 mg/kg of UPA. mRNA levels of the Pgr gene were assessed in addiction-relevant brain regions 24 hours after a UPA injection. A locomotor test was conducted to test if chronic UPA administration altered locomotion.

Results: UPA treatment did not alter cocaine self-administration or motivation to self-administer cocaine. No mRNA changes were observed in the hippocampus, interpeduncular nucleus, or prelimbic + infralimbic cortices. Lastly, no changes in locomotor behavior were observed following UPA treatment.

Conclusions: Antagonizing progesterone receptors with UPA did not alter cocaine-related behaviors, change Pgr mRNA levels, or alter locomotion. Although acute administration of hormonal contraceptives had no effect, further investigations of the role of chronic hormonal contraceptives on drug-related behaviors should be conducted.

Suravi Bajaj

Neurobiology, ERC

Mentored By Weg Ongkeko

Short-Read DNA Analysis in Alzheimer's Disease--APOE-Stratified Differential Expression and Predictive Modeling

Alzheimer’s disease (AD) is a progressive neurodegenerative disorder characterized by cognitive decline and neuronal dysfunction. Early and accurate diagnosis remains a major challenge, as current diagnostic methods rely on symptomatic evaluation and costly imaging techniques. Recent studies suggest that small RNAs (sRNAs) may play a critical role in neurodegeneration and may thus serve as viable biomarkers for AD. Identifying variations in sRNA expression patterns in AD patients could provide novel insights into disease pathology and enhance diagnostic precision, enabling clinicians to detect and predict AD with greater accuracy.

Using RNA-sequencing data from samples of 62 patients obtained from Sequence Read Archive (SRA), this study will analyze differential sRNA expression in AD by leveraging high-throughput sequencing and computational modeling to identify key regulatory variations. These samples comprise of healthy controls, mild cognitive impairment (MCI) patients, and those diagnosed with AD. By mapping these alterations, we can uncover potential genetic contributors to AD and pinpoint pathological targets for therapeutic intervention. Understanding these molecular signatures may lead to the development of biomarker-based diagnostic tools that allow for earlier detection and more effective disease monitoring.

Furthermore, elucidating the role of sRNA in AD could reveal novel pathways associated with neurodegeneration, opening avenues for targeted therapies and personalized medicine. This project thus seeks to bridge the gap between genetic markers and clinical outcomes, ultimately contributing to improved patient prognosis.

Andrea Balcan

Pharmacological Chemistry, Eighth

Mentored By Borsika Rabin

Ethnographic assessment of a theory of change process involving academic-community partnerships across California focusing on increasing capacity for social service organizations

This study aims to evaluate the extent of meaningful community engagement during Community Engagement Alliance (CEAL) Theory of Change (ToC) sessions using ethnographic documentation. The study at hand follows the use of the ToC framework to address community health disparities and achieve equitable healthcare access by engaging individuals from community-based organizations and academic institutions at 20 sites in California in co-creating a framework by which the collective needs of communities are addressed in the context of community-academic partnerships. The nature of community-academic partnerships demands the evaluation of the quality of engagement from the community side as to inform necessary adjustments to maximize engagement. This study utilizes a mixed-methods approach, primarily focusing on the use of ethnographic documentation as a means to assess community engagement. This is important to inform necessary adjustments for future endeavors to ensure maximum engagement across different groups. Ethnographic approaches are common in implementation science as they take into account complex interactions between participants and provide context. Each 2-hour ToC session was hosted virtually and consisted of web-based engagement activities. The sessions were recorded and subsequently, data was collected using an ethnographic documentation process for 15 total meetings. By analyzing this data, it is possible to evaluate whether the sessions demonstrated the core principles of community engagement, including co-creation, trust, bi-directionality, and shared governance, to confirm if community partners were meaningfully engaged in this ToC process.

Daniella Bandari

Human Biology, Revelle

Mentored By DR. Tony Yaksh

An Immunofluorescent Approach: HD10.6 Cells and their Nociceptive Neuronal Characteristics

The dorsal root ganglion (DRG) is a cluster of sensory neurons that plays a key role in transmitting sensory signals from the peripheral nervous system to the central nervous system. Nociceptors are considered a subset of neurons found in the DRG, that are responsible for detecting harmful stimuli and play a crucial role in pain detection. With the substantial impact of chronic pain on quality of life and healthcare systems, reliable human nociceptor models are essential for studying pain mechanisms and developing analgesic drugs. The HD10.6 cell line (PMID:10377351) is a developed immortalized human DRG model; HD10.6 neuronal precursors can be proliferated and differentiated into sensory-like neurons.Through immunofluorescence and functional assays, we find that HD10.6 cells replicate key

characteristics of native DRG nociceptors. This study explores the molecular properties of HD10.6 cells, demonstrating the expression and localization of key ion channels, excitatory receptors, and afferent peptides involved in nociception and pain sensation, such as TRPV1, Nav1.7, CGRP, and Substance P. Imaging also reveals calcium influx upon stimulation with TRPV1 and Nav1.7 agonists, confirming their electrical functionality in the HD10.6 cells. Additionally, the presence of Toll-like receptor 4 (TLR4) and lipid rafts highlights the potential for immune-neural interactions. These findings establish HD10.6 as a valuable in vitro model for studying human nociceptors, pain mechanisms, and drug responses, offering a platform for advancing pain research and therapeutic development.

Marfred Barrera

Mechanical Engineering, ERC

Mentored By Sylvia Herbert

Sampling-Based Robust State Estimation for Deterministic Safety Controllers

Established safety frameworks such as Hamilton-Jacobi Reachability and Control Barrier Functions provide powerful formal guarantees for performance and safety of dynamical systems. However, they traditionally assume perfect knowledge of the state and deterministic state transitions. In the case that there is process or measurement uncertainty within the system, these formal guarantees are compromised. To address this limitation, this work leverages a Nested Monte Carlo method from stochastic Model Predictive Control. This approach selects the best-performing state estimate from candidates generated by a particle filter by optimizing a prescribed finite-horizon cost function while satisfying state and input constraints. The state estimate that minimizes the cost is then used in Certainty Equivalence feedback control. When combined with a Quadratic Program-based Control Barrier Function safety filter, this heuristic approach to stochastic optimal control provides a robust state estimate, improving the safety of deterministic controllers in stochastic settings while preserving performance objectives.

Almog Bar-Yossef

Mathematics - Computer Science (MA30), Revelle

Mentored By Jeff Tully

Crashcart: building an alternative network to support a hospital under a ransomware attack

As a part of the Healthcare Ransomware Resiliency and Response Program (H-R3P), this research project, focusing on the “response” part of the program, aims to establish a backup network for a healthcare facility undergoing a cyberattack. A ransomware attack on a hospital, often leading to the malfunction or complete shutdown of parts of the hospital’s network, can negatively impact the quality of patient care and the ability of medical personnel to perform their duties for days, weeks, and

sometimes months following the initial date of the attack. There is currently no standard support system available for hospitals attacked by ransomware, and H-R3P seeks to bridge this gap.

We have designed a backup network, appropriately named “Crashcart”, that would serve as an alternate complete clinical workflow platform including internet backhaul, private 5G wireless networks, and clinical imaging, laboratory, and EHR tools. A key component of that network is providing a wireless connection setup across the hospital, i.e. a local area network (LAN), to which user endpoints (UEs) would be able to connect. This research project focuses on testing the viability of directional antennas for this purpose, specifically in the form of point-to-point links in an indoor environment. We examine the performance of multiple point-to-point devices that have varying mechanisms of creating directional wireless communication with the goal in mind of learning the kind of devices and features that would have optimized latency, capacity, and throughput in the settings of a medical facility.

Tyler Bashor

General Biology, Revelle

Mentored By Jose Pruneda-Paz

Unraveling the molecular mechanisms underlying the regulation of on Plant Growth and Development by the Circadian Clock

Environmental stressors and growing populations emphasize the need to enhance crop yields. Plants optimize their response to periodic environmental changes via an internal timekeeping mechanism. This mechanism, the circadian clock, optimizes metabolic functions by driving 24h rhythms that oscillate with daily cycles. The clock exerts a critical role in plant growth and developmental responses, thus refining the plant circadian clock is a promising approach to increase agricultural productivity.

In Arabidopsis two morning-expressed genes, CCA1 (Circadian Clock Associated 1) and LHY (Late Elongated Hypocotyl), and one evening expressed gene, TOC1 (Timing of Cab 1), build the core circuitry that drives circadian rhythms. While these clock components regulate plant growth and development, the molecular mechanisms underlying this control remain poorly understood. This work focuses on CCA1, previously shown to regulate plant structure, growth, and the initiation of flowering. Importantly, we have identified a mutant in the CCA1 locus that exhibits phenotypic characteristics of both CCA1 loss- and gain-of-function alleles. The phenotypes displayed in the mutant have not been reported together in literature suggesting the existence of previously unidentified regulatory pathways associated with CCA1 regulation.

This research aims to identify the molecular framework driving the observed phenotypes by testing the following hypotheses: 1) Phenotypes are driven by the location of CCA1 expression, and, 2) Phenotypes depend on rhythmic CCA1 expression. Understanding how CCA1 regulates growth and flowering will provide insights that will enable researchers to leverage the circadian clock and optimize plant performance in novel agricultural settings.

Ashley Becker

Cognitive Science, Spec. Clinical Aspects, Seventh

Mentored By Carolina Makowski

Associations between mental health, cognition, and brain imaging within the Adolescent Brain Cognitive Development Study

Within the past ten years, there has been a sharp increase in adolescent mental health disorder diagnoses, currently affecting approximately 20% of children in the US. Many mental health disorders—including depression, anxiety, attention deficit hyperactivity disorder, and obsessive-compulsive disorder—typically onset around childhood/adolescence and have high comorbidity rates. The dynamic interaction between adolescent cognition, mental health, and brain tissue microstructure is an underexplored field of research that could provide key insights into markers of these disorders, which may contribute to future biologically-informed treatment paths. Leveraging 9802 individuals (12-16 years) from the Adolescent Brain Cognitive Development Study—a large-scale longitudinal multisite study following nearly 12,000 youth across the US—we used mixed effects cross-sectional models to investigate associations between cognitive and psychiatric variables and diffusion MRI measures, as modeled by the restriction spectrum imaging framework, in the third wave of imaging data. Models controlled for age, sex, genetic principal components, socioeconomic resources, parent education, and behavioral visit type (in-person vs. virtual). Cognition was measured using the NIH Toolbox Cognition Battery's crystallized (vocabulary and reading) and fluid (inhibitory control, attention, visual/working memory, and processing speed) tests. Emphasis was placed on the unique interactions between individual cognitive tasks and the previously-mentioned mental health disorders. Preliminary results of separate cognition and mental health models show unique global imaging patterns and some subcortical areas and white matter tracts associated with both a mental health and cognitive variable—indicating potential shared variance and interactions in neurobiological underpinnings.

Sophia Bell

Sociology, Seventh

Mentored By Christena Turner

Half, Whole, and Home: Family and the Making of Mixed Japanese Identity

This study examines how cultural factors and specific child-rearing practices influence the identity, character, and sense of belonging of mixed Japanese individuals in the United States. Despite the increasing emergence of individuals identifying as mixed heritage, little literature addresses the role of parental socialization in shaping mixed identity, for both minority majority and dual minority mixed individuals. Using semi-structured interviews with 9 mixed Japanese individuals and 5 Japanese-born parents of mixed Japanese children, this research applies an inductive analysis to explore the

complexities of identity formation. Preliminary findings suggest that while Japanese parents are generally united in passing down core cultural values, their mixed Japanese children will still face challenges navigating their cultural and racial identity, especially when trying to reconcile their mixed heritage with societal expectations. The study reveals that the process of forming identity for mixed Japanese individuals often conflicts with traditional categories, highlighting the need to rethink our current conceptions of race and ethnicity. These findings contribute to a broader understanding of how child socialization and cultural transmission shape the experiences and identities of mixed individuals in the United States.

Alex Beltran

Cognitive Behavioral Neuroscience, Muir

Mentored By James Nieh

Finding the Gene: Measuring changes in juvenile hormone genes in response to honey bee shaking signals.

The honey bee shaking signal is a communicative signal indicating when bees need to change tasks. It appears that the signal is most common during the morning and afternoon when bees transition from inside tasks to outside tasks in the morning and vice versa in the afternoon. In this study, we examined how honey bee shaking signals alter genes (JHE, JHAMT) that regulate juvenile hormone, which helps bees grow and develop.

Some bees in this study received the shaking signal naturally from another bee, while others received it artificially from a robot. Bees that did not receive the shaking signal served as controls. By subjecting bees to these signals in different settings, we can learn how the shaking signal affects juvenile hormone concentration in relation to their circadian rhythm, as well as the quantification of genes of interest. Juvenile hormone titers will be measured by a radioimmunoassay (RIA), while gene expression will be measured through qPCR. We hypothesize that the quantity of genes linked to juvenile hormone production will change as the bees experience the shaking signal.

These results will help us understand how social cues shape the biology of individual bees and affect the entire colony. They deepen our understanding of insect social dynamics and may suggest new ways to manage honey bee colonies for research and agriculture.

Manu Bhat

Math and Computer Engineering, Revelle

Mentored By Rose Yu

AtlasD: Automatic Local Symmetry Discovery

Existing symmetry discovery methods predominantly focus on global transformations across the entire system or space, but they fail to consider the symmetries in local neighborhoods. This may result in the reported symmetry group being a misrepresentation of the true symmetry. In this paper, we formalize the notion of local symmetry as atlas equivariance. Our proposed pipeline, automatic local symmetry discovery (AtlasD), recovers the local symmetries of a function by training local predictor networks and then learning a Lie group basis to which the predictors are equivariant. We demonstrate AtlasD is capable of discovering local symmetry groups with multiple connected components in top-quark tagging and partial differential equation experiments. The discovered local symmetry is shown to be a useful inductive bias that improves the performance of downstream tasks in climate segmentation and vision tasks.

Luca Boccalato-Rodriguez

Psychology with a Specialization in Human Health, Seventh

Mentored By Caren M Walker

USMexico Differences: Do Different Modes of Interdependence Have the Same Psychological Consequences?

Cultural differences between the United States and Mexico have been investigated using a broad array of psychological tasks measuring cognition, language, perception, and reasoning. Using online and in-person adult samples, we aim to conduct a large-scale comparison of 12 psychological tasks that have previously shown cross-cultural differences between Western and East Asian cultures but have been minimally studied in Latin America. Additionally, exploratory analyses will examine whether specific dimensions of interdependence, such as familial respect (familial obligation), simpatía, and self-construal, are associated with distinct cognitive tendencies beyond broad measures of interdependence.

Olimpia Carrioli

Cognitive Science/Machine Learning, Muir

Mentored By Jason G. Fleischer

Decoding Preadolescent Anxiety with Machine Learning Insights from Neuroimaging Data

Although anxiety disorders are well studied in adults, their neurobiological basis in preadolescents remains poorly understood. Current diagnostic methods rely on behavioral assessments without a strong biological foundation, making objective classification difficult. This study applies machine learning to fMRI activation data from the ABCD Study to classify two anxiety subtypes: Anxious-Depression from the ASEBA scale and Generalized Anxiety Disorder from DSM-5 scale. We used beta weight values from the en-back task, which probes emotion and working memory processes, at baseline (ages 9–10), year 2 follow-up (ages 11–12), and both years combined to increase sample size. A random forest binary

classifier was trained for each dataset while accounting for collection site, scanner type, and medication confounds. Test accuracies exceeded 0.8 at all timepoints, indicating that whole-brain fMRI activation patterns may provide useful features for distinguishing these anxiety subtypes. These findings contribute to the growing effort to integrate neuroimaging into psychiatric classification in preadolescents.

Nicole Castro

Biochemistry, Marshall

Mentored By Kim Dore

Metabolomics of mouse plasma reveals sex differences in lipids and sugars metabolism in Alzheimer's disease model mice

Due to proprietary information, this abstract has been redacted.

Derrick Cha

Public Health Concentration in Biostatistics, Seventh

Mentored By Nancy Binkin

Making Ends Meet: How UC San Diego Students Pay for their Education and Overcome Financial Gaps

Introduction: While financial aid packages provide grants and scholarships, they often include loans. To learn more about student loan attitudes and practices, we conducted a survey to assess the number of students who were offered and who accepted loans, anticipated total debt, the extent to which the loans alleviate financial insecurity, and concerns about their impact.

Materials and Methods: In February 2025, a multi-purpose Qualtrics survey that included a debt module was administered to undergraduate Public Health and Economics students at UCSD. EpiInfo 7.2.6 was used to calculate frequencies and prevalence rate ratios.

Results: The response rate was 80%. Of the 774 respondents, 440 (57%) received a financial aid package, of whom 35% were offered Federal loans. Of those offered loans, 74% accepted. Forty percent of students with loans believed they will accumulate loan debts greater than $20,000 by graduation. Despite the additional funds that loans provide, students with loans were still 1.3 times more likely to face financial difficulties than students with other forms of financial aid (53% vs. 41%; $p < 0.01$). Common reasons among respondents for rejecting loans are fear of accruing debt (27%) and insufficient knowledge of student loans (14%).

Discussion: Many students rely on loans to meet rising attendance costs, although students are reluctant to take out loans, and current loans are not adequate to prevent financial insecurity. To ensure student

needs are met, additional aid and resources on loan repayment and long-term financial wellness should be implemented.

Cara Chan

Human Developmental Sciences, Warren

Mentored By Gail Heyman

Burden of Secrecy: A Naturalistic Investigation of Secret-Keeping

Keeping secrets—and disclosing privileged information—both offer ways for people to strengthen relationships with others, build trust, and advance their social status. However, there is limited psychological research on the social contexts and consequences of secret-keeping. Through structured interviews with young adults on their experiences with keeping secrets, this project investigates what kinds of secrets people keep, the sociocognitive factors that lead people to keep or disclose secrets, and the psychosocial consequences of secret-keeping in everyday contexts. The structured interviews will then inform the development of surveys to identify the predictors and impacts of secret-keeping among a larger sample of participants.

Jason Chang

Aerospace Engineering, Mathematics-Computer Science, Marshall

Mentored By Dr. Nicholas Gravish

Phase Transitions of Active Robotic Materials

This project aims to develop active, biological-like swarms of robots to demonstrate and characterize the metamaterial properties of these robots. The approach involves fabrication of nonlinearly interacting robots, then demonstrating the interactions between a testbed and environmental boundary conditions on robot behavior.

Preliminary simulations in 2D and 3D of these interacting robots will be performed to examine the relationships between the individual robot characteristics and collective properties of the robots. Various interaction laws are explored, and environmental constraints such as constant volume and constant pressure testbeds are designed. Furthermore, multiple iterations of robots were designed and constructed; rotating, elliptical robots were designed such that its interactions are phase dependent and active. To minimize friction on the testbed, an air hockey table-like setup is used, blowing air through holes of the table to minimize friction between the robots and the testbed surface. Using the testbed, phase diagrams of the robots can be characterized, replicating experiments in situations of constant pressure and constant volume.

Ultimately, this research seeks to develop a better understanding of active robotic swarm dynamics and material behavior in various phase regimes and boundary conditions.

Avery Charneski

Sociology, Mathematics, Marshall

Mentored By Kevin Lewis

UC Socially Dysfunctional: Investigating a Trend of Social Dissatisfaction at UCSD by Examining the Network Ties of its Students

The University of California, San Diego has a reputation for student dissatisfaction when it comes to social aspects of the college experience, and this study aims to figure out why that is. I surveyed 174 students at UCSD and interviewed 21 of those, asking them about their strong and weak ties, as well as about their happiness, social wellbeing, and thoughts about the university's role in the social lives of its students. Students showed a preference for a large group of weak ties accompanied by a small group of strong ties, and reported fairly high levels of both happiness and social wellbeing in the survey. However, in interviews, students validated the "UC socially dead" stereotype and spoke at length about the role that UCSD plays in perpetuating social dissatisfaction. I concluded that UCSD creates an environment that makes social connection particularly challenging, and so the students who have the greatest sense of social satisfaction are those with the appropriate time and energy to grow their network and those who are content with a small social circle. Those in the middle, who want to connect with their peers but lack sufficient time and energy, tend to be dissatisfied with their social lives, and their prevalence is where the school's reputation comes from. These findings suggest that schools have some control over the social outcomes of their student body, and are responsible for understanding the unique needs of multiple student populations and ensuring that no group slips through the cracks.

Calvin Chen

Sociology, Seventh

Mentored By Harvey Goldman

Ni Hao I Speak English : Understanding the Definitions of the Identity of Chinese American

The concept of wénhuà (文化), commonly translated as "culture," extends beyond traditions and customs to encompass a broader intellectual and philosophical framework shaping Chinese identity and social values. This concept can also be applied in understanding Chinese American culture, and as the younger generation of the Chinese community in the greater Los Angeles County grow into adults, some having their own children, we can begin to see the values that these young adults have now that they are more independent and have a sense of their own identity we may begin to see and understand their definitions of cultural identity. When exploring the complexities of cultural retention, knowledge, and

identity among Chinese American young adults between the ages of 20-26, we are able to see the complexities of retaining native roots, assimilating to American culture, as well as creating a middle point that these interview participants define as Chinese American culture. This paper highlights and examines the ways in which knowledge of homeland is maintained, how Chinese American culture is reshaped, and how their parents view this change.

Vivian Chen

Human Biology, ERC

Mentored By Pamela Mellon

Bmal1 Regulation of RNA Degradation During Oocyte Development

The Bmal1gene regulates circadian rhythm. It is expressed on oocytes, though its importance in successful oocyte development has not been well explored. Bmal1 -/- dams are infertile, even when mated with Wild Type (WT) sires, highlighting the importance of Bmal1 in female fertility. Previous studies looking at Bmal1 in the liver showed that Bmal1 -/- cells had elevated levels of the m6A RNA modification as well as abnormal localization of m6A and YTHDF2, a protein that reads the m6A modification, in the nucleus. m6A and YTHDF2 play a role in the degradation of maternal RNA during the maternal-zygotic transition, and without breakdown of maternal RNA, the embryonic genome cannot activate. I aim to understand the role of Bmal1 in the degradation of maternal RNA during oogenesis using immunofluorescence. Immunofluorescence allows me to determine whether there are abnormal accumulations of m6A-modified RNA or YTHDF2 protein in the Bmal1 maternal knockout (Bmal1 m-KO) germinal vesicle (GV) and meiosis II (MII) oocytes. I hypothesize that in GV and MII Bmal1 m-KO oocytes, there will be elevated levels of m6A and aberrant localization of m6A and YTHDF2 in the nucleus, that contribute to improper RNA degradation and result in non-viable oocytes.

Serena Chen

Computer Science, Revelle

Mentored By Michael Coblenz

A Rust-Based Comparison of Functional and Imperative Programming

In the Rust programming language, functional-style code is often considered idiomatic. However, is this universally true across programmers of various experience levels and backgrounds? In this ongoing research, we investigate the readability and usability of functional versus imperative paradigms in Rust to determine which is more effective. Through a code-review quiz, we assess participants' preferences and their ability to identify bugs in both paradigms to examine readability. For usability, we examine the prevalence of each paradigm in participants' code using SALT, a custom-built IDE extension for Rust.

Through our research, we aim to uncover how different programming styles impact comprehension, and how experience influences the choice of paradigm.

Natalee Chin

Sociology - International Studies, Seventh

Mentored By April Sutton

Defining Change for Chinatowns in California

Chinatowns in California have endured physical, economic, and racial changes, evolving to meet the needs of the Chinese American community. The identity of Chinatowns is tied to the transient, new immigrant population and responses to surrounding dominant culture. This study proposes an analytical framework for studying Chinatown identity across four indices: (i) geographic, (ii) racial, (iii) semantic, and (iv) legal dimensions, culminating in the Four-Dimension Approach. Accompanied by a case study of San Francisco Chinatown as an empirical example, the Four Dimensions provide future researchers tools for comprehensive study of this unique ethnic enclave.

Gabriella Ching

Chemical Engineering, ERC

Mentored By Justin Opatkiewicz

Formulation and Materials Study of Early-stage Lip Glosses

Due to proprietary information, this abstract has been redacted.

Alessandro Cirulli

Biochemistry, Revelle

Mentored By Kevin Corbett

Chromosome cross-over architecture: investigating chromatin binding of HORMAD ASY1

Due to proprietary information, this abstract has been redacted.

Kamryn Conway

General Biology, Marshall

Mentored By Lindsey Burnett

Pain from Birth Trauma is Socially Transferred to Partners

Despite its joyous perception, childbirth causes posttraumatic stress in 1 in 5 women, impacting mothers, families, and healthcare teams, emphasizing the need for recovery strategies amid the healthcare-worker mental health crisis. This study aimed to explore whether the social transfer of pain occurs in a preclinical mouse model of simulated birth injury (SBI). Early pregnant (E8.5) C57/Bl6 mice were randomly housed to two groups: solo or with a nulliparous non-pregnant female bystander (BY). In late pregnancy (E16.5), the pregnant mice underwent an SBI using foley balloon distension, mimicking traumatic human childbirth, and delivering naturally. Pain-sensitivity, anxiety-like behavior, and depressive-like behavior were assessed using Von Frey up-down (VF), elevated plus maze (EPM), and tail suspension testing (TST), respectively. Data were analyzed with a 2-way ANOVA, post-hoc tests ($p=0.05$). All groups demonstrated reduced VF scores 2 days postpartum compared to baseline (SBI 1.324 vs. 0.442; PARSBI 0.979 vs 0.489; BY 0.781 vs 0.396), $p=0.0005$), with negligible difference between groups ($p=0.1603$). On postpartum day 8, EPM testing revealed high closed-arm time (SBI 96%; PARSBI 92%; BY 88%) indicating anxiety-like behavior, though BY spent less time than SBI or PARSBI ($p=0.0366$). On postpartum day 9, TST revealed negligible differences in immobility across groups ($p=0.374$). Pain sensitivity and anxiety-like behavior were socially transferred to bystanders, but having a bystander did not reduce pain-sensitivity in birth-injured animals, suggesting partner type or injury severity may influence social buffering.

Andrew Dallape

General Biology, Muir

Mentored By Ellen Breen

GGTA1 gene inactivation in mice: Effects on running endurance and muscle strength

A major question of human evolution is how we evolved to become more proficient long-distance runners than our primate ancestors. The cytidine monophospho-N-acetylneuraminic acid hydroxylase (CMAH) gene was inactivated in hominids ~ 2-3 Million years ago (Mya), and the GGTA1 gene, encoding α1–3-galactosyltransferase (α1–3GT), was inactivated at an earlier time during evolution in Old World Monkeys. Our experiments are designed to elucidate the role of these two glycan modifying genes in endurance exercise capacity. To test this hypothesis, skeletal muscle oxygen delivery and utilization parameters were evaluated in mice with the combined deletion of these two genes (aGal/Cmah-/-), deletion of only the Cmah gene (Cmah-/-) or WT (C57Bl6N). Forced treadmill testing showed increased endurance running times for aGal/Cmah-/- and Cmah-/- mice compared to WT in male mice ($p=0.002$). For female mice only aGal/CMAH -/- ran for longer times than the Cmah-/- mice ($p=0.005$). In ex vivo muscle contractile function tests, average maximal force was significantly lower in male aGal/Cmah-/- soleus muscles than Cmah-/- ($p=0.02$). No significant differences in average maximal force were detected in female soleus from the different genotypes ($p=0.31$). Ex vivo fatigue

tests did not reveal differences between genotypes for soleus isolated from male (p=0.61) and female (p=0.49) mice. Further testing will be done to examine capillary number and in situ fatigue resistance in the gastrocnemius complex between these genotypes.

Saloni Dangre

Molecular and Cell Biology, Seventh

Mentored By Douglas Bartlett

Investigating the Genetic Mechanisms Behind Pressure Tolerance in a High Pressure- Evolved E. coli strain

The majority of the Earth's microbial biomass persists at high pressure. These abundant microbes are better known as piezophiles or are considered piezotolerant. However, genetic adaptations that allow microbes to grow under high-pressure conditions are virtually unknown. In order to better understand the molecular mechanisms operating in high pressure adaptation in bacteria, we investigated the genes responsible for the pressure-tolerant phenotype of the previously evolved Escherichia coli strain AN62– capable of growing at pressures up to 62 MPa. Using genetics techniques, we have found that mutations involved in nitrogen assimilation and transcription regulation are critical for AN62's ability to grow at elevated pressure. Additionally, using label-free proteomics we observed increased concentrations of proteins associated with the nitrogen starvation response and anaerobic respiration pathways in AN62 compared to its parental strain. Currently, we are continuing our investigation of other mutations in AN62 that may be critical for its piezo-tolerant phenotype.

Ruman Das

Molecular and Cell Biology, Seventh

Mentored By Gene Yeo

Profiling mRNA Translation with RNA Editors

Messenger RNA (mRNA) is a crucial intermediate in protein synthesis, providing a template for the production of a diverse range of protein isoforms. Translational modifications such as alternative splicing can affect the structure, function, and localization of these proteins. Prevalent methods of profiling mRNA translation, such as polysome profiling and ribosome footprinting, can be inefficient and are unable to examine the full transcriptome due to incompatibility with long-read sequencing. However, Surveying Targets by APOBEC1-Mediated-Profiling (STAMP) can pair with long-read sequencing, allowing for the measurement of larger amounts of genetic information. APOBEC1 is a cysteine deaminase that catalyzes RNA cysteine to uracil conversion on mRNA transcripts. Assessing the ratio of C-U edits across the transcriptome can provide insight into translation levels.

Nevertheless, distinguishing between background noise and signal is critical, as not all edits may truly reflect shifts in translational efficiency. To limit background noise and improve signal efficiency, we seek to test a new editor: TadA. Here we demonstrate TadA to be more precise in its editing activities and have improved scopes for targeting. Using slippage sites between both APOBEC1 and TadA, we measured differences between background noise for both editors, and were able to show the improved accuracy and efficiency of TadA.

Sinatra De Quiroz

History, ERC

Mentored By Nancy Kwak

Finding Margret Robinson

“The Black Pioneers of Julian” is a perfect encapsulation of the "post-racial" project in the United States. A gold rush boom town "founded" by ex-confederates which new evidence showed had at least one black founder and many prominent black residents in its history. A rustic live-in museum to buy Apple Pies now had a feel good multi-racial backdrop. This story about Julian gained the town its first ever brush with a national level profile and its first serious attention in over half a century.

There’s just one issue with the narrative, it’s just not true. The narrative requires an assumption that proximity proved integration, and that’s not what the evidence suggests. The evidence actually suggests something more powerful, that the marginalized people led lives full of community, love, and productive capacity in spite of a lack of support. It suggests figures like Margret Robinson.

Margret Robinson is not supposed to be the story here. She is marginalized even relative to the other black pioneers as her husband Albert gets most of the credit for founding the Hotel Robinson. However the legacy that Margret fought for in life, and leaves in the mystery surrounding her death, provides a powerful space to consider the post-racial historiographical tradition that supposedly made Julian worth discussing. In Finding Margret Robinson we find an America that’s never been a harmonious land of liberty, but one made up of people who fought to the death in ordinary, and perhaps futile, ways to make it so.

Zoe Decatur

B.S. Education Sciences and B.S. Psychology, Revelle

Mentored By Amy Vatne Bintliff, PhD., Assistant Teaching Professor

Wellbeing Intervention on Ugandan Adolescents Amid COVID-19

The COVID-19 pandemic exacerbated existing mental health challenges for adolescents in Uganda due to prolonged school closures and limited access to mental health support. This study investigates the

effectiveness of "The Wellbeing Club," a pilot arts-based mindfulness intervention aimed at enhancing emotional regulation, communication skills, sense of belonging, and self-efficacy among 25 Ugandan adolescents aged 12-19. Conducted in collaboration with Africa Education and Leadership Initiative (Africa ELI) and the University of California, San Diego, the intervention spanned ten days during Uganda's 83-week school closure in 2021.

Utilizing qualitative participatory methods, including field notes, arts-based activities, and semi-structured interviews at post-intervention and six-month follow-up, this research assesses the impact of community-driven and culturally responsive approaches on adolescent wellbeing. The study is grounded in Developmental Assets Theory, which emphasizes the role of internal strengths and external supports in fostering resilience. Findings indicate that participation in The Wellbeing Club significantly improved emotional regulation, strengthened interpersonal communication skills, and fostered a sense of belonging and self-efficacy. Participants reported enhanced ability to manage emotions, increased confidence in self-expression, and stronger peer and community connections. These results suggest that arts-based mindfulness interventions can serve as protective factors for adolescents in crisis-affected and resource-limited settings. This research contributes to the growing literature on youth mental health interventions in low-resource contexts and informs future wellbeing initiatives that prioritize culturally relevant, community-led strategies to support adolescent resilience and mental health.

Cynthia Deng

Psychology, ERC

Mentored By Elizabeth Twamley

Correlates of Cognitive Compensatory Training (CCT) adherence among unstably housed Veterans with mental health conditions

Homelessness is a prevalent issue among U.S. Veterans, contributing to significant barriers to social reintegration, employment, and healthcare access. Veterans experiencing homelessness often present with high rates of psychiatric and neurocognitive impairments, including PTSD, depression, and executive dysfunction, which may hinder engagement in rehabilitative interventions. Compensatory Cognitive Training (CCT) is a structured cognitive rehabilitation program designed to improve executive functioning, memory, and problem-solving skills in individuals with cognitive impairments. While CCT has demonstrated efficacy in enhancing cognitive and mental health outcomes, adherence remains inconsistent, limiting its effectiveness.

This study examines baseline factors associated with CCT adherence among unstably housed post-9/11 Veterans with mental health conditions and cognitive impairments. Using a secondary analysis of data from the ASPIRE Cognitive Enhancement Study (ACES), a randomized controlled trial conducted at the VA San Diego Healthcare System, we assess how demographics, self-reported health, community engagement, neuropsychological functioning, and psychiatric symptoms predict treatment adherence. Participants (n = 39) were randomized to receive CCT or an active control intervention. Adherence,

operationalized as the number of CCT sessions attended, will be analyzed using correlation and regression models.

Findings will inform targeted strategies to enhance engagement and optimize CCT implementation in high-risk populations. Understanding the interplay of cognitive and psychiatric factors with treatment adherence can improve intervention accessibility, refine support strategies, and ultimately enhance rehabilitation outcomes for unstably housed Veterans.

Abby DeSpain

Psychology, Seventh

Mentored By Celeste Pilegard

Developing Science Beliefs: Investigating the Role of Motivation on Nature of Science Instruction

A key component of science literacy is understanding the nature of science—knowledge about scientific practices, processes, and assumptions underlying scientific knowledge. Epistemic beliefs, or ideas about knowledge and knowing, are a valuable tool for assessing this understanding. Despite its importance, few studies focus on developing epistemic beliefs in classroom settings, particularly considering students' achievement goals. Mastery goals emphasize personal competence, while performance goals focus on demonstrating competence relative to peers. This study examines the efficacy of a video lesson intervention on developing students' epistemic beliefs in science by teaching nature of science concepts (e.g., how scientific theories change). It also investigates whether achievement goals moderate the intervention's effectiveness. Students in an online introductory psychology course (N = 199) completed a pre-course survey measuring epistemic beliefs and achievement goals before being randomly assigned to an experimental or control condition. While the control group received standard instruction, the experimental group watched three nature of science video lessons embedded in online lectures. These lessons prompted reflection on how scientific knowledge is constructed (e.g., through peer review). At the end of the course, epistemic beliefs were reassessed to measure change. Data collection concluded in December 2024, and analysis is ongoing. We hypothesize that mastery goals, linked to intrinsic motivation and deep engagement, will predict greater shifts toward sophisticated epistemic beliefs. Thus, we expect achievement goals to moderate the intervention's effectiveness, with the greatest impact on students high in mastery goals. Findings will inform how educational interventions foster epistemic belief development in science.

Yifei Ding

Bioengineering, Muir

Mentored By Bernhard Palsson

A Machine Learning Model of Bacterial Translation Efficiency from DNA Sequence for Protein Production Applications

Our project addresses the challenges of predicting translation efficiency (TE) in E. Coli, a critical factor in protein synthesis for biotechnology and pharmaceutical development. Despite extensive research, the mechanisms regulating TE are complex and remain incompletely understood, making optimization of protein production difficult.

We developed and evaluated different machine learning models to predict TE based on multiple factors, including mRNA transcript features, tRNA availability, and codon usage. Using Elastic Net Cross-Validation as our final approach, we integrated features such as the Codon Adaptation Index, tRNA Adaptation Index, and many others. We systematically evaluated the importance and effect of our feature set through iterative research and testing to improve model performance.

The result shows our model achieved an R2 value of 0.35 with a mean squared error of 0.06. Key factors influencing TE included TAI, MFE, and many other factors. Correlation analyses using Pearson, Spearman, and Kendall methods, along with Shapley values, helped identify feature importance.

We conclude that TE is regulated by a combination of interacting factors rather than a single primary mechanism. While our model demonstrated predictive power, the R2 value suggests further improvements.

Further directions include refinding features to better capture TE-affecting factors, obtaining higher quality TE datasets with less noise, and exploring non-linear models that better represent the complex biological interactions. These can potentially enhance the predictive power of our model and potentially make it applicable to more diverse organisms, ultimately contributing to more efficient protein production.

Hannah Drake

History & Ethnic Studies, Marshall

Mentored By Nancy Kwak

The Rise of the Undead: The Racial and Gender Politics Present in 1929-49 Zombie Cultural Productions

Since the early 20th century, the zombie has been a source of fear and tool for discourse in the American psyche. In modern depictions, it is often used as a metaphor for capitalism and disease. With its prevalence in popular media, the figure has been subject to entire articles and even books unpacking the reason for its popularity and what zombies represent in our collective imagination. Much of the current literature on zombies traces the roots of the figure back to Haiti, but that is where the connections stop. After mentioning the country for its origin story, there are no further mentions of the ties to Haiti or Vodou again. For this project, I go back to this moment in the 1930s and 40s when the zombie first enters the American cultural zeitgeist in order to show the way the figure was used as a site of contestation over questions of race, gender, miscegenation, and the United States' relationship with Haiti

during its occupation. I argue that the zombie is a significant site of discourse during this period and that these ties to Haiti are significant and continue until today. I prove this through an analysis of these zombie films, their production notes, travel writing on Haiti, and African American cultural and literary productions utilizing the figure to argue for racial equality alongside Black liberation globally.

Mia Elliott

History, ERC

Mentored By Alain J.J. Cohen

Lost in Transposition: Female Agency in Roger Vadim's Les Liaisons Dangereuses

The transposition of literature to film necessitates the alteration and subtraction of literary elements that may change the meaning of the film and the power of the characters. Roger Vadim's 1959 transposition of Pierre Choderlos de Laclos' 1782 epistolary novel Les Liaisons Dangereuses demonstrates what can be lost as letters are transmitted to film. Examining a pivotal scene in the relationship between Valmont and Marianne (in the film)/ Tourvel (in the novel) reveals how a powerful feminist character is diminished to a male-defined projection of womanhood. Using Dr. Alain J.J. Cohen's model of a sequence-by-sequence breakdown, I then analyze one scene, shot-by-shot, and compare it to three letters the scene corresponds to from Laclos' novel. I demonstrate how Vadim's transposition diminishes the impact of Valmont's emotional manipulation of Marianne/ Tourvel and minimizes the power of Marianne/ Tourvel's character. Vadim's version of Tourvel is passive and flimsy as compared to the pious, righteous, and determined Tourvel constructed in Laclos' novel, and of those in other filmic adaptations of Liaisons Dangereuses from Miloš Forman, Stephen Frears, and Roger Kumble. Vadim's transposition of Marianne ultimately detracts from the entire narrative of the film and re-interprets a powerful female character through a misogynistic lens that weakens female agency, dignity, and interiority. Examining what is lost in this filmic transposition reveals how a director's re-interpretation of literature risks sacrificing the compelling complexities of characters constructed in the written word.

Bella Ely

Sociology and Political Science, Seventh

Mentored By Michel Estefan

Mapping the Chaos: How Organizations Respond to Shifting Political Contexts

This thesis explores how organizations serving immigrant communities in San Diego adapt to shifting political contexts, contributing to understanding how the precarity of immigrants and the organizations that serve them are impacted by political changes. As the Trump administration has shown a willingness to challenge precedents, the question of how organizations are affected and respond has become even more significant than in previous presidential transitions. Existing literature has examined perceptions of

immigration and immigrant experiences; however, this thesis seeks to understand how organizations adapt when their work is politicized under uncertain political contexts.

Adapting Golash-Boza and Valdez's theory of "nested contexts of reception," which demonstrates that immigrants' experiences are shaped by a multi-level exchange between federal, state, local, and organizational actors, I expand their framework to include non-profit organizations and asylum seekers. Much of the literature around contexts of reception focuses on the student experience, often overrepresenting it as the immigrant experience. My thesis aims to address this imbalance and explore how other actors outside universities experience these nested contexts of reception.

Through in-depth interviews and ethnographic observations, my thesis compares the adaptive capacities of institutions (universities) and non-profit organizations in response to changing federal immigration policies. While institutions benefit from greater resources and state support to buffer federal policy, nonprofits face greater vulnerability with fewer buffers. By analyzing institutional responses to political uncertainty, this research contributes to discussions on immigration, organizational adaptability, and support for marginalized communities.

Naomi Esparza

Cognitive Science with Neuroscience Specialization, Revelle

Mentored By Gedeon Deák

The Effects of Multimodal Sequences on Eliciting Joint Attention in Infants

Joint attention refers to the shared attention to a single event or object by multiple individuals. Joint attention episodes are important in early learning as they can help older infants and toddlers associate an adult's attentional focus with informative extrinsic events or with social input such as unfamiliar words. I will be focusing on three attention-directing cues: gaze, point and speech, with an aim to determine if different sequences of the multimodal behaviors relate to the success rate of a child looking at what their mother wants them to look at. Specifically, I will be looking at 1) how often different attention-directing cue combinations are being used by the mother, 2) whether the number of attention-directing cues in a bid affect its success rate, and 3) whether there are certain sequences of attention-directing cues that are more effective than others in eliciting joint attention.

Devin Esser

Marine bio minor in film studies, Marshall

Mentored By Alain Cohen

Color recurrence in Godard's Contempt

Jean-Luc Godard's Contempt (Le Mépris) employs a striking recurrence of the colors red, yellow, and blue to represent the shifting dynamics between the characters Jeremy, Camille, and Paul. Red symbolizes power and dominance, embodied by Jeremy; yellow conveys Camille's growing sense of neglect and fading love for Paul; and blue reflects Paul's emotional coldness and distance, ultimately pushing Camille away. I identified 33 significant occurrences of these colors, with the most compelling being Jeremy's red car, which sparks the rift between Camille and Paul, leading to their ultimate downfall. Another key moment appears in the film-within-the-film, where Penelope's blue eyes, red lips, and a yellow background contrast Ulysses in blue against a red backdrop, foreshadowing the power struggles and betrayals in the main narrative. This sequence connects the color recurrence to the Master Narrative Program, linking the gods of Rome to the gods of Hollywood. The color symbolism is further emphasized as Camille's wardrobe shifts between red, yellow, and blue, reflecting emotions she otherwise conceals through her quiet demeanor. I categorized the recurrences into lighting, background, clothing, and features, with clothing being the most revealing. Through my analysis, I conclude that relationships in cinema are not only conveyed through dialogue but also through deliberate visual cues. Godard masterfully uses color to express hidden emotions, illustrating that true feelings in relationships are often layered beneath actions and words. His use of red, yellow, and blue allows the audience to perceive the emotional depth of the characters beyond their spoken interactions.

Momei Fang

Physics and Cognitive Science, Muir

Mentored By Tongyan Lin

Dark Matter Direct Detection Through Phonon Creation

From the rotational speed of galaxies to the strength of gravitational lensing, the past century has revealed a myriad of evidence for the existence of dark matter. The potential mass range of dark matter spans 50 orders of magnitude, but the hypothesis of thermal contact, which would allow some non-gravitational interactions between dark matter and the standard model, would decrease the mass range to around 1 keV to 100 TeV. At the larger end of this mass scale, dark matter would be able to collide elastically with the standard model. Nuclear recoil is commonly used for direct detection of dark matter with a mass around 100 GeV. The effectiveness of nuclear recoil detectors breaks down if dark matter is less than around 100 MeV, so a new approach is necessary to try and detect dark matter at the lighter end of the scale. The interactions between particles becomes more important at the sub-GeV scale, meaning that phonons would dominate. Previous theoretical models for phonon creation have used an incoherent approximation for calculations, which removes the interactions between neighboring particles on each other. This research includes this coupling to calculate the scattering rate of dark matter. By using a one-dimensional coupled harmonic oscillator model of the target crystal, we aim to predict the scattering rate of dark matter and find the necessary cross-sectional area of a Silicon target crystal to get three events per year.

Yolanda Feng

General Biology, Marshall

Mentored By Claire Meaders

Comparing the Use and Implementation of Classroom Observation Protocols from an Observer's Perspective

Classroom observation tools quantify teaching and learning activities and they offer instructors constructive feedback to enhance their instructional practices. In this study, two undergraduate research assistants (URAs) were trained to apply three observation protocols - COPUS, CDOP, and PAITE - simultaneously in STEM classrooms where each of these protocols measures a different aspect of teaching. The URAs received formal training in each protocol and conducted observations across multiple STEM classrooms. Data analysis focused on evaluating the type and depth of information each tool offered, along with the time investment and ease of implementation. Results showed that each protocol provides instructors with useful and varied feedback on their teaching practices. Moreover, the process of analyzing classrooms differed between protocols where the undergraduate observers encountered distinct benefits and challenges between COPUS, CDOP, and PAITE. These classroom observation tools provided an additional way for instructors to receive feedback on their teaching. Additionally, the comparison of each protocol may provide the Teaching and Learning Commons with important insights on how to effectively implement them. This may lead to the wider use of classroom observation protocols as a method for providing feedback to college instructors.

Amber Fig

Sociology, Marshall

Mentored By Harvey Goldman

All of which are American Dreams: Framing Theory in the US and its Effects on Pro-Palestinian Demonstrations On College Campuses

The purpose of this thesis is to trace how state governments and institutions utilize the framing process to dismantle student demonstrations and influence personal perceptions. It suggests that media and university responses to nationwide protests integrate framing tactics to enforce charged narratives that delegitimize social movements and shape public opinion. These tactics are explored through the actions taken against pro-Palestinian protestors at the University of California-San Diego (UCSD) analyzed for framing mechanisms such as the reinforcement of normative ideologies to foster a favorable narrative, the enforcement of adversarial groups, and the inlaying of political narratives into everyday interaction. In looking at official statements, social movement theory, and media analysis; this paper proposes that framing is used as an extension of power on behalf of the United States government through the university. Sourcing the origins of master frames, looking at how those frames shape attitudes on campuses, and applying them to the UCSD context shows how framing with the intent to dismantle

functions. Alternatively, this paper looks to understand how despite these efforts counterframes emerge as a form of resistance to master frames, challenging the existing narrative and reshaping public discourse. Overall, this thesis serves to provide real-world examples of the framing process so that individuals may be able to recognize legitimate frames versus hegemonic frames; in hopes that they may use this knowledge to understand power and work to counteract it.

Alisha Foster

Applied Mathematics, Marshall

Mentored By Robert Webber

Comparison of Algorithms for Nonnegative Matrix Factorization for Automatic Drum Transcription

This work applies partially fixed nonnegative matrix factorization (PFNMF) to the problem of automatic drum transcription (ADT). ADT is a task in the field of music information retrieval that includes signal separation and onset detection of drums from polyphonic music. When PFNMF is applied to this task, the magnitude spectrogram of the original signal is approximated by the product of a frequency dictionary matrix and a temporal activation matrix, both of which are constrained to have nonnegative entries. The PFNMF approach involves two pairs of dictionary and activation matrices, corresponding to the drum signal and the rest of the signal. The drum dictionary matrix is pre-trained and fixed, while the other factors are optimized based on the available musical recordings. To perform PFNMF quickly and accurately, this work compares two nonnegative matrix factorization solvers based on a multiplicative update rule (MUR) and proximal gradient descent with Nesterov momentum (NeNMF). The MUR and NeNMF algorithms are systematically derived, their time complexity is analyzed theoretically, and their performance is compared empirically.

Breanna Fraire

Cognitive Science - DSGN&INT, Muir

Mentored By Monique Smith

Social Behavior Dynamics Following Food Deprivation in Mice

This research project aims to investigate the impact of food deprivation on social interaction using mouse models. We will employ pose estimation machine learning algorithms (SLEAP) to analyze kinematic differences between mice in pain and 'bystander' mice as well as food deprived and fed bystander mice. Additionally, we will focus on sex differences within these conditions. Our primary analytical tools will include SLEAP and Key Point MoSeq to capture and interpret movement patterns.

Jewel Fulmore

Literature and Writing, Marshall

Mentored By Elizabeth (Libby) Butler

Challenging Linguistic Discrimination: Anti-Racist Writing Pedagogy in First-Year College Courses

Linguistic discrimination in higher education disproportionately affects Black students who speak African American Vernacular English (AAVE) and Black Language (BL). Standard Language Ideology (SLI) reinforces the belief that Standard English (SE) is the only legitimate academic language, embedding racial biases in grading and assessment. Traditional grading systems penalize students for linguistic diversity, positioning AAVE as "improper" and "unacademic" rather than recognizing it as a legitimate linguistic system. Scholars (Inoue, 2015; Baker-Bell, 2019) advocate for anti-racist assessment models.

Although there is research that shows alternative models for instruction and assessment are good for Black students, many writing instructors do not implement these approaches (Inoue, 2015). This gap between research and practice means Black students continue to face linguistic barriers in academia. This study examines first-year writing programs at UC San Diego to explore how, and to what extent, anti-racist grading practices are implemented, along with their effectiveness in supporting Black students facing linguistic discrimination.

Using surveys of UCSD freshman writing instructors and students who are enrolled in or recently completed at least one freshman writing course, this project investigates the types of assessment models used and students' perceptions of their impact on academic success. Understanding how grading practices influence student success is critical in addressing systemic linguistic racism in higher education. By reshaping assessment practices, universities can foster learning environments that recognize linguistic diversity as an asset rather than a deficit, ultimately contributing to more equitable and inclusive academic spaces.

Moumen Gabir

Neurobiology and Cognitive Science, Marshall

Mentored By Kay Tye

Investigating Anhedonia in Chronic and Acute Stress Models Reveals Distinct Behavioral Patterns in Depression-like Responses

Anhedonia, the inability to experience pleasure, is a key symptom in psychiatric disorders like Major Depressive Disorder (MDD) and Schizophrenia remain difficult to treat with current antidepressants. To understand how different stressors induce anhedonia and depressive-like behaviors, we compared two stress paradigms: Chronic Mild Stress (CMS) and Learned Helplessness (LH). CMS models chronic

unpredictable stress, while LH represents acute, severe stress. This study aimed to determine whether these paradigms produce distinct behavioral phenotypes and stress susceptibility patterns.

Mice in the CMS and LH paradigms were classified as resilient or susceptible using k-means clustering, based on Sucrose Preference Test (SPT) performance for reward-seeking in CMS and Shuttle Box Escape Performance for escape learning in LH. Anhedonia and depressive phenotypes were assessed using SPT, the Tail Suspension Test (TST) for behavioral despair, and the 3-Chamber Sociability Test for social deficits. To examine stress effects on antidepressant response, ketamine was administered post-stress, and its impact on behavioral despair and social interaction was measured.

CMS-exposed mice exhibited increased TST mobility following ketamine treatment, regardless of anhedonic classification, suggesting a broad antidepressant response. In contrast, resilient LH mice, identified by shuttle box escape performance, displayed greater social preference in the 3-Chamber Task, linking escape learning to sociability following stress. These findings reveal key differences between chronic and acute stress paradigms, with CMS primarily affecting ketamine responsiveness and LH influencing social behavior. These distinctions underscore how stress context alters anhedonic resilience and susceptibility, shaping depressive phenotypes and treatment responses.

Melanie Gallegos

Public Health, Muir

Mentored By Dr. Nancy Binkin

Safety Net or Tightrope? Assessing Basic Needs Resource Support for Undergraduates at UC San Diego

Background and Purpose: In 2024, UC San Diego reported that 51% of undergraduates experienced food insecurity while 22% faced housing insecurity. The Basic Needs Center (BNC) provides essential food and housing support to students in need, but little is known about their use of BNC services. We conducted a survey to assess BNC awareness, use, and satisfaction among food- and housing-insecure students.

Methods: In February 2025, undergraduate students enrolled in selected public health and economic courses completed a Qualtrics questionnaire that included questions on basic needs and knowledge and use of the BNC. EpiInfo 7.2.6 was used to examine frequencies and calculate prevalence rate ratios (PRR) for associations between food and housing insecurity and BNC awareness and use.

Results: The response rate was 80%. Of the 774 respondents, 32% were food-insecure and 20% were housing insecure. Food-insecure students were equally likely to know about BNC food resources as food-secure students (79%v.76%;p=0.4), but were 2.1 times as likely to have used them (35%v.16%; p<0.0000001). Housing-insecure students were 1.4 times more likely to know about BNC housing resources (44%v.30%; p=0.002) and 5.0 times more likely to have used them, (14%v.2.8%; p<.00000001). Sixty-five percent of housing-insecure and 59% of food-insecure students who used BNC resources reported that their needs had not been fully met.

Conclusion: Many food-insecure students knew about but did not use BNC services; housing-insecure students had low knowledge and even lower BNC use. User dissatisfaction was common for both services. Addressing these concerns is crucial to improving BNC support for students facing basic needs challenges.

Lan Gao

Molecular and Cell Biology, Revelle

Mentored By Jing Yang

The Role of TWIST1-mediated Mechanotransduction in Breast Cancer Metastasis

Breast cancer metastasis remains the primary cause of breast cancer-related mortality, with a five-year survival rate of only 32% for metastatic cases. A key factor in metastasis is the increased stiffness of the extracellular matrix (ECM), which enables cancer cell invasion through mechanotransduction. My project aims to elucidate the molecular mechanisms by which ECM stiffness regulates TWIST1, a mechanosensitive transcription factor that promotes metastasis.

Karla Garcia

Public Health, Muir

Mentored By Nancy Binkin

Bridging the Gap: The Impacts of Financial Insecurity on Student Wellbeing at UC San Diego

Background and Purpose: Financial insecurity makes it difficult for college students to meet their basic needs and may affect academic performance and well-being. Little is known about the prevalence and impact of financial insecurity at UC San Diego (UCSD). We therefore conducted a survey to assess its prevalence and highlight its impacts on academic performance and physical and mental health among UCSD undergraduates.

Methods: In February 2025, UCSD undergraduates enrolled in selected Economics and Public Health courses completed a Qualtrics questionnaire that collected information on financial insecurity and wellbeing. The PHQ-2 and GAD-2 were used to assess possible depression and anxiety. Students were considered financially insecure if they reported difficulty getting through with the funds available to them during at least one month during the current academic year. EpiInfo 7.2.6 was used to calculate frequencies and prevalence rate ratios and p-values.

Results: The response rate was 80%. Of the 774 respondents, 36% met the definition of financially insecure. Financially insecure students were 1.6 times as likely to have a GPA below 3.5 (65%v.40%, $p<0.0000001$), and were 1.5 times as likely to rate their general health as “poor/fair” (33%v.22%,

p=0.0005). They were also 1.9 times as likely to have possible depression (27%v.14%, p=0.000005) and 1.5 times as likely to have possible anxiety (41%v.28%, p=0.0001).

Conclusion: Financial insecurity significantly impacts academic performance and wellbeing for the many students struggling to pay for basic needs. UCSD should invest in financial counseling and expand financial aid programs to assist students in attaining financial security.

Sebastian Gastelum

Human Biology, Revelle

Mentored By Nigel Calcutt

A KCC2 Potentiator Reverses Impaired Spinal KCC2 Expression and Rate Dependent Depression of the H Reflex and Alleviates Painful Neuropathy in Rodent Models of Type 1 Diabetes

Peripheral neuropathy is a common complication of diabetes, producing both pain and sensory loss. There is no FDA approved therapy for sensory loss while current treatments for pain have inconsistent efficacy and harmful side effects. Rate-dependent depression of the spinal Hoffman-reflex (HRDD) is a biomarker for pain arising from spinal disinhibition. Impairment of HRDD secondary to downregulation of potassium/chloride cotransporter-2 (KCC2) is reported in both animal models of diabetes and diabetic patients with neuropathic pain. The present studies investigated impact of the oral KCC2 potentiator AXN-A (Axonis Therapeutics Inc.) on impaired spinal KCC2 protein expression, HRDD defects, and neuropathic pain in diabetic rats and mice. Groups of STZ-diabetic rats received AXN-A (100mg/kg/day po, N=10) or vehicle daily (N=10), and age-matched controls received vehicle daily (N=10). STZ-diabetic rats treated with AXN-A, showed improvement in HRDD profile ($p<0.05$: ANOVA with Holm-Sidak test) and alleviation of tactile allodynia ($p<0.05$: ANOVA with Holm-Sidak test) compared to vehicle treated STZ-diabetic rats. Western blotting of spinal cords obtained at autopsy showed that reduced expression of KCC2 protein in STZ-diabetic rats was prevented by AXN-A treatment. In a separate study, STZ-diabetic Swiss Webster mice (N=9/group) received a single dose of AXN-A (300mg/kg po) or vehicle. Tactile allodynia in the STZ diabetic mice was significantly ($p<0.01$: 2-way ANOVA with Holm-Sidak test) alleviated within two hours after treatment without impacting other sensorimotor functions. These data suggest that targeting KCC2 activity with AXN-A successfully improves both spinal HRDD and diabetes induced neuropathic pain.

Ainsley Gibson

Psychology, Marshall

Mentored By Amy Bintliff

Healing & Learning: Trauma-Informed social-emotional learning for Refugee Youth in Uganda

My presentation builds on our lab's 2024 publication which explored the implementation of trauma-informed social-emotional learning (TI-SEL) for refugee youth in Uganda through an international research-practice partnership. Using insights from The Wellbeing Club, an adapted SEL curriculum, this research examines how culturally responsive, trauma-informed interventions can foster resilience, emotional regulation, and community engagement among refugee adolescents. Findings will highlight key lessons for effective TI-SEL implementation, emphasizing youth voice, facilitator training, and sustainable program development in crisis-affected educational settings

Nathalie Gider

Cognitive Science, Marshall

Mentored By Tyler Bell

Association of Hearing Loss and Cognitive Decline in the Advanced Cognitive Training for the Independent and Vital Elderly (ACTIVE) Study

Hearing loss has been identified as a potential risk factor for dementia, but findings remain inconsistent due to methodological limitations, such as failure to account for hearing aid use and comorbidities like depressive symptoms. This study examined the relationship between hearing loss and cognitive decline using data from the Advanced Cognitive Training Trial for the Independent and Vital Elderly (ACTIVE) Study (n=2,802; Mean age=73.63, SD=5.91; 52.9% women; Mean education=13.35, SD=2.66). Linear mixed models assessed whether baseline hearing loss predicted changes in Mini-Mental State Examination (MMSE), processing speed (Useful Field of View), reasoning (Letter Series, Number Series, Letter Sets), and memory (Hopkins Verbal Learning Task) over 12 years, adjusting for age, gender, education, race, depressive symptoms, and intervention effects.

At baseline, 48.8% of participants (n=1,205) reported hearing loss, with only 23.2% (n=280) using hearing aids. Over time, individuals declined in memory ($b=-.043$, $p<.001$). Those with hearing loss had worse baseline memory ($b=-.256$, $p<.001$) and experienced faster memory decline ($b=-.013$, $p<.001$). However, hearing loss was not associated with differences in reasoning or processing speed at baseline or over time ($ps>.05$), and hearing aid use did not moderate these associations ($ps>.05$).

These findings suggest that hearing loss, regardless of hearing aid use, is linked to worsening memory but not other cognitive domains. Preventing hearing loss—rather than treating it after onset—may be critical for preserving memory and reducing dementia risk. Addressing hearing loss in aging populations could enhance daily functioning and quality of life.

Ananya Giri

Ecology, Behavior, and Evolution, Revelle

Mentored By Aniket De

The Divergence of Hindi and Urdu: Evolving Ideas of Nationhood and Religious Identity in Colonial and Partitioned India

Hindi and Urdu are languages spoken widely in northern India and Pakistan. Mutually intelligible as spoken languages, they are considered to be variations of an older language, Hindustani. A Persianized version of Hindustani began to develop during the time of the Delhi Sultanate and Mughal Empire, and came to be known as Urdu. Urdu, with its Persianized vocabulary and a variant of the Perso-Arabic script, became associated with Muslim identity, while Hindi, using a more Sanskritized lexicon and the Devanagari script, became closely linked to Hindu identity. Ideas of linguistic purism have overshadowed the story of this divergence, with members from both religious communities advocating for changes to vocabulary. These linguistic shifts became symbols of broader religious and political struggles during the British colonial period, when the use of Hindi and Urdu became deeply intertwined with political, cultural, and religious identities. Following Partition, Urdu became Pakistan's national language, and Hindi became one of the official languages of India. This project explores how the divergence of Hindi and Urdu as distinct languages contributed to the shaping of national and cultural identities in colonial and post-colonial India and Pakistan. By examining literary works and historical documents, it investigates the role of language in shaping political ideologies, identity, and nationalistic ideas, particularly during the anti-colonial movement and the period following the 1947 Partition. By tracing this story of linguistic divergence alongside the cultural transformations of this period, this research explores the broader implications of language as a tool for nation-building and identity formation.

Erik Glesne

Cognitive Science, Revelle

Mentored By Sarah Creel

Using Forced Aligners to Analyze Perception Production Relationships in Native Mandarin Speakers

What features of second-language (L2) accented speech differ from first language (L1) speech, and how does this impact understanding? Here, we report acoustic analyses of over 4000 recordings of words produced by L2 speakers of English whose L1 is Mandarin. Several theories could account for accent differences. One possibility is that listeners' accent production is rooted in their perception of L2 speech sounds. If this were the case, it would initially be difficult for L2 speakers of English to hear speech sound differences made by L1 speakers that are not present in the L2 speakers' first language. Furthermore, it would suggest that as speakers' perception of the L2 (English) improves, their production would improve at a similar rate, in turn predicting that they should understand their own speech as well as that of an L1 speaker. Another hypothesis to account for accent differences is that production lags behind perception, as is the case in young children. If so, L2 speakers should perceive speech sound differences from L1 speakers before they can produce them. To address these questions, we used a neural network forced aligner to detect speech sound boundaries, hand-adjusted boundaries as needed, and then extracted time- and frequency-based properties of the sounds. We are now relating those properties to the accuracy of listeners' own perceptions and to the accuracy of automatic speech

recognition to determine what auditory cues Mandarin L2 speakers use to distinguish similar sounding English words.

Angel Gomez

Physics, Warren

Mentored By Dr. Boyu Meng

Developing a Clinical Quality Assurance procedure for Multiple Targets Stereotactic Radiosurgery

Purpose: Single-Isocenter Multiple Targets (SIMT) Stereotactic Radiosurgery (SRS) is widely used for its precision and effectiveness. However, standardized quality assurance (QA) protocols for SIMT SRS and the integration of surface-guided radiotherapy (SGRT) and image-guided radiotherapy (IGRT) for setup and monitoring remain underexplored. This study aims to establish a comprehensive SRS QA protocol and evaluate SGRT and IGRT under conditions such as camera occlusion and skin tone variation.

Methods: A 3D-printed anthropomorphic head phantom with a Multi-Met Winston-Lutz cube (Sun Nuclear Corporation, Melbourne, FL) containing radiopaque fiducial markers was used to evaluate deviations in isocenter and off-axis targets during Winston-Lutz (WL) tests across 15 fields. An IGRT technique was implemented by setting up the phantom based on matching of the skull, target deviations were reported and compared to traditional WL. SGRT accuracy was assessed using AlignRT (Vision RT Ltd., London, UK) systems under varying conditions, including camera occlusion at gantry angles and skin tones simulated using makeup foundations.

Results: WL tests with manual fiducial matching showed mean deviations of 0.35 ± 0.15 mm(isocenter) and 0.49 ± 0.26 mm (off-axis), while IGRT setup resulted in 0.41 ± 0.21 mm (isocenter) and 0.59 ± 0.35 mm (off-axis), respectively. SGRT showed significant camera occlusion at gantry angle 270∘, with a 23.66 ± 1.70% decrease in percentage overlap compared to the 0∘ reference. For skin tone variation it was found that detectability for darker skin tone decreases with surface signal detection dropping from 74.13 ± 1.31%(baseline) in percentage overlap to 65.45 ± 1.24 %.

Conclusion: The anthropomorphic phantom in this study improved QA efficiency and closely mimicked clinical setups. Skin tone settings were identified as critical setup parameters for SGRT performance. These findings provide valuable guidance for integrating SGRT and IGRT into clinical SRS treatment and monitoring

Grace Gomez

Communication, Sixth

Mentored By Andrew deWaard

In a Moment It Could All Go Boom: An Extreme Western Government, How Netflix's Arcane Uses Solidarity, Power, and Family to Shape Class and Gender Struggles of Minorities in Political Conflict Using a Feminist, Marxist, and Stylistic Analysis

Great stories have the power to make us reflect on the happenings of our world, offering insights into society, power structures, and human struggles. Arcane is one such series, with its portrayal of the conflict that arises between characters from the wealthy Piltover and the oppressed in Zaun, calling attention to how characters navigate morality, solidarity, and equity amidst the complexities of their political systems and social divisions. The project will primarily employ a sociopolitical and gender theory framework to examine the text and the characters. Three methods of analysis will be used to triangulate and analyze the series. First, a narrative analysis will focus on using specific scenes to examine the conflict, portrayal of societal issues, and development of solidarity. Second, a visual style analysis will help uncover how visuals and aesthetics influence our perception of authority and evolving relationships. Lastly, an ideological analysis will explore the characters and their world, aiming to understand how individuals and groups justify their actions to systemic injustices and how these ideologies can uphold or challenge the systems in place. Through this analysis, we can consider the complexities of real-world politics and challenges of bringing about meaningful changes that help foster community when so much of politics feels like taking sides.

Mak Gonzales

Communications, Warren

Mentored By Andrew deWaard

Is This Town Big Enough for the Two of Us?: Reconsidering how the Portrayal of Women in TV Shows of the Western Genre Reinforces and Challenges Gender Norms, using industrial, textual, and audience reception, and analysis

This study seeks to examine the portrayal of women in Western television shows, a genre rooted deeply in American culture and history. By analyzing the series Gunsmoke, Little House on the Prairie, Dr. Quinn Medicine Woman, Deadwood, Strange Empire, and Yellowstone: 1883, the research highlights the constrained archetypes historically assigned to female characters and discusses the way in which women are both limited and empowered within the genre. Utilizing textual, content, and discourse analysis, alongside historical production accounts, the project investigates how women's roles have shifted within Western narratives in response to societal changes and audience expectations. This includes exploring behind-the-scenes dynamics, particularly the limited participation of female writers and directors within long running popular western series, as well as the often hostile work environment created by early Hollywood television shows. The study also uses feminist frameworks, such as the Bechdel Test, in critiquing gender representation and pointing out when women interact with each other outside of male desires. Ultimately, the research offers insights into the way in which women are represented in this genre that is of extreme importance to American culture.

Itzel Gonzalez Velazquez

Cognitive Science w/specialization in Neuroscience, Revelle

Mentored By Dr. Amy Vatne Bintliff

Family Engagement through Out-Of-School Time: A Community Engaged Study

Due to proprietary information, this abstract has been redacted.

Michaela Goodman

Molecular and Cell Biology, Muir

Mentored By Maripat Corr

MyD88 as master regulator in a murine model of arthritis

Due to proprietary information, this abstract has been redacted.

Michelle Griffith

Public Health and Psychology, Revelle

Mentored By Dr. Nancy Binkin

What it Takes to Pay the Bills: The Impacts of Student Employment on Academic Performance and Well-Being

Introduction: Working during college helps students cover costs, reduce debt, and obtain valuable experience, but may have negative consequences. Little is known about student employment and its effects among undergraduates at the University of California, San Diego (UCSD). We therefore conducted a survey examining prevalence, motivations, satisfaction, and challenges of student employment.

Methods: During February 2025, UCSD undergraduates enrolled in selected Public Health and Economics classes completed a Qualtrics questionnaire, which included questions about current working practices, scales to assess impact of working on academics, health, financial security, career development, and work satisfaction. Data analysis was performed using EpiInfo7.2.6.0.

Results: The response rate was 80%. Among the 774 respondents, 274 (36%) were currently working, of whom 33% worked >20 hours/week and 17% worked >1 job. When asked to rank their top motivation for working, 44% selected paying for basic needs, followed by gaining experience (24%), covering school expenses (18%), and earning extra money (14%). Negative academic effects were reported by 46% of working students, and 37% reported that working had negative health effects. However, 70%

reported that working positively impacted financial security, and 59% said that it positively affected their career development. Overall, 84% expressed positive feelings about working.

Discussion: Student employment improved financial insecurity, but it had negative impacts on academics and health. As students work to pay for personal expenses, greater consideration for increasing access to basic needs and improving work conditions may lead to higher academic performance and improved wellbeing.

Juliette Hamid

Chemistry, Revelle

Mentored By Padmini Rangamani

Computational modeling demonstrates the role of store-operated calcium entry in modulating skeletal muscle force production

Calcium ion dynamics provide a direct link between electrochemical activation of skeletal muscle fibers and force generation. An improved understanding of the mechanisms by which calcium dynamics modulate force production allows for insights in optimizing muscle performance. Recent experimental data suggests that store-operated calcium entry (SOCE), the process of extracellular calcium influx upon depletion of calcium from intracellular stores (sarcoplasmic reticulum), helps delay the onset of muscle fatigue. However, the mechanistic links between SOCE and sustained force generation remain unclear. We hypothesize that SOCE regulates elevations in myoplasmic calcium by refilling stores during sustained periods of muscle activity. We test this hypothesis with a mathematical model that simulates the biochemical events of muscle contraction. We first minimize the error between model predictions and experimental measurements of action potential and myoplasmic calcium transients to estimate parameter values. With these parameters, we then test the effects of SOCE inhibition on calcium dynamics and force production. We find that the magnitude of myoplasmic calcium and force are both significantly reduced compared to control conditions, in agreement with experiments. Finally, we examine the effects of SOCE inhibition across different types of exercise. Our simulations predict reduced force in all cases, with a more significant reduction observed during high-intensity training.

Marshall Hamon

Mechanical Engineering, Sixth

Mentored By Olivia Graeve

Optimizing Red-Emitting Phosphors Through Host Lattice Composition for Advanced Lighting Applications

Fluorescent red-emitting phosphors are a critical component of modern lighting applications and show great promise in next-generation commercial white light-emitting diodes. Since a phosphor's

luminescence depends on its lattice structure, this study examines the structural and luminescent properties of $Ca_{4-x}Sr_xLaO(BO_3)_3 : Eu^{3+}$ (x = 0 to 3.95) and $Ca_{4-x}Ba_xLaO(BO_3)_3 : Eu^{3+}$ (x = 0 to 0.375) phosphors. The emission and excitation spectra of these phosphors were determined by luminescence spectrophotometry resulting in a distinct red emission at 613 nm and 630 nm. X-ray diffraction was also used to detect the presence of additional solid phases in samples with higher concentrations of strontium and barium.

Yang Han

Bioengineering: Bioinformatics, ERC

Mentored By Reem Khojah

AI-based Detection and 3D Imaging of Suspended Organoid Culture

Organoids are derived from induced pluripotent stem cells to imitate biological properties of in vivo organs. In particular, human cortical organoids (hCO) are becoming increasingly popular in biological research related to neural disease pathologies and aging due to its high resemblance to human brain tissues. This project aims to provide the research community with a simple and highly automated brightfield microscope for better monitoring of organoids in culture plates. It uses widely available and budget-friendly Raspberry Pi components and general supplies to construct the microscope. Automatically captured images of organoids are automatically uploaded to the cloud, where a pre-trained AI model is run to detect and measure organoids properties in real-time. In addition, users can train the AI model to better suit their image detection tasks. Through imaging experiments, the microscope operated at least 48 hours without any human intervention. The AI model achieved >95% accuracy in detection of organoids in brightfield images. The organoid images are then validated by images captured from a traditional microscope. Once fully implemented, the product will enable researchers to remotely monitor organoid culture and obtain growth data continuously with minimal human efforts. This can drastically reduce the cost of organoid culture and help to improve the consistency and efficacy of existing protocols for organoid culture, which benefits many biological research fields.

Irum Hasan

Human Biology, Revelle

Mentored By Marianna Alperin

The Effect of Pregnancy-Associated Systemic Milieu on Muscle Stem Cells in Vitro

Pregnancy is a physiological state characterized by extensive systemic changes in the hormonal milieu. Vaginal childbirth causes injury to the pelvic floor muscle (PFM). Muscle stem cells (MuSCs) are responsible for muscle regeneration in response to birth injury, however the effects of hormones on

MuSCs are not known. This study aims to determine how hormones impact MuSCs proliferation in the pubocaudalis (PCa) muscle – one of the pelvic floor muscles. We discovered that MuSCs proliferation, detected by EdU and Pax7 expression, increases in mid-pregnancy (MP) and decreases in late-pregnancy (LP) compared to non-pregnant (NP) controls. To try to understand what is modulating MuSCs proliferation through pregnancy, we isolated serum from NP, MP, and LP rats and used it to treat the MuSCs isolated from the same animals.

When the cells were treated with the late pregnant serum, proliferation was completely absent and MuSCs died. This prompts us to investigate whether hormones in the LP serum may be responsible for inducing this blockage in cell proliferation. However, when we treated the MuSCs with each hormone, we detected no difference in proliferation. Given that single hormones had no impact, we pulled the hormones together and looked at their effects: MuSCs proliferation was still not affected. These findings suggest that hormonal changes do not impact cell proliferation and do not induce cell death. Further analysis of pregnancy serum will be performed to identify the factor inducing cell death present in the late-pregnant serum.

Veronica Hernandez

Clinical Psychology & Cognitive and Behavioral Neuroscience, Muir

Mentored By Dr. Lisa Eyler

Longitudinal Changes in Cognition and Mood Instability in Bipolar Disorder

Cognitive dysfunction and mood instability are hallmark features of Bipolar Disorder (BD); however, long-term patterns of these symptoms are not well-understood. Previous studies have primarily focused on cross-sectional assessments, though few have explored the longitudinal changes in cognitive performance and mood within individuals with BD, particularly in comparison to nonpsychiatric controls (NCs). This study aims to examine cognitive function and mood longitudinally using the MATRICS Consensus Cognitive Battery (MATRICS) and the 5-choice Continuous Performance Task (5C-CPT). Based on what is currently known, we hypothesize that individuals with BD will show greater cognitive decline over time, particularly in their executive functioning, in comparison to NCs. Additionally, we anticipate that mood fluctuations, which are assessed through daily phone-based affect ratings, will significantly impact cognitive performance. Using linear mixed models, we will examine how these variables change across the years, with a focus on whether or not changes in mood predict subsequent cognitive performance. Ultimately, this study aims to contribute to a better understanding of the relationship between mood instability and cognitive dysfunction in BD, offering insights into the long-term trajectory of these symptoms and informing future interventions.

Megan Hsu

International Studies - International Business, ERC

Mentored By Munseob Lee

South Korean Beauty Standards and their Economic Impacts

Pale skin, double eyelids, and a v-shaped jawline. These are among the many features that define South Korea's strict beauty standards. With one in five South Korean women undergoing plastic surgery, the country holds the highest plastic surgery rate per capita. Rooted in historical influences and reinforced by societal pressures, these strict beauty standards are ingrained in South Korean culture, lifestyle, and society. However, how have these standards influenced its economy? My research examines their economic impact, assessing both benefits and costs while proposing policy recommendations

South Korea's beauty standards have created a culture that encourages consumer beauty spending, creating booming industries in skincare, cosmetics, and plastic surgery. These flourishing industries contribute to revenue generation, employment opportunities, and technological innovation. The global popularity of South Korean beauty standards, propelled by the Hallyu wave, has further expanded global beauty exports and medical tourism, significantly boosting the economy.

However, these beauty standards also create negative economic consequences. Societal emphasis on appearance fosters lookism, contributing to hiring discrimination, reduced workplace productivity, and gender inequality. Moreover, the psychological toll of unrealistic beauty expectations contributes to mental health issues such as depression and body dysmorphia, further impacting workforce efficiency.

While South Korea's beauty standards have driven economic growth, their broader societal consequences pose detrimental economic costs that outweigh the benefits. Despite existing policies to address discrimination, policy interventions must dismantle the cultural mindset of conforming to unhealthy ideals and redefine the concept of beauty beyond appearance to address the root causes of these costs.

Reagan Hsu

Computer Science, Marshall

Mentored By Weg Ongkeko

Short-Read DNA Analysis in Alzheimer's Disease--APOE-Stratified Differential Expression and Predictive Modeling

Alzheimer's disease (AD) is a progressive neurodegenerative disorder characterized by cognitive decline and neuronal dysfunction. Early and accurate diagnosis remains a major challenge, as current diagnostic methods rely on symptomatic evaluation and costly imaging techniques. Recent studies suggest that small RNAs (sRNAs) may play a critical role in neurodegeneration and may thus serve as viable biomarkers for AD. Identifying variations in sRNA expression patterns in AD patients could provide novel insights into disease pathology and enhance diagnostic precision, enabling clinicians to detect and predict AD with greater accuracy.

Using RNA-sequencing data from samples of 62 patients obtained from Sequence Read Archive (SRA), this study will analyze differential sRNA expression in AD by leveraging high-throughput sequencing and computational modeling to identify key regulatory variations. These samples comprise of healthy controls, mild cognitive impairment (MCI) patients, and those diagnosed with AD. By mapping these alterations, we can uncover potential genetic contributors to AD and pinpoint pathological targets for therapeutic intervention. Understanding these molecular signatures may lead to the development of biomarker-based diagnostic tools that allow for earlier detection and more effective disease monitoring.

Furthermore, elucidating the role of sRNA in AD could reveal novel pathways associated with neurodegeneration, opening avenues for targeted therapies and personalized medicine. This project thus seeks to bridge the gap between genetic markers and clinical outcomes, ultimately contributing to improved patient prognosis.

Stephen Huang

Electrical and Computer Engineering, ERC

Mentored By Nikolay Atanasov

Robot Proving Grounds

Our work aims to develop tutorials and workshops to introduce students to the field of mobile robot systems. We are developing a website and interactive simulation focused on occupancy grid mapping, robot localization, motion planning, and robot control techniques, designed to ease students into more advanced concepts in robotics. We aim to provide clean implementations of simple algorithms for these four robot capabilities and supplement them through visualization and intuitive explanations on the website. Another objective of our work is to investigate the impact of early exposure to robotics algorithms on students' future involvement in STEM. We aim to gather information on whether our tutorials and workshops contribute to heightened interest, confidence, and performance in STEM-related classwork and research, providing insights on how educators can address the challenges students face when encountering advanced topics for the first time. The findings ultimately lay a foundation for improving educational practices to better equip students for success in STEM disciplines.

Emily Huang

Mechanical Engineering, Sixth

Mentored By Michael Tolley

Volumetric Control System for Fluidic Soft Robots

Obtaining accurate data and emulating biological forms is vital to the various soft robotic experiments. One way to facilitate this data collection and simulation is through a volumetric control device. In this project, we designed a system that can precisely control the amount of fluid being exerted into soft

robotic actuators. By incorporating easily accessible parts into the design of an existing fluidic control system, we created a modular, cost-effective solution for characterizing and controlling soft robots.

Jair Huerta

Political Science, ERC

Mentored By Erika Crable

Policy Surveillance & Political Rhetoric About Harm Reduction Services in Six States

Nearly 87,000 individuals in the US died from a fatal drug overdose in 2024. Harm reduction services are safe, effective strategies to mitigate the negative consequence of drug use (e.g., overdose, disease transmission), and include: syringe service programs, drug testing, overdose reversal medication, overdose prevention centers, and educational materials. However, access to harm reduction is hindered by state laws and varying political climates that inhibit resource allocation for such services. This project aims to investigate the legality of and political landscapes around harm reduction in six states as a preliminary, formative research effort to identify and engage relevant local stakeholders in efforts to scale-up harm reduction services. Two undergraduate researchers conducted document review and policy surveillance analyses to create individual jurisdictional profiles for each state. Researchers performed a structured search of state health agency websites to identify current public health efforts to deliver harm reduction and collect data about overdose prevention. Structured scoping reviews were also conducted to identify local news coverage, social discourse, and political rhetoric about harm reduction services. Policy surveillance methods are being used to search legal databases and state legislative websites for proposed bills and passed laws restricting or enhancing access to harm reduction. Jurisdictional profiles are continuously updated, living documents that directly guide how the larger research team engages stakeholders in state health departments, state substance use task forces, opioid settlement boards, and other policy actors who are critical to informing decisions about expanding access to harm reduction services.

Deborah Hughes

Psychology with a Specialization in Clinical, Revelle

Mentored By Caren Walker

The Influence of Normality on Causal Judgment: Can Mechanism Information Elicit Abnormal Selection in Children?

How normal or typical something is can influence our explanations about what makes an outcome happen. Specifically, prior studies show that adults exhibit a bias to pick the abnormal cause when two causes jointly make an outcome, yet there is very little research that explores when and how that bias develops. Initial results from the current study that uses child-friendly and novel stimuli showed that 5-

to 7-year-old children, unlike adults, overwhelmingly attribute effects to the normal cause. However, it is unclear whether children failed to show an understanding of causal structure, or whether this bias appears later in development. The present study introduces aspects to the experimental design, aiming to create conditions that might elicit children to select the abnormal cause. We hypothesize that visual access to the causal mechanism might enable children to consider causal structure better. Therefore, the present project examines whether introducing a more visible causal mechanism will elicit the abnormality bias in 5- to 7-year-old children. If children select the abnormal cause in this new design, this would emphasize the importance of mechanism information in the development of causal reasoning. Throughout the follow up stage, more changes will be made to determine whether the children's reasoning is being more impacted by the causal mechanism or the lack of clarity of the task. These results suggest that children are capable of exhibiting the abnormality bias to some degree even when there are no social or moral agents that contribute to the outcome.

Griffin Hurst

Chemical Engineering, ERC

Mentored By Justin Opatkiewicz

Formulation and Materials Study of Early-stage Lip Glosses

Due to proprietary information, this abstract has been redacted.

Sarah Huynh

Microbiology, ERC

Mentored By Julian Schroeder

Investigating new approaches to improving water use efficiency of crops

With climate change resulting in higher temperatures globally and prolonged droughts, developing crop varieties with higher water use efficiencies have become of significant interest. Stomata apertures presented on the outermost layer of plant leaves play a pivotal role in exchanging the CO2 intake for photosynthesis and transpired water vapor. Arabidopsis thaliana mutant leaves lacking a signaling protein show narrow stomatal apertures and impair the response to CO2. These mutant leaves show intact stomatal closing in response to the stress hormone abscisic acid (ABA) and have growth and biomass comparable to the wildtype plant, providing a potential target for improving water use efficiency while minimizing growth defects. Through CRISPR/Cas9-mediated gene editing, we aim to improve water use efficiency in water-thirsty rice through targeted mutagenesis. We hypothesize that our gene editing can result in a lower steady state stomatal conductance. We will perform physiological experiments of selected Cas9-free plants using infrared thermal imaging to qualitatively assess this hypothesis. Protein-protein interactions will be measured through Bimolecular fluorescence

complementation (BiFC) and split-luciferase assays. We hypothesize that our targeted mutagenesis can increase water efficiency of crops such as C3 rice due to lower stomatal opening. With further research this may result in breakthroughs in generating new rice varieties with stronger resistance to water limitation.

Sophia Jaberi Vivar

General Biology, Warren

Mentored By Shiri Gur-Cohen

Unveiling the Role of the Lymphatic Niche in Guiding Stem Cell Fate Decisions During Tissue Regeneration

Due to proprietary information, this abstract has been redacted.

Saee Jadhav

Neurobiology, Seventh

Mentored By Dr Tony Yaksh

Understanding Widespread Pain in Rheumatoid Arthritis: The Role of the Trigeminal Ganglion

Rheumatoid arthritis (RA) is a chronic autoimmune disease characterized by inflammation of the synovial joints, leading to pain, swelling, stiffness, and progressive joint damage. While pain in patients is primarily localized to the affected joints, emerging evidence indicates the development of widespread pain that persists beyond joint pathology, suggesting mechanisms independent of local inflammation. Recent studies emphasize the role of neuroimmune interactions in driving persistent pain sensitization, particularly through IgG immune complexes, Fc gamma receptors (FcγRs), and macrophage activation.

While the dorsal root ganglia (DRG) have been extensively studied in RA-related pain, the trigeminal ganglion (TG)—which processes orofacial sensory input—remains largely unexplored despite reports of facial pain and hypersensitivity in RA patients. This study aims to investigate the role of TG in RA-related widespread pain. We hypothesize that circulating IgG immune complexes bind to FcγRs on TG-resident immune cells, inducing neuronal hyperexcitability and immune cell infiltration.

To test this hypothesis, we are using the K/BxN serum transfer mouse model of RA to assess the development of facial hyperalgesia in experimental and control groups. We will also examine the activation of macrophages and satellite glial cells and the infiltration of immune cells such as neutrophils, T cells, and B cells as potential contributors to persistent orofacial pain.

Identifying TG-mediated pain mechanisms provides novel insights into RA pain pathology beyond joint inflammation. This research offers a paradigm shift in pain management by highlighting FcγR-targeted and neuroimmune interactions as potential targets for RA-related widespread pain therapies.

Understanding the TG's role in RA may lead to more effective pain interventions, improving patient outcomes where traditional anti-inflammatory treatments fall short.

Michael Janelle

Oceanic and Atmospheric Science, Sixth

Mentored By Sarah Gille

Investigating Carbon Cycle Anomalies and Surface Dynamics in the Southern Ocean Using B-SOSE

The Southern Ocean plays a critical role in the global carbon cycle due to ocean circulation patterns, yet it remains one of the least understood regions largely due to its remoteness, prominent seasonality, and harsh environmental conditions. The rapidly changing sea ice cover regulates light availability and nutrient cycling, causing it to be a crucial element in phytoplankton productivity and thus carbon flux (Bisson & Cael, 2021). The past two years have seen the lowest sea ice extent on record (Younger, 2024), raising major questions about how phytoplankton blooms, carbon flux, and other processes react to shifting ice conditions (Thomalla et al., 2023).

This research leverages the Biogeochemical Southern Ocean State Estimate (B-SOSE), which integrates real-world observations with high-resolution, time-evolving estimates of ocean conditions (Verdy & Mazloff, 2017). Because it captures fine-scale processes, such as sea ice variability and phytoplankton blooms, B-SOSE provides insights that sparse observational datasets cannot resolve. This study will investigate spatial and temporal correlations between sea ice anomalies and biogeochemical parameters, such as net primary productivity (NPP) and carbon flux, to evaluate how shifting ice regimes influence ecosystem function.

The central hypothesis posits greater sea ice loss results in increased phytoplankton productivity, however other environmental factors, such as nutrient availability and regional variability also play roles in regulating biological growth (Arteaga et al., 2020). By analyzing how shifting sea ice regimes affect carbon cycling, this study will improve predictions of how Southern Ocean biogeochemistry evolves in a changing climate.

Jessica Jatiram

Public Health with a concentration in Epidemiology, ERC

Mentored By Nancy Binkin

What it Takes to Pay Your Bills: The Impacts of Student Employment on Academic Performance and Well-Being

Introduction: Working during college helps students cover costs, reduce debt, and obtain valuable experience, but may have negative impacts. Little is known about rates of student employment at the

University of California, San Diego and effects on students. We conducted a survey examining motivations, satisfaction, and challenges of student employment.

Methods: During February 2025, UCSD undergraduates enrolled in selected Public Health and Economics classes completed a Qualtrics questionnaire, which included questions about work current working practices, scales to assess impact on academics, health, financial security, and career development, as well as work satisfaction. Data analysis was performed using EpiInfo7.2.6.0.

Results: The response rate was 80% (774/968). Among 774 respondents, (274) 36% were currently working, 33% worked >20 hours/week and 17% worked >1 job. Students ranked paying for basic needs as their top reason for working (44%), followed by gaining experience (24%), paying school expenses (18%), and earning extra money (14%). Negative academic effects were reported by 46% of working students, and 37% reported that working had negative health effects. However, 70% reported that working positively impacted financial security, and 59% said that it positively affected their career development. Overall, 84% expressed positive feelings about working.

Discussion: Student employment was found to improve financial insecurity among students surveyed, but had negative impacts on academics and health. As students work to pay for personal expenses, greater consideration for increasing access to basic needs and improving work conditions may lead to higher academic performance and improved wellbeing.

Parth Jha

Mechanical Engineering, Marshall

Mentored By Professor Lisa Poulikakos

Tailored Filters as a Solution to Color Vision Deficiency

Three hundred million people in the world are affected by color vision deficiency (CVD), leading to frustration in their everyday lives due to their inability to accurately perceive color. Cone cells, which are responsible for color vision have a unique spectral tuning resulting in a distinctive spectral distribution for each type of cone cell. The unique response of each cone to different wavelengths of light enables the perception of different colors. CVD arises when variations in proteins present in cone cells alter their absorption of light wavelengths. This leads to a state where the spectral responses of the different cones overlap each other, impacting color perception. By filtering wavelengths of light that coincide with overlapping regions in the cones' spectral response, our study proposes a novel approach using optical filters to aid CVD. Through analytical and numerical modeling, our experiments revealed that our proposed optical filters were able to make red and green colors more distinguishable for people with Red-Green type of CVD. Our optical filters open new possibilities for people with CVD as they can be optimized for different forms of CVD and can be fabricated using nanostructures to create wearable lenses

Suqi Jiang

Psychology, Marshall

Mentored By Piotr Winkielman

Do Ratings of Biracial Individuals Depend on How We Categorize Them?

This study examines how the categorization of biracial individuals influences their perceived attractiveness and trustworthiness and how it changes their processing fluency. Previous research has shown that biracial individuals are generally considered more attractive than monoracial individuals because they are more typical and similar to the average human. This preference, called the "beauty-in-averageness" effect, occurs because more typical faces are easier (more fluent) to process, and fluency feels positive. However, the categorization of biracial individuals into binary options (e.g., Asian vs. Caucasian) can introduce cognitive disfluency due to the ambiguous identity of biracial faces. This disfluency can diminish their perceived attractiveness compared to monoracial individuals. This study aims to explore the dynamics between categorization and social impressions. We hypothesized that, providing a "middle" category, which may better accommodate the biracial identity, could reduce cognitive disfluency and enhance perceived attractiveness by resolving identity ambiguity during categorization. To test this hypothesis, we conducted an online experiment using a 2x2 mixed-factorial design with students from the University of California, San Diego. The findings aim to explore the underlying mechanisms influencing social impressions and inform interventions to avoid cognitive biases that may lead to lowered social impressions.

Jin Johnson

History and Ethnic Studies, Sixth

Mentored By Prof. Ross Frank

'Stochastic Terrorism': A Case Study of Online Extremism and anti-LGBTQ+ Activism

Chaya Raichik (also known by the internet handle Libs of TikTok) is an anti-LGBTQ+ activist who is regularly at the forefront of online culture wars. Raichik's harassment of marginalized groups – especially the LGBTQ+ community – has led to extreme acts of violence against these communities or individuals who are perceived to be supporting these communities. A common method of intimidation that is used by Raichik is the branding of openly LGBTQ+ teachers as "groomers". This discriminatory language originates from 1970s anti-LGBTQ+ activist Anita Bryant who was similarly focused on the harassment and identification of LGBTQ+ individuals (especially teachers) as "pedophiles". Despite the over 50 year gap between these two activists, the language utilized is nearly identical – with an emphasis on teachers, national identity, and the rights of parents. Bryant and Raichik both are influential in American politics and the shaping of America's culture war against the LGBTQ+ community. Analysis of their careers provides insight into the religious right as well as how the movement against LGBTQ+ rights develops across America.

Margaret Jones

Biology with a Specialization in Bioinformatics, Sixth

Mentored By Jill Mesirov

Validating a mouse model of a pediatric brain tumor

Medulloblastoma is the most common malignant pediatric brain tumor and has multiple molecular subtypes with distinct clinical outcomes. One subtype of medulloblastoma is driven by Sonic Hedgehog (SHH) signaling. The goal of this project was to determine whether the transcriptional profile of a newly developed SHH medulloblastoma mouse model was well representative of the human SHH subtype. The approach was to project gene expression profiles of the SHH mouse model samples into a mathematically derived latent space of a human medulloblastoma reference dataset. The work required addressing cross-platform differences, species variation, and batch effects. The analysis was implemented as a workflow in a Jupyter Notebook. The workflow will support validation of other experimental medulloblastoma models using the same approach.

Margaret Jones

Biology with a Specialization in Bioinformatics, Sixth

Mentored By Ida Deichaite

The Role of TSC2 Variant rs1800720 in Head and Neck Cancer: Implications for Prognosis and Treatment

Due to proprietary information, this abstract has been redacted.

Elizabeth Ju

Communication, Muir

Mentored By Andrew deWaard

"They are Mine!": The Dangers of Kpop Music Videos and Fandoms at the Extremes: Sexualization, Objectification, and How Kpop Companies Use Music Videos to Reinforce Parasocial Behaviors at the Expense of Both Fans and Artists

Korean pop music or Hallyu has become a global sensation. Not only is it the music that has gained mass popularity, but also the stars of the music, also known as idols, who have received great attention and adoration from fans. With this growing popularity, Korean media companies are persistently trying to find ways for idols and fans to have deeper connections with one another. This could be through creating apps designed for idols to text, call, livestream and also holding events like fan meetings and

creating merchandise to further their connection with the audience. However, this may cause some problems because of the parasocialism that occurs from a deeper relationship with the idols. These problems and the ways in which K-pop companies are able to reinforce these ideas comes from the messages that they portray via their music and music videos. Therefore, although K-pop has many positive influences, like bringing communities together (Kakaoudaki), nevertheless K-pop companies promote toxic fan behavior like parasocialism through the sexualization of young artists as seen in music videos, like “Cookie” and “Cool with You” by New Jeans and by other artists.

Tylar F. Kameda

Linguistics, ERC

Mentored By Gabriela Caballero

Principles of grammatical gender assignment in San Juan Piñas Mixtec

San Juan Piñas Mixtec (SJPM) is a previously undocumented Otomanguean language spoken in Oaxaca, Mexico and in diaspora communities in the US and Mexico. This language is the focus of the SJPM language project, carried out together with Maestra Claudia Juárez Chávez, other SJPM language experts, as well as UCSD and UCLA faculty and students. My research within this project focuses on the grammatical gender system of SJPM and the principles that underlie gender assignment of nouns in the language by its speakers.

Based on the analysis of data obtained with SJPM speakers in San Diego county and the town of San Juan Piñas in Oaxaca, I show that the nouns in this language are assigned to specific genders through primarily semantic means. Preliminary findings show that these grammatical genders specify the humanness (and if human, masculine or feminine social genders), material, and shape of the noun referents. However, investigation has both revealed variation in gender assignment within and across speakers when particular nouns fulfil the semantic criteria of more than one gender, as well as special pragmatic uses of gender assignment that do not conform with the expected gender assignment of the language (e.g., marking human names with the animal gender for humor).

Eagan Kaminetz

Mathematics-Computer Science, Muir

Mentored By Robert Webber

Low-Rank and Sparse Preconditioners for Kernel Learning

Kernel machine learning is a common means of inference in data science that models labeled data point as the realization of a Gaussian process with a known covariance structure. The current state of the art for solving kernel learning problems is preconditioned conjugate gradient, which is an iterative method that requires a preconditioner to run quickly. The most effective preconditioners are matrix factorizations

that are cheap to generate, with inverses that can be rapidly applied to vectors. We give an overview of the state of the art in both low-rank and sparse preconditioners. Then, we present an original algorithm for generating preconditioners with both low-rank and sparse components. We optimize the novel preconditioning algorithm so it runs quickly and prove error bounds that guarantee its effectiveness across a wide range of data matrices arising in practice.

Emma Kandel

Cognitive Behavioral Neuroscience, Psychology, Sixth

Mentored By Anastasia Kiyonaga

The Power of Choice: Effects of Agency and Goal Cohesion on Working Memory

Every day, we use working memory (WM) to navigate tasks, but WM in the real-world may differ from traditional laboratory tasks, potentially leading to overestimated capacity limits. This study explores two factors that may influence working memory (WM): agency and goal cohesion. Prior research shows that a sense of agency—the sense of control or choice over one's actions—enhances long-term memory, but its effects on WM remain unclear. Goal cohesion refers to how well stored information aligns with a common goal, which might also influence WM. We have developed a novel grocery shopping inspired word list task to examine how agency and goal cohesion interact to shape WM capacity. Participants either choose (agency) or are assigned (no agency) a word list labeled as a recipe (goal cohesion) or a shopping list (no cohesion). Participants then encode the associated list. After a short delay, they complete a recognition task by selecting between two images, only one of which corresponds to a previously encoded item. We hypothesize that agency's effect on WM depends on goal cohesion and cognitive load. Understanding these relationships can bridge the gap between laboratory and real-world cognition, informing applications to enhance WM performance.

Leena Kang

Applied Mathematics, Sixth

Mentored By Dr. Christian Cazares

Reduction of broadband neural activity measures are associated with acute periods of aging in healthy adults

Previous studies have identified several candidate electrophysiological biomarkers for cognitive aging in adults, with one emerging biomarker being broadband (1/f-like) neural activity measures. However, these studies have focused on pediatric or geriatric populations, leaving unknown how these age-related changes in broadband neural activity manifest in early to late adulthood. Here, we analyzed an open, task-free electroencephalography (EEG) dataset from 141 participants (aged 20-70 years, sourced from Gajewski et al., 2022) to compare within-subject differences in broadband (exponent, offset) and

oscillatory (delta, theta, alpha) power measures across 5 years of each participant's lifespan. Preliminary findings showed that averaged data from all scalp electrodes showed a reduction of broadband neural activity measures, regardless of whether participants had their eyes open or closed, replicating prior work showing that older adults tend to have "flatter" spectra than younger adults. For the aperiodic exponent, we found differences in how aging was associated with activity in central ($F=7.34$, $p=0.007$), occipital ($F=1.00$, $p=0.002$) and temporal regions ($F=5.10$, $p=0.024$), where exponent decreased with age. We found similar differences in aperiodic offset across central ($F=7.53$, $p=0.006$), temporal ($F=3.78$, $p=0.053$), and occipital regions ($F=1.26$, $p<0.001$). Our findings suggest that broadband neural activity measures are sensitive to acute periods of adult aging. These findings support the inclusion of resting-state aperiodic features as candidate biomarkers for tracking aging trajectories in adults during periods outside of rapid neurodevelopment.

Riki Kataoka

Marine Biology, ERC

Mentored By William Fenical

Finding Antibacterial Compounds in Marine Bacteria in the Great Salt Lakes

Abstract: Actinomycetes and fungi from the Great Salt Lake region have not been studied for their production of potential antibacterial compounds. As pathogens continue to become resistant to existing drugs, it is important to look for products in previously under researched areas. This allows for the discovery of new natural products that work against pathogens displaying antimicrobial resistance. My research was to culture unidentified strains of bacteria and fungi from the Great Salt Lake region, extracting and identifying new, potentially antibacterial compounds. The methods involved in cultivation, and my results on chemical analysis will be discussed.

Manjot Kaur

Cognitive and Behavioral Neuroscience, Sixth

Mentored By Erin Sundermann

Evaluating Preliminary Recruitment Strategies for Research Studies in Older Women at Higher Risk of AD

Background: Recruitment for Alzheimer's disease (AD) research is challenging, with many factors impacting screening and enrollment. Data on effectiveness and relative cost of recruitment techniques are rarely shared yet comprise an important aspect of research planning. We evaluated preliminary recruitment data in an ongoing, two-year, longitudinal study of older women at higher risk for AD. Costs per participant and enrollment yield were compared across recruitment strategies.

Methods: The Women: Inflammation and Tau Study (WITS) contacted 540 interested individuals. Major eligibility requirements are: ≥65 years, female, no dementia diagnosis, mild impairment on the T-MoCA (score 13-20), and AD polygenic hazard score >50th percentile. Recruitment avenues were sorted into four categories: Geotargeted Mailers, Affiliate Group referrals (AGs; from collaborator studies), Generated Contact Lists (GCLs; from electronic health records and research registries), and Community-based recruitment (e.g., education talks, local news segment).

Results: Of 540 individuals contacted, 213 completed screening, and 70 were enrolled. AGs were most cost-effective ($0), followed by Mailers ($223), GCLs ($256), and Community outreach ($365.92). Across six-month intervals, Mailers yielded the highest average number of participants enrolled (n=6.12, 37.4%), followed closely by Community-based recruitment (n=6.00, 36.6%), GCLs (n=3.00, 18.3%), and AGs (n=1.12, 7.6%).

Conclusions: This preliminary work provides insight into the effectiveness of WITS recruitment strategies and emphasizes the need for significant financial investment for recruitment. Despite cost, Community-based recruitment was highly effective, justifying sustained investment. Current WITS participants lack diversity, possibly due to early recruitment methods, but novel engagement strategies for underrepresented groups are being implemented.

Elizabeth Kim

Business Psychology, Marshall

Mentored By Jessica Wang-Rodriguez

The Interaction of Alzheimer's Disease Risk Factor Treatment Drugs on Alzheimer's Disease Incidence and Progression

Alzheimer's disease (AD) is the seventh leading cause of death, with over 6.7 million cases, in the United States. AD, the most common form of dementia, is a brain disorder that is characterized by cognitive decline and memory loss. Diabetes, obesity, high cholesterol levels, and hypertension are all prevalent risk factors amongst AD cases and especially known to accelerate cognitive decline. Previous research has demonstrated associations between antihypertensive drugs, such as diuretics, ACE inhibitors, and Angiotensin II Receptor Blockers (ARBs), with a lower risk of AD. It has been suggested that these drugs may play a role in preventing deteriorating cognitive function and interrupt inflammatory pathways in AD. The use of type 2 diabetes medication has demonstrated a reduction in dementia, including AD. Statin treatments were also found to improve cognition for AD patients. Overall, these findings were limited to smaller cohorts, thus limiting the understanding of the influence of drug efficacy on treating risk factors and influence on AD incidence and progression across larger, more diverse populations. This study examines the relationship between various drug efficacy of treating risk factors and AD incidence and progression. We plan to analyze data from 393,596 participants in the All of Us Research Program, and compare AD incidence between individuals taking risk factor treatment drugs and the general population. Ultimately, this study will contribute valuable insights to the understanding of preventative care for AD.

Matthew Kim

Computer Science, Warren

Mentored By Sylvia Herbert

DeepCBF: Learning Hamilton-Jacobi Solutions to Generate Smooth and Flexible Control Barrier Functions

Due to proprietary information, this abstract has been redacted.

Hodaya Knafo

Human Biology, ERC

Mentored By Shiri Gur-Cohen

Microenvironmental and Cellular Influences of Angptl7 Expression in Cancer Models

Angiopoietin-like 7 (Angptl7) is a protein expressed by resting telogen bulge stem cells and is involved in promoting lymphatic drainage, however, its role in cancer remains unclear. This study aims to characterize the cellular and environmental factors that predisposes Angptl7 expression in cancer cell models.

Angptl7 reporter lines will be generated using a lentiviral system to ensure continuous transgene expression in both dividing and resting cells. The three lentiviral conditions employed are Scramble (a control virus with a randomized sequence), shRNA-Angptl7 (to silence Angptl7 expression and assess its role in tumor behavior), and Peak 500 (a dual-reporter system with enhancer-driven GFP to track enhancer activity), where nuclear RFP (PGK) will be used as an internal control for viral integration in all three conditions.

The two cancer models that are being studied are oral and skin cutaneous Squamous Cell Carcinoma (SCC). The oral SCC (4MOC2), is an aggressive and well-established cell line that is induced by a carcinogen and lacks lymphatic integration. The skin SCCs are cell lines of tumors that originate from BB Sox9-expressing hair follicle stem cells, which include both EpCAM+ and EpCAM- populations, cells known for their role in adhesion, migration, proliferation, and epithelial-to-mesenchymal transition (EMT). By analyzing reporter activity in vitro and in vivo, we will determine whether Angptl7 expression correlates with lymphatic proximity, tumor localization, and metastatic potential.

This study will provide insights into the regulation of Angptl7 in cancer, revealing its potential role in tumor progression and identifying possible therapeutic targets.

Daria Kouzminova

Cognitive Science, ERC

Mentored By Lieselot Carrette

Ilastik Interactive Supervised Image Classification to Improve Whole-Brain Cell Counting

Substance use disorders (SUDs) are chronic conditions characterized by compulsive substance use despite harmful consequences. While key neuronal pathways, including dopaminergic reward and CRF stress networks, have been identified, understanding how whole-brain networks adapt to substance use to drive complex behavior remains a challenge. Whole-brain activity mapping using single-cell whole-brain imaging with immunohistochemistry, brain clearing, and light-sheet microscopy can address these questions, but the large datasets obtained require automated processing.

Microscope images are processed using the ClearMap pipeline for cell detection and registration to the Allen Brain Atlas. To simplify deployment, a JSON file is first created from the imaged data to direct the ClearMap pipeline. Next, six images are randomly selected from six different brains to create a diverse training set for supervised pixel classification. This sample is then loaded in a GUI with the Ilastik machine learning framework to generate a classification model, which is then returned into the ClearMap pipeline for analysis.

Previously, cell detection in ClearMap required manual input of samples. The current pipeline streamlines data handling, ensuring standardized organization and efficient data retrieval. Moreover, cell detection previously relied on threshold-based optical parameters, such as intensity, sphericity, and background filtering. The integration of the Ilastik GUI improved accuracy, sensitivity, artifact removal, and user-friendliness, while enabling detection of non-spherical, low-intensity structures, often missed by spot detection algorithms.

The development of a user-friendly, robust, and reproducible computational pipeline for counting desired structures supports whole-brain activity mapping by enabling precise analysis to ultimately advance our understanding of SUDs.

Meghana Krishnan

General Biology, Seventh

Mentored By Karl Willert

Characterizing Wnt5a: Biochemical Insights into Robinow Syndrome-correlated Mutation

Robinow Syndrome is a rare genetic disorder characterized by severe skeletal malformation and developmental defects. Previous studies have identified causative mutations in the Wnt5a-Ror2 signaling pathway that are directly correlated with this disease. In particular, a point mutation in the Wnt5a gene that changes the 83rd amino acid of the mature Wnt5a protein from a cysteine to a serine (C83S) is associated with an autosomal dominant form of Robinow Syndrome. To further understand the impact of this mutation on Wnt5a's signaling activity, I have engineered Chinese hamster ovary (CHO)

cell lines to inducibly overexpress the wild-type (WT) and C83S mutant Wnt5a protein. Immunoblotting confirmed that both proteins are expressed upon doxycycline induction and secreted into the culture medium. Currently, I am developing a purification protocol using fast protein liquid chromatography (FPLC) to isolate and purify each protein from culture media. After each fractionation step, I monitor and quantify the amount, purity, and activity of the WT and C83S Wnt5a proteins. The long-term goal of this project is to assist in elucidating the causative role of this mutated protein in the autosomal dominant form of Robinow Syndrome, to increase understanding of mechanisms underlying this disease and to support potential future therapeutic intervention.

Shanthi Kuppa

Cognitive Psychology, ERC

Mentored By Caren Walker

Generalizing Causal Structures: Can causal category training support children's learning of scientific feedback loops?

Understanding abstract scientific causal systems can be a challenging task for children, especially when the system involves dynamic and non-linear changes (Sweeney & Sterman, 2007; Hokayem et al., 2019). We investigate whether explicitly teaching children to classify examples by their causal structure enhances their conceptual understanding of that structure. Specifically, we test whether introducing the concept of a negative feedback loop (termed as 'balancing loop' for children) as a causal category improves learning about predator-prey population dynamics. Children aged 6-11 are randomly assigned to one of two conditions. In the experimental condition, children are introduced to the concept of a balancing loop via a base example, and then complete a subsequent classification task with four examples, classifying each as either a balancing loop or not a balancing loop. Children then view two novel test examples (a predator-prey balancing loop and a counterexample about allergies) and answer questions testing their conceptual knowledge for each. In the control condition, children learn about the same set of examples, but without classification. We predict that children in the experimental condition will show an increased understanding of predator-prey dynamics, as evidenced by higher scores on conceptual questions relative to the control condition. Further, we hypothesize that children's performance will be moderated by their accuracy in classifying the predator-prey example as an example of a balancing loop structure. This study will reveal whether explicit instruction of a negative feedback system and practice classifying examples according to this system will improve children's learning of a novel negative feedback loop.

Nehme Lahoud

Human Biology, Revelle

Mentored By Justin Meyer

Evolving Phage Antibiotic Synergisms

Bacteriophage therapy—the use of bacterial viruses to suppress bacteria in multi-drug-resistant infections—has emerged as a promising experimental strategy to combat the growing problem of antibiotic resistance in the clinic. However, the phages' capacity to clear bacterial infections is often limited because bacteria evolve resistance to phage. Coevolutionary bacteriophage training, which encourages an arms race between bacteriophages and their hosts, offers a potential solution by developing more suppressive "trained" phages with a suite of counter-defenses against bacteria, limiting the bacteria's ability to evolve resistance. Previous experiments have shown trained phages are more effective at suppressing bacteria, partly because the resistance mutations required to defend against the trained phages are costlier and interfere with bacteria's growth. Here, we show that a second consequence is that the bacteria become more vulnerable to antibiotics. These findings suggest that some antibiotics can synergize specifically with trained phages. This research highlights the potential of the development of phage therapies tailored to patients undergoing antibiotic treatment.

Arya Lalezarzadeh

Human Biology, Revelle

Mentored By Jing Yang

The Role of IFNAR1 in Breast Cancer Metastasis

Due to proprietary information, this abstract has been redacted.

Kaitlyn Lavarias

Mechanical Engineering, Warren

Mentored By Tania Morimoto

HaptOGrasp: A Soft Haptic Origami Grasper for Rendering Grip Force Feedback

Most commercially available haptic interfaces lack grip force feedback, which can hinder users' ability to properly judge the amount of force applied to virtual or remote objects. Recent work has explored the creation of grip force feedback devices that operate using electromechanical actuators. However, the reliance on motors and rigid components tend to result in bulky or heavy devices. In this work, we present the Haptic Origami Grasper (HaptOGrasp)– a novel lightweight, origami haptic grasper that renders kinesthetic grip force feedback via pneumatic actuation. The actuator takes the form of the Yoshimura origami pattern, which allows for linear expansion and compression. At varying grasp widths, air pressure is adjusted to reliably render between 0 N to 8 N of force to mimic normal forces felt when grasping objects. We conducted a preliminary user study, in which participants used HaptOGrasp to grip a virtual object with a specified level of force, demonstrating the potential of the device to help with telemanipulation tasks requiring specific target forces during grasping.

Amber Lawrence

Neurobiology, Seventh

Mentored By Kim Dore

Sex Differences in Amyloid Plaques and Astrocyte Migration in an Alzheimer's Disease Mouse Model

Alzheimer's disease (AD) is a neurodegenerative disease caused by a buildup of amyloid beta (Aβ) plaques impacting the function of neurons. Our lab has found that increasing palmitoylation (a post translational modification facilitating the association of proteins with membranes) of the postsynaptic protein PSD-95 restored memory and synaptic function in AD model mice. Here, we wanted to determine if our drug treatment affected AD pathology directly. We analyzed amyloid plaques in the hippocampus using Thioflavin-S staining on 9-10 month AD model mice, and found the area covered by plaques was not affected by our palmitoylation-increasing drug. However, we observed female mice had a higher plaque load, resulting in smaller hippocampal area. Additionally, we quantified astrocytes, glial cells playing crucial roles in the brain; absorbing, storing, and removing waste products (including Aβ). We utilized immunofluorescence detection of GFAP (glial fibrillary acidic protein), present in most glial cells of the CNS. We identified GFAP signal gathering around amyloid plaques in AD model mice, while in contrast GFAP signal was uniformly distributed in WT mice. In male AD model mice (treated and untreated), we saw higher GFAP signal in areas with larger plaques, suggesting that astrocytes migrate to high pathology areas. In contrast, untreated female AD model mice, GFAP signal was uniformly distributed in areas with plaques, indicating a deficit in this process. Astrocyte migration was restored in female AD model mice treated with the palmitoylation-increasing drug. This suggests that restoring PSD-95 palmitoylation in neurons can normalize other processes, like astrocyte migration.

Elysa Loraine Lebig

Chemical Engineering, Seventh

Mentored By Prof. Justin Opatkiewicz

Formulation and Materials Study of Early-stage Lip Glosses

Due to proprietary information, this abstract has been redacted.

Mark Lee

Public Health w/ Concentration in Health Policy and Management, Revelle

Mentored By Dr. Nancy Binkin

Bridging the Gap: The Impacts of Financial Insecurity on Student Wellbeing at UC San Diego

Background and Purpose: Financial insecurity makes it difficult for college students to meet their basic needs and may affect academic performance and well-being. Little is known about the prevalence and impact of financial insecurity at UC San Diego (UCSD). We therefore conducted a survey to assess its prevalence and highlight its impacts on academic performance and physical and mental health among UCSD undergraduates.

Methods: In February 2025, UCSD undergraduates enrolled in selected Economics and Public Health courses completed a Qualtrics questionnaire that collected information on financial insecurity and wellbeing. The PHQ-2 and GAD-2 were used to assess possible depression and anxiety. Students were considered financially insecure if they reported difficulty getting through with the funds available to them during at least one month during the current academic year. EpiInfo 7.2.6 was used to calculate frequencies and prevalence rate ratios and p-values.

Results: The response rate was 80%. Of the 774 respondents, 36% met the definition of financially insecure. Financially insecure students were 1.6 times as likely to have a GPA below 3.5 (65%v.40%, $p<0.0000001$), and were 1.5 times as likely to rate their general health as "poor/fair" (33%v.22%, $p=0.0005$). They were also 1.9 times as likely to have possible depression (27%v.14%, $p=0.000005$) and 1.5 times as likely to have possible anxiety (41%v.28%, $p=0.0001$).

Conclusion: Financial insecurity significantly impacts academic performance and wellbeing for the many students struggling to pay for basic needs. UCSD should invest in financial counseling and expand financial aid programs to assist students in attaining financial security.

Nathen Lee

Data Science, Seventh

Mentored By Seana Coulson

Multimodal Semantic Representations in the Brain: Predicting EEG Responses with CLAP

The problem of considering large language model (LLM) based information structures as human-like is that humans build their representations using both the language statistics and real world experiences through sensory and motor engagement in the world. One way people have addressed this issue is through building multimodal models that are trained on a language corpus along with other modality information such as images and auditory files. CLAP is a multimodal model that is trained on both auditory and textual information (such as a barking sound and the label dog). In this study, we test whether representations from the CLAP model are predictive of electroencephalogram (EEG) signals collected when humans perform a cognitive semantic task. We employ a property verification task, where participants read concept-property pairs that are either auditory (eg., bell - rings) or visual (eg., apple - red) and report whether the property is typically true for the concept. We measured semantic information shared between the concept-property pairs as cosine distances using CLAP embeddings. We then analysed EEG voltages collected on the property words between 300-500ms post word onset time,

the window associated with the semantic event-related potential (ERP) N400 component. In our analysis, we fitted regressions on auditory and visual property trials separately, using CLAP cosine distances and controlling for cosine distances measured using a pure textual information model, GPT2. We find that CLAP based measurement is able to significantly explain variance in EEG signal over and above GPT2 for auditory trials but not for visual trials.

Eamon Lee

Electrical Engineering, Seventh

Mentored By Hanh-Phuc Le

Integrated Vertical Power Delivery for High-Performance Computing

The large project aims to design, fabricate, and test a novel integrated power converter to tackle the challenges to achieve high efficiency, high power density, reduced system complexity, and lower cost in power delivery management for high-power (kW) and high-performance computing for AI/ML and data centers.

Julia Lee

Mechanical Engineering, Revelle

Mentored By Patricia Hidalgo-Gonzalez

Evaluating Capacity Factors for Renewable Energy Integration in a Climate Resilient & Energy Equitable California Electricity Grid

Due to proprietary information, this abstract has been redacted.

Philip Li

Business Psychology, Seventh

Mentored By Timothy Brady

Understanding the Influence of Recent Perceptual Experiences on Current Memory Biases

Memory is a reconstructive process that is influenced by prior experiences and current sensory inputs. One example of memory's reconstructive nature is the finding that memories can be systematically biased by similar perceptual stimuli, such that people report their memories as looking more alike those percepts than they actually were. To explain this phenomenon, most models focus on the immediate properties of the stimuli that are currently being perceived and remembered, such as their physical

similarity or their category typicality. However, it remains unclear whether higher-order knowledge, such as the observer's recent history of encountering similar percepts, influences current memory biases beyond these properties. To test this, we manipulated the similarity between memories and perceptual inputs across short runs of trials to determine its influence on subsequent memory reports. In Experiment 1, we found that new percepts were judged as similar to memory more often following runs of other highly-similar percepts than those that were highly-dissimilar. More importantly, this change in the perceived similarity of the new percept produced a corresponding increase in its bias on memory. In a series of follow-up experiments, we extended this finding to show that history-related changes in memory bias were not explained by changes in memory strength and that they occurred even when incoming percepts were task-irrelevant. Together, these findings show that perceptual history shapes memory biases by altering perceived similarity, demonstrating that memory distortions emerge not just from the properties of individual stimuli, but also from the broader context of recent perceptual experiences.

Leanne Liaw

Neurobiology and Public Health (concentration in Medicine Sciences), Marshall

Mentored By Nancy Jeanne Binkin

A Safety Net or a Tightrope? Assessing Basic Needs Resource Support for Undergraduates at UC San Diego

In 2024, UC San Diego reported that 51% of undergraduates experienced food insecurity while 22% faced housing insecurity. The Basic Needs Center (BNC) provides essential food and housing support to students in need, but little is known about their use of BNC services. We conducted a survey to assess BNC awareness, use, and satisfaction among food- and housing-insecure students.

In February 2025, undergraduate students enrolled in selected public health and economic courses completed a Qualtrics questionnaire that included questions on basic needs and knowledge and use of the BNC. EpiInfo 7.2.6 was used to examine frequencies and calculate prevalence rate ratios (PRR) for associations between food and housing insecurity and BNC awareness and use.

The response rate was 80%. Of the 774 respondents, 32% were food-insecure and 20% were housing insecure. Food-insecure students were equally likely to know about BNC food resources as food-secure students (79%v.76%;p=0.4), but were 2.1 times as likely to have used them (35%v.16%; p<0.0000001). Housing-insecure students were 1.4 times more likely to know about BNC housing resources (44%v.30%; p=0.002) and 5.0 times more likely to have used them, (14%v.2.8%; p<.00000001). Sixty-five percent of housing-insecure and 59% of food-insecure students who used BNC resources reported that their needs had not been fully met.

Many food-insecure students knew about but did not use BNC services; housing-insecure students had low knowledge and even lower BNC use. User dissatisfaction was common for both services. Addressing these concerns is crucial to improving BNC support for students facing basic needs challenges.

Alyssa Lim

Sociology: Law and Society and Political Science: Public Law, Warren

Mentored By Kwai Ng

Exclusion to Idealization: The Ideology of Model Minority for Asian Americans and Immigrants

This thesis explores how US immigration policy exhibited racism and discrimination against Asian Americans and immigrants. It applies Louis Althusser's theory of ideology and ideological state apparatuses to explain how Asian Americans and immigrants were hailed to the Model Minority standard to reach economic and social success. Through an examination of congressional records and historical archives in the years 1882, 1917, 1924, 1952, and 1965, the rhetoric of US officials reflects both the American public's and the government's objectives of the respective time periods. In 1965, the amended Immigration and Nationality Act dismantled the framework that previously restricted Asians'– and other nationalities' –immigration by ridding of the quota system and creating a preference system centered on family reunification and skilled labor. In 1966 sociologist William Peterson coined the term Model Minority to describe the success of Japanese-Americans in the US and posited that this group was more successful than other minority groups due to their inborn cultural characteristics. This term became generally used to describe all Asian Americans, and I argue in this thesis that it describes the characteristics Asian Americans and immigrants were hailed to. These traits aided them in reaching meritocratic success in the US, which may seemingly attribute positive properties to Asians given that amidst racism and discrimination, Asian Americans and immigrants were able to persevere and achieve the American Dream. Nonetheless, the history of the systemic oppression of this group continues to impact Asian American's identity within US society revealing how US legislation shapes ideology.

Hannah Lim

Bioengineering: Biotechnology, Muir

Mentored By Tania Morimoto

HaptOGrasp: A Soft Haptic Origami Grasper for Rendering Grip Force Feedback

Most commercially available haptic interfaces lack grip force feedback, which can hinder users' ability to properly judge the amount of force applied to virtual or remote objects. Recent work has explored the creation of grip force feedback devices that operate using electromechanical actuators. However, the reliance on motors and rigid components tend to result in bulky or heavy devices. In this work, we present the Haptic Origami Grasper (HaptOGrasp)– a novel lightweight, origami haptic grasper that renders kinesthetic grip force feedback via pneumatic actuation. The actuator takes the form of the Yoshimura origami pattern, which allows for linear expansion and compression. At varying grasp widths, air pressure is adjusted to reliably render between 0 N to 8 N of force to mimic normal forces felt when grasping objects. We conducted a preliminary user study, in which participants used

HaptOGrasp to grip a virtual object with a specified level of force, demonstrating the potential of the device to help with telemanipulation tasks requiring specific target forces during grasping.

Rain Lins

Urban Studies and Planning, Seventh

Mentored By Amy Lerner

Facilitating Food Sovereignty Through Sustained Land Access for Urban Agriculture: Barriers, Mechanisms, and Opportunities in the City of San Diego

Urban agriculture (UA) is an increasingly relevant strategy to localize food systems and reduce inequalities in urban food access. UA offers many social, health, environmental, and economic benefits, oftentimes promoting food justice and food sovereignty. An important component of food sovereignty is creating pathways for long-term access and community-based control over land. Current research underscores long-term land access as a fundamental limitation to the viability of UA. However, there is limited research on the specific mechanisms for securing long-term land access as a way to support localized control over food systems and promote their longevity. This research project utilized a mixed-methods approach to understand the challenges of land access for UA, current mechanisms, and opportunities to overcome these challenges within the City of San Diego. This paper showcases the many ways UA supports food sovereignty through various forms of land access. A consistent challenge for growers is the high cost and restricted amount of usable land. While there are few mechanisms to support long-term land access for UA, the most important intervention to address this issue is the City of San Diego Parks and Recreation Departmental Instructions: Community Gardens in City Parks. These instructions offer a mechanism for non-profits to develop community gardens on City-owned parks as a means to create more access to public lands. Outside of the City, there are other opportunities to leverage policies and plans to create pathways for long-term access to public lands.

Nathanial Linstrom

Human Biology, Revelle

Mentored By Nigel Calcutt

A KCC2 Potentiator Reverses Impaired Spinal KCC2 Expression and Rate Dependent Depression of the H Reflex and Alleviates Painful Neuropathy in Rodent Models of Type 1 Diabetes

Peripheral neuropathy is a common complication of diabetes, producing both pain and sensory loss. There is no FDA approved therapy for sensory loss while current treatments for pain have inconsistent efficacy and harmful side effects. Rate-dependent depression of the spinal Hoffman-reflex (HRDD) is a biomarker for pain arising from spinal disinhibition. Impairment of HRDD secondary to downregulation of potassium/chloride cotransporter-2 (KCC2) is reported in both animal models of

diabetes and diabetic patients with neuropathic pain. The present studies investigated impact of the oral KCC2 potentiator AXN-A (Axonis Therapeutics Inc.) on impaired spinal KCC2 protein expression, HRDD defects, and neuropathic pain in diabetic rats and mice. Groups of STZ-diabetic rats received AXN-A (100mg/kg/day po, N=10) or vehicle daily (N=10), and age-matched controls received vehicle daily (N=10). STZ-diabetic rats treated with AXN-A, showed improvement in HRDD profile ($p<0.05$: ANOVA with Holm-Sidak test) and alleviation of tactile allodynia ($p<0.05$: ANOVA with Holm-Sidak test) compared to vehicle treated STZ-diabetic rats. Western blotting of spinal cords obtained at autopsy showed that reduced expression of KCC2 protein in STZ-diabetic rats was prevented by AXN-A treatment. In a separate study, STZ-diabetic Swiss Webster mice (N=9/group) received a single dose of AXN-A (300mg/kg po) or vehicle. Tactile allodynia in the STZ diabetic mice was significantly ($p<0.01$: 2-way ANOVA with Holm-Sidak test) alleviated within two hours after treatment without impacting other sensorimotor functions. These data suggest that targeting KCC2 activity with AXN-A successfully improves both spinal HRDD and diabetes induced neuropathic pain.

Tairan Liu

CG35, Muir

Mentored By Jason Fleischer

Gender Inequality in English Textbooks around the world: An NLP approach.

This study quantifies gender inequality in middle school (7-9th grade) English textbooks from 21 countries. On average I analyze three textbooks from each country, using the following indices: occurrence, firstness, and TF-IDF word lists for each gender. After breaking the texts up into segments with the length of 100 words, those segments with gendered keywords (e.g. man, queen) will be compiled into the respective gendered context list. Occurrence counts the frequencies of gendered words and calculates the proportion of each gender. Firstness is about the proportion of instances where both genders occur in a phrase, and a given gender is mentioned first like “ladies and gentlemen” versus “boys and girls.” Top 300 TF-IDF word lists for context windows around each gender mentioned are taken, and the words that are repeated for both genders and the gendered keywords are removed from the list. Then, for the two lists, names are counted, LLM distinguishability is assessed, and the semantic distance (in GloVE vector embedding space) between the world lists and predefined keywords (extreme keywords, e.g. weapon, baby) is measured.

The textbooks are then categorized by cultural sphere, and the indices are compared across cultural groups. The culture spheres are: African, Eastern Europe, Indosphere, Islamic, Latin American, Sinosphere, and Western. Each cultural sphere is represented by the textbooks of three separate countries within that sphere. The indices measured above are compared to indices of real-life gender equality of these cultural spheres, like GGPI (Global Gender Parity Index) and WEI (Women’s Empowerment Index).

Bianca Lopez

Molecular and Cell Biology, Warren

Mentored By Andrew Muroyama

Designing Genetically Encoded Tools for Local Cytoskeletal Disruption

Filamentous actin, or F-actin, constitutes a crucial part of the cytoskeleton in plant cells, governing cell polarity, shape, and organelle movement. However, dissecting its roles during specific phases of plant development remains challenging due to its critical involvement in vital pathways. Drugs like latrunculin B, which promote actin disassembly and are cell-permeable, prevent cell type-specific actin perturbation and therefore cannot be used to manipulate actin levels in a localized manner. To overcome this, we have utilized disassembly-promoting, encodable actin tools (DeActs), which have been shown to work in plant cells. We conducted a series of controlled studies, using transient expression in Nicotiana benthamiana, to investigate the efficacy of targeting DeActs-GS1 activity to the outer nuclear envelope. Using confocal microscopy, we observed that DeActs-GS1 expression perturbed F-actin organization in the cell. We noted an accumulation of GS1 patches at the nuclear envelope, which we interpreted as sequestered G-actin monomers. We also saw conditional F-actin disruption that may depend on expression levels. In the mitochondria experiments, we observed that the mitochondria became filamentous, or elongated when F-actin was disrupted. In ongoing work, we are testing construct efficiency with cell type-specificity in Arabidopsis . Ultimately, we plan to leverage these new tools to investigate how the cytoskeleton regulates stomatal formation, which has important implications for plant growth and stress response

Yifan Lou

Cognitive Science, ERC

Mentored By Andrea Chiba

Characterizing Homebase Dynamics in Free-Roaming Rats Through Behavioral, Neural, and Robotic Interaction Analysis

Understanding the relationship between spatial exploration and allostatic self-regulation in rats is fundamental to studying their cognition, decision-making, and adaptive behaviors. Homebase behavior, where a rat preferentially returns to a specific location, serves as a key framework for investigating how animals balance exploration with safety. This study examines the social and environmental influences on homebase selection and usage by integrating SLEAP-based behavioral tracking with local field potential (LFP) recordings from the insula, a brain region implicated in social processing and decision-making under uncertainty.

A primary focus of this research is how social context and external agents influence homebase behavior. This study investigates how social spatial dynamics influence homebase behavior by analyzing rat-rat interactions and, where applicable, rat-robot dyads. Using SLEAP-based tracking and local field potential (LFP) recordings from the insula, we examine how social context influences time spent at

homebase, movement trajectories, and spatial exploration patterns. By focusing on insula activity during homebase occupancy, we aim to understand how social interactions shape decision-making in dynamic environments.

Our findings contribute to cognitive neuroscience, ethology, and robotics, providing insights into social modulation of spatial behavior and the neural mechanisms underlying adaptive decision-making. Additionally, this research informs the design of autonomous robots that interact seamlessly with biological agents, advancing our understanding of socially responsive AI systems and their role in behavioral modulation.

Ethan Lu

General Biology, Sixth

Mentored By Robert Ross

The characterization of the resulting phenotype of dual loss of ZO1 and ZO2 in cardiac myocytes in embryonic mouse development

Introduction: Zona occludens (ZO) are structural proteins typically identified in tight junctions, but also in cardiac myocyte (CM) intercalated discs crucial for strengthening cells and signaling in the heart. Global knockout of the ZO-1 protein resulted in early embryonic lethality. Therefore, the roles of the ZO proteins during embryonic cardiac development and junction formation remain elusive. We hypothesized that combined loss of ZO-1 and ZO-2 specifically in CM, would impact embryonic cardiac development.

Methods: ZO-1/ZO-2 floxed mice were crossed to Xenopus laevis myosin light-chain 2 Cre mice to produce CM-specific excision of ZO-1 and ZO-2(ZO1/2dKO). Embryos from embryonic (E) days E9.5–E14.5 of the 21-day mouse gestation period were assessed for histological and molecular microscopic analyses.

Results: No ZO1/2dKO embryos survived past E14.5 (n=36). By E12.5, the KO embryos show 32% observed survival expected from the Mendelian ratios (n=102), which drops to 15% by E13.5. Compact layer thickness was 27.9% at E10.5 (±7.8%, $p = 0.0072$) and 41.6% at E11.5 (±9.9%, $p = 0.0029$). Trabeculation was underdeveloped, which indicates arrested heart formation. Cell proliferation was evaluated using EdU labeling of E11.5 embryos (n=5) and showed a 33 ±4.2% ($p < 0.03$) reduction in CM proliferation in ZO-1/ 2dKO vs. controls.

Conclusion: Our findings demonstrate morphological and proliferative abnormalities in the hearts of ZO1/2dKO embryos, highlighting a previously unappreciated role for ZO proteins in normal heart development.

Melissa Lupian

Public Health with concentration in medicine sciences, Warren

Mentored By Nancy Binkin

Safety Net or Tightrope? Assessing Basic Needs Resource Support for Undergraduates at UC San Diego

Background and Purpose: In 2024, UC San Diego reported that 51% of undergraduates experienced food insecurity while 22% faced housing insecurity. The Basic Needs Center (BNC) provides essential food and housing support to students in need, but little is known about their use of BNC services. We conducted a survey to assess BNC awareness, use, and satisfaction among food- and housing-insecure students.

Methods: In February 2025, undergraduate students enrolled in selected public health and economic courses completed a Qualtrics questionnaire that included questions on basic needs and knowledge and use of the BNC. EpiInfo 7.2.6 was used to examine frequencies and calculate prevalence rate ratios (PRR) for associations between food and housing insecurity and BNC awareness and use.

Results: The response rate was 80%. Of the 774 respondents, 32% were food-insecure and 20% were housing insecure. Food-insecure students were equally likely to know about BNC food resources as food-secure students (79%v.76%;p=0.4), but were 2.1 times as likely to have used them (35%v.16%; p<0.0000001). Housing-insecure students were 1.4 times more likely to know about BNC housing resources (44%v.30%; p=0.002) and 5.0 times more likely to have used them, (14%v.2.8%; p<.00000001). Sixty-five percent of housing-insecure and 59% of food-insecure students who used BNC resources reported that their needs had not been fully met.

Conclusion: Many food-insecure students knew about but did not use BNC services; housing-insecure students had low knowledge and even lower BNC use. User dissatisfaction was common for both services. Addressing these concerns is crucial to improving BNC support for students facing basic needs challenges.

Charlie Luthi

Sociology, ERC

Mentored By Michel Estefan

From Farm Fields to Lecture Halls: Agrarian and Academic Socialist Consciousness in America

This investigation compared two instances of socialist consciousness in the United States across multiple dimensions of difference, conditioned by elective affinity between the U.S. economic position and cultural composition through the framing of socialism as a threat, its interaction with American religious and community traditions, and socialism’s unique relationship to education. Newspaper publications and party documents associated with the Oklahoma agrarian socialist movement during the early 20th century and participant observation, social media content, political education resources, and interview data from the California university socialist group in the early 21st century were used for a comparative historical analysis of the two movements. This investigation revealed that socialist consciousness has been conditioned through the U.S. position in the capitalist world system and internal

hegemonic capitalism as economic factors and interconnected cultural aspects of individualism and religious traditions which are typically considered as hostile to it. Firstly, these instances of socialist consciousness have adapted a defensive posture and legitimization through socialist states in response to threat framing. Secondly, they have adapted a religious expression in two variations of the Gospel of Socialism and an ethic of commitment borrowing on American religious and community influence and contrasting the culture of individualism. Finally, the transition to a predominantly academic context for socialism can be traced to the relegation of considerations of Marxism to the analysis of society in a space where the perceived threat is relatively diffused.

Josh Lyman

Cognitive Behavioral Neuroscience, Sixth

Mentored By Kelly Courtney

Associations Between Physical Activity and Structural Brain Volume Among Mid-Adolescents who Engage in Sports

Associations Between Physical Activity and Structural Brain Volume Among Mid-Adolescents who Engage in Sports.

Joshua K. Lyman*, Ryan M. Sullivan, Ph.D., Alexander L. Wallace, Ph.D., Natasha E. Wade, Ph.D., & Kelly E. Courtney, Ph.D.

University of California, San Diego

Physical activity is critical in adolescent neurodevelopment, but the impact on specific brain regions remains less understood. This study investigates the relationship between past-year metabolic equivalent of task (MET) scores and structural brain volume in 3,727 adolescents (age 12-16) that endorsed past-year engagement in sports from the Adolescent Brain Cognitive Development study. Structural MRI data were preprocessed using standardized pipelines to harmonize data across the various study sites. Linear mixed effect models assessed 84 volumetric regions of interest, while controlling for age, intracranial volume, and MRI scanner. After false discovery rate (FDR) correction, total past-year MET scores were positively associated with right paracentral gyrus [$t(3264)=4.24$, $p<.001$, $pFDR=0.002$] and right cerebellum [$t(3257)=3.25$, $p<.001$, $pFDR=0.049$] volume. Functionally, the paracentral gyrus is associated with motor execution, suggesting increased physical activity may strengthen neural pathways responsible for movement control. Similarly, cerebellar volume changes may reflect adaptations in balance and coordination, crucial for motor learning. These results further support the hypothesis that habitual physical activity may be linked to neuroplasticity, potentially contributing to downstream neurocognitive benefits among adolescents. Thus, encouraging active lifestyles during adolescence may yield long-term benefits for neurodevelopment.

Molly MacLaren

Computer Engineering, Seventh

Mentored By Michael Coblenz

A Rust-Based Comparison of Functional and Imperative Programming

In the Rust programming language, functional-style code is considered idiomatic, but is this always true for programmers at various experience levels? In this ongoing research, we examine functional and imperative paradigms in Rust to determine which is more readable and usable. To study readability, we designed a code-review quiz to find which paradigm participants prefer and test their ability to find bugs. For usability, we examine which style is more prevalent in participants' code using a custom-built IDE extension, SALT.

Richard Madsen

sociology, Marshall

Mentored By Christena Turner

Volunteerism and Motivation

This thesis investigates how and why people get engaged in community service. Engaging in volunteer work provides individuals with a feeling of connection and promotes the development of responsible citizenship. The research delves into the reasons that inspire individuals, specifically college students from Westwood Institute, to engage in public service and their aspiration to create a positive change in society. Further investigating the book "Habits of the Heart" by Robert Bella et al. indicates that participation in local civic organizations can cultivate a sense of duty toward the common good. By exploring how non-profit entities like the Helping Hands Association nurture future leaders, this research emphasizes the convergence of personal development and community influence, offering valuable insights into the motivations that lead individuals to engage in significant public service.

Cameron Manard

Psychology B.S. with a Specialization in Clinical Psychology, Marshall

Mentored By Leslie Carver

Autism Community Outreach Project: What is the US Autism Community's Opinion on the Current Trajectory of Autism Research

In recent years, more people on the milder end of Autism Spectrum Disorder (ASD) have been getting diagnosed. As the number of people being diagnosed increases, greater importance and funding has been

placed on conducting research to better understand ASD. But, does the US autistic community agree with how the funds are allocated? Previous research (Pellicano et al., 2014) suggests that at least in the past, there has been a disconnect between the priorities of the autistic and scientific communities. However, it is not clear whether this gap has narrowed in the intervening decade. We surveyed autistic adults, parents/caregivers of an autistic person, relatives of an autistic person, autism researchers, practitioners who work with autistic people, and anyone else who feels like they are part of the autism community to get their unique perspectives on what the current focus of research ought to be. We will compare the results of the survey to reported funding allocations from the Interagency Autism Coordinating Committee (IACC) Strategic Plan for Autism Research, Services, and Policy. From there, we will compare our results to what Pellicano and her UK colleagues found in 2014. We will discuss the historical and cultural reasons for any changes that might have happened within the past decade.

Varsha Mani

Bioengineering, Revelle

Mentored By Dr. Bernhard O. Palsson

A Machine Learning Model of Bacterial Translation Efficiency from DNA Sequence for Protein Production Applications

Our project addresses the challenges of predicting translation efficiency (TE) in E. Coli, a critical factor in protein synthesis for biotechnology and pharmaceutical development. Despite extensive research, the mechanisms regulating TE are complex and remain incompletely understood, making optimization of protein production difficult.

We developed and evaluated different machine learning models to predict TE based on multiple factors, including mRNA transcript features, tRNA availability, and codon usage. Using Elastic Net Cross-Validation as our final approach, we integrated features such as the Codon Adaptation Index, tRNA Adaptation Index, and many others. We systematically evaluated the importance and effect of our feature set through iterative research and testing to improve model performance.

The result shows our model achieved an R2 value of 0.35 with a mean squared error of 0.06. Key factors influencing TE included TAI, MFE, and many other factors. Correlation analyses using Pearson, Spearman, and Kendall methods, along with Shapley values, helped identify feature importance.

We conclude that TE is regulated by a combination of interacting factors rather than a single primary mechanism. While our model demonstrated predictive power, the R2 value suggests further improvements.

Further directions include refinding features to better capture TE-affecting factors, obtaining higher quality TE datasets with less noise, and exploring non-linear models that better represent the complex biological interactions. These can potentially enhance the predictive power of our model and potentially make it applicable to more diverse organisms, ultimately contributing to more efficient protein production.

Gabriela Marcial

Environmental Systems: Ecology, Behavior, Evolution, Revelle

Mentored By Professor James Nieh

Tracking infection in Apis Mellifera: understanding the progression of Nosema ceranae

Honey bees, Apis mellifera, are responsible for the annual pollination of at least $17 billion worth of US crops, but face severe health challenges. They are commonly exposed to a spore disease called Nosema ceranae. Such spores can drastically reduce the number of honeybee workers within a colony, result in a queen's death, and ultimately lead to colony collapse. Recent research has focused on finding sustainable solutions that harness the natural immune system of honeybees. This project will build upon research in the Nieh lab that tests immune priming, a "honeybee Nosema vaccine" that feeds honeybees heat-killed Nosema spores, to help protect worker honeybees against subsequent infection with live pathogens. This project will focus on examining levels of Nosema infection in individual worker bees over time and testing immune priming. By monitoring the parasite's progression through non-destructive sampling, we observed how infection levels fluctuate over time in individual bees. Our technique allows precise tracking of pathogen spread, illuminating the effects of chronic infection on bee physiology and behavior. These findings provide a new avenue to study host-parasite interactions in social insects and may inform better management strategies to safeguard honey bee populations.

Jonathan McGurrin

Marine Biology, Revelle

Mentored By Lisa Levin

Macrofauna Invertebrates on Carbonates at the Newly Discovered Sanak Methane Seeps (2020m), Aleutian Margin Alaska

The seepage of methane along oceanic continental margins provides unique geochemical conditions for diverse ecosystems to form in the otherwise low-density deep ocean. This study focuses on the recently discovered Sanak methane seep that sits 2020 meters deep on the Aleutian Margin Alaska. The macrofaunal invertebrate communities (>300μm) on authigenic carbonate rock samples from the seep were sorted, identified, and characterized using the metrics of organism density, composition, and diversity. When comparing carbonate rock macrofaunal densities across the seep site, there was no statistical difference in animal densities between rock samples grouped by collection location within the site. A wide variety of phyla were found on the carbonate rock samples, including Annelida, Arthropoda, Mollusca, and Porifera. Mollusca contributed to the highest animal counts and densities. Rock samples with low animal counts (<160 animals) were dominated by the Arthropoda. Diversity analyses are underway. Community features of the Sanak methane seep site were compared to other methane seep sites previously studied along the North Pacific continental margin, including Costa Rica,

Hydrate Ridge Oregon, and Southern California. Sanak seep densities on carbonates were less than active and inactive Costa Rica methane seep densities, between the active seep densities of the two Hydrate Ridge sites, greater than the inactive seep densities of Hydrate Ridge, and greater than all sites of Southern California. Sanak methane seep animal densities were also greater than non-seeping hard substrates of Southern California. This research advances our understanding of deep-sea chemosynthetic ecosystems and biodiversity of the Aleutian margin.

Dyllan Mead

Bioengineering:Biotechnology, Muir

Mentored By Elizabeth Winzeler

Malaria Drug Discovery Pipeline

Due to proprietary information, this abstract has been redacted.

Leo Megliola

Physics, Computational, Sixth

Mentored By Professor Benjamin Grinstein

mg5qs: Integration Tools for HEP MCMC Simulations

Long-standing High-Energy physics simulation tools such as MadGraph 5 and Pythia 8 offer a powerful framework for inquiry on both new and established physics. These programs employ highly general data structures. While descriptive, these structures require significant storage and overhead for many kinds of routine inquiry. The purpose of mg5qs is to facilitate preliminary inquiry with minimal overhead. mg5qs is designed to intercept key results at time of processing, flatten and reduce data structures, calculate convenient intermediate quantities, and store results in a compact and accessible format. These results are then exposed in a Python programming language environment, allowing custom, user-defined statistics by leveraging common Python-based tools (e.g., NumPy, SciPy, pandas). mg5qs also offers pipeline automation, a reworked user interface, and multithreading support. The result is a desktop computing environment where initial inquiry into new physics is tractable.

Rafael Mejia Ramos

Molecular and Cell Biology, Revelle

Mentored By Uri Manor

Genetic Hearing Loss: Understanding from Cochlea Dissection and Imaging Software Analysis of Stereocilia Length

Genetic hearing loss affecting the cochlea accounts for 60% of all cases. The cochlea's sensory hair cells contain mechanosensitive stereocilia that detect sound and transmit signals to the brain. Stereocilia length is crucial for proper sound transmission and is regulated by the actin-associated protein Epidermal Growth Factor Pathway Substrate 8 (Eps8), which has both actin-capping and bundling domains. Eps8 accumulates at stereocilia tips in proportion to their lengths. Eps8 knockout (KO) mice have abnormally short stereocilia, leading to congenital deafness. Eps8's role in actin regulation is paradoxical. In neurons, its loss results in elongated filopodia, suggesting a capping function that limits growth. However, in hair cells, Eps8 depletion shortens stereocilia, indicating a different role in elongation. The Manor Lab demonstrated that AAV-mediated gene therapy restoring Eps8 in KO mice rescues stereocilia length, but the specific contributions of its capping and bundling domains remain unclear. This study investigates Eps8's mechanism in stereocilia elongation. Mutant Eps8 variants—lacking capping, bundling, or both functions—are expressed in Eps8 KO mice via AAV delivery. Using high resolution 3D confocal microscopy image analysis, I quantitatively assess stereocilia lengths to determine how Eps8 promotes elongation. Understanding these mechanisms may inform future gene therapies for hearing loss caused by stereocilia shortening, ultimately advancing treatments for both mice and humans.

Andrea Melendez

Cognitive science with a specialization in Neuroscience, Marshall

Mentored By Nicola J. Allen

Astrocyte GLT-1 and GLAST in Rett syndrome

Due to proprietary information, this abstract has been redacted.

Omar Mokhashi

Neurobiology, Muir

Mentored By Weg Ongkeko

Evaluation of Alcohol, Tobacco, and HPV's Synergistic regulation of HNSCC's Potential Treatment Response to PD-L1 Checkpoint Inhibitor Treatment

Due to proprietary information, this abstract has been redacted.

Sofia Morales

Political Science, Warren

Mentored By Erika Crable

Policy Surveillance & Political Rhetoric About Harm Reduction Services in Six States.

Nearly 87,000 individuals in the US died from a fatal drug overdose in 2024. Harm reduction services are safe, effective strategies to mitigate the negative consequence of drug use (e.g., overdose, disease transmission), and include: syringe service programs, drug testing, overdose reversal medication, overdose prevention centers, and educational materials. However, access to harm reduction is hindered by state laws and varying political climates that inhibit resource allocation for such services. This project aims to investigate the legality of and political landscapes around harm reduction in six states as a preliminary, formative research effort to identify and engage relevant local stakeholders in efforts to scale-up harm reduction services. Two undergraduate researchers conducted document review and policy surveillance analyses to create individual jurisdictional profiles for each state. Researchers performed a structured search of state health agency websites to identify current public health efforts to deliver harm reduction and collect data about overdose prevention. Structured scoping reviews were also conducted to identify local news coverage, social discourse, and political rhetoric about harm reduction services. Policy surveillance methods are being used to search legal databases and state legislative websites for proposed bills and passed laws restricting or enhancing access to harm reduction. Jurisdictional profiles are continuously updated, living documents that directly guide how the larger research team engages stakeholders in state health departments, state substance use task forces, opioid settlement boards, and other policy actors who are critical to informing decisions about expanding access to harm reduction services.

Celeste Morales

Molecular and Cell Biology, Marshall

Mentored By Kim Dore

Characterization of protein palmitoylation in the brain of Alzheimer's disease model mice

Palmitoylation is a posttranslational protein modification that facilitates the association of proteins with membranes and research indicates the potential role of altered palmitoylation in hallmarks of Alzheimer's Disease (AD), including amyloid-beta plaque aggregation, synaptic toxicity, and synaptic loss. Palmitoylation regulates enzymes involved in amyloidogenic processing, such as BACE-1 and y-secretase subunits, and importantly targets 50% of synaptic proteins. Among these is postsynaptic density protein 95 (PSD-95), the reduction of which is thought to be a precursor of synaptic loss, as the protein provides support at the synapse. We found that PSD-95 palmitoylation was specifically reduced in female AD model mice. The prevalence of altered palmitoylation in AD indicates great significance in methods that aim to explore this modification. In this presentation, we compare different biochemical methods to measure protein palmitoylation. APEGS, the acyl-pegyl exchange gel shift assay, is one such method, in which palmitic acid groups are cleaved from cysteine residues on proteins, and the resulting

thiols are labeled with a 10kD polyethylene glycol (mPEG). This reaction will lead to mobility shifts in Western Blots, allowing quantification of palmitoylation. We compared the APEGS assay with a similar assay relying on the biotin-streptavidin reaction. Additionally, using a novel antibody that marks all palmitoylated cysteine sites, global palmitoylation levels can be studied across different brain regions. This last approach revealed interesting sex differences in the mid-brain and the hippocampus of AD model mice.

Andrea Mota

Sociology, Sixth

Mentored By DR. Harvey Goldman

For Love of the Game: Examining the Weight the Business of College Sports Places on Collegiate Athletes

Due to proprietary information, this abstract has been redacted.

Naseem Moussa

Neurobiology, Marshall

Mentored By Kay Tye

Analyzing the Effects of Social Relocation on Rodent Behavior and Medial Prefrontal Cortex (mPFC) Dynamics

Social instability has been shown to induce behavioral alterations that may contribute to psychiatric disorders. Recent studies have indicated a higher rate of depression in those who moved once or more as a child. In mice, the medial prefrontal cortex (mPFC) has been implicated in processing social information, such as rank and isolation. I utilized a novel relocation paradigm in which group-housed mice were relocated into cages with established social hierarchies, and used in-vivo epifluorescent calcium imaging to assess the effects of relocation on the mPFC. In relocated mice, I found an anxiogenic effect with no changes in social rank compared to control. Additionally, future cohorts will elucidate the effects of relocation on mPFC responsiveness during hierarchy-based social interaction. These results demonstrate a novel method of social instability that induced anxiogenic effects in mice, as well as opening the door for further research into the mPFC's response to social instability.

Ruby Munoz

Neurobiology, Revelle

Mentored By Matthew Lovett-Barron

Effects of hunger on social behavior in schooling fish

Schooling behavior is the coordinated movement of a group of fish that provides an adaptive advantage to individuals, like enhanced protection from predators or more efficient foraging. Internal states, such as fear, arousal, and hunger, have been shown to modulate sensory perception and collective behavior. This project seeks to explore how individual-level hunger state influences group-level social behavior, specifically schooling in fish groups. A well-suited model organism to study group social behavior is the small micro glassfish, Danionella cerebrum, which are known to engage in schooling behavior. Previous work in the Lovett-Barron lab has demonstrated that hungry D. cerebrum groups demonstrate increased schooling behavior, as indicated by increased group alignment, speed, and proximity to one another. The goal of this project is to further evaluate hunger-dependent schooling by a) manipulating physiological state and measuring behavioral phenotypes, and b) investigating hunger-dependent sensory perception at the individual fish level. To manipulate physiological state, hormonal manipulation will be employed by exposing D. cerebrum to the hunger-inducing hormone ghrelin, and assessing resulting schooling dynamics. To investigate how hunger impacts the individual interactions in a fish group, we will isolate a single individual fish and measure its interactions with a virtual fish group. This research will add to our understanding of how hunger shapes group behavior in fish and ultimately contribute to our understanding of human social behavior, paving the way to find new approaches to address health concerns related to social feeding including obesity and malnutrition.

Arlene Grace Nagtalon

Molecular & Cell Biology and Community Research, Education, and Well-Being (Individual Studies Major), Revelle

Mentored By Dr. Erika Cyphert

Validating a reproducible in-vitro microbiome culture for high-throughput drug screening

Pathogens can significantly disrupt the natural balance of the gut microbiome and can lead to antibiotic resistance, which is a major gut health issue. Microbial derived metabolites can directly influence bacterial physiology and metabolism and have been shown to impact antibiotic resistance by influencing interspecies competition. Stool-derived in-vitro cultures (SICs) are a useful method to analyze how the gut microbiome responds to novel therapies (such as microbial metabolites) in a cost-effective and high-throughput manner. The main objective of this study is to validate a stable stool-derived in-vitro microbiome platform that is controllable and reproducible for high-throughput drug screening. Along with the creation of a pseudo-gut microbiome using brain heart infusion (BHI) media, fresh stool samples from healthy C57BL/6 mice serve as a template for how microbial communities flourish in a controlled environment. To validate this model, fecal pellets were collected from C57Bl/6 mice with an unaltered microbiome, transferred to anaerobic conditions, and cultured in BHI media over 72 hours per passage. Following each 72 hour passage, the optical density (OD) was measured to quantify microbial growth relative to blank media controls. OD measurements revealed consistent and reproducible growth

across passages of replicates. Conditions for culturing were optimized by evaluating different fecal sample mass. Replicates from two experimental groups with different fecal sample masses showed similar OD values and low variability after the second passage.

Robert Nasanbat

Neurobiology, Eighth

Mentored By Kathleen Fisch

Developing In Vitro Models of Pregnancy Disorders Using Human iPSCs

The placenta is a transient organ that facilitates maternal-fetal gas and nutrient exchange during pregnancy. Placental dysfunction occurs when the placenta is unable to meet the nutrient and oxygen demands of the developing fetus. Despite the fact that pregnancy complications arise in ~8% of pregnancies, the underlying mechanisms that lead to these disorders are severely understudied.

To investigate pregnancy disorders, this project establishes experimental protocols using trophoblast-derived cancer cell lines as a precursor to working with trophoblast stem cells. JEG-3 and BeWo, human choriocarcinoma cell lines, serve as models for placental development. BeWo cells mimic syncytiotrophoblasts (STBs), which regulate maternal-fetal nutrient exchange, while JEG-3 cells resemble extravillous trophoblasts (EVTs), responsible for uterine invasion and blood flow establishment. Both play critical roles in placental function, making them valuable models for studying pregnancy disorders.

This study explores optimal culture conditions to model placenta disorders in vitro. We hypothesize that JEG-3 and BeWo cells can be co-cultured on Geltrex (diluted 1:200 in DMEM/F12)-coated plates to better mimic human placental development. To test this, we will compare the morphology, proliferation, and growth rates of JEG-3 alone, BeWo alone, and co-cultured cells on Geltrex-coated plates over multiple days.

We anticipate that establishing these protocols will aid in our future endeavors to model placenta disorders in vitro, enabling us to continue studying underlying causes of pregnancy disorders. Future work will integrate iPSC (induced pluripotent stem cell)-derived trophoblast models to validate the functional consequences of mutations that are potentially associated with pregnancy disorders.

Sophie Neale

Cognitive & Behavioral Neuroscience, ERC

Mentored By Lara Rangel

Ultrasonic Signaling in Rats: the 25 kHz Call

The phenomenon of ultrasonic vocal (USV) communication in rats has been well-documented, with observations generalized into two primary categories of signals: the 22 kHz and the 50 kHz call. In accordance with the assumption that signaling in animals is affective in origin, these signal groups have often been associated with affective states, aptly as general as the signal groups themselves. The 22 kHz call correlates with negative affect and is thought to serve as an alarm call, while 50 kHz signal correlates with positive affect and often occurs during play, positive social interactions, or reward consumption. It's important to note that these vocalizations are context-dependent and vary in their patterning, yet, despite this nuance, these generalizations have held.

We have observed a previously undocumented 30 kHz call synchronized with chattering, an acoustic, non-vocal behavior seen in rats under conditions of negative affect and high arousal, such as aggression or anxiety. This signal has been seen in pairs of rats undergoing an experiment in which one rat is confined in a transparent box that can be opened by their conspecific via lever-press. Rats that learn an association between lever pressing and liberation from confinement expressed the 30 kHz as a "call to action" to encourage helping behavior in the free conspecific. The 30 kHz differs from the 22 kHz signal in that appears to serve a distinct function, asking for help in situations where the vocalizer is in distress.

Bri Newton

Psychology: Cognitive and Behavioral Neuroscience, Sixth

Mentored By Miranda J. Koloski

Investigating Flexibility Using Probabilistic Reversal Learning in Male and Female Rats Following Prefrontal Cortex Traumatic Brain Injury

Each year, traumatic brain injuries (TBI) affect millions of Americans, often leading to long-term behavioral problems with decision-making and increased risk taking. The prefrontal cortex (PFC) is well-established for its role in executive functions and is often damaged by brain injuries. However, few have looked into the connection between chronic damage from frontal TBI and reward-guided behaviors. We predict that if severe TBI creates chronic brain damage, then behavioral differences will emerge in rodents performing a probabilistic reversal learning (PRL) task requiring reward discrimination, valuation, and behavioral flexibility. Using controlled cortical impact, we created a bilateral TBI centered over PFC, comparing behavior to control rats without TBI. Subsequently, all rats received an implant with 32 local field potential (LFP) probes to collect brain-wide electrophysiological data while completing the PRL task. During the PRL task, rats choose between a high probability reward port (80% chance of reward) or low probability reward port (20% chance of reward). Reversals, where high and low probability ports switch, occurred if eight of the ten previous trials were from a high probability port. Preliminary data shows no significance in reversal count ($F(2,25)=3.056$, $p=.065$) between three groups (TBI female, TBI male, and control male), but a significant difference is found in trial count ($F(2,25)=4.134$, $p=.028$), indicating possible motivational deficits following TBI. Further studies can explore treatment options for human motivational deficits following PFC TBI.

David Ngan

Neurobiology, Seventh

Mentored By Matthew Lovett-Barron

The Timescales and Neural Basis of An Odor-Evoked Persistent Internal State in Larval Zebrafish

Internal states, such as fear and arousal, can be elicited by a transient sensory stimulus to greatly influence animal behavior and physiology over long timescales, allowing animals to adapt their neural function and behavior to changing circumstances. However, persistence generation and maintenance mechanisms remain elusive. Previous work in our lab has induced a persistent internal state with a brief 1-minute pulse of cadaverine (an innately aversive odor) in larval zebrafish, characterized by a persistent heart rate elevation after 1 mM cadaverine but only a transient elevation after 0.1 mM cadaverine. Here, we first further characterized the physiology and behavior during this state and examined their timescales. We found that in larval zebrafish engaging in a visuomotor behavior, 1-minute exposure to cadaverine induces 15-20 minutes of elevated heart rate (after 1 mM but not 0.1 mM cadaverine) and movement suppression. Furthermore, functional imaging data revealed anatomically distinct neuronal activities across short, intermediate, and long timescales in olfactory bulb, diencephalic areas enriched in monoaminergic neuron types, and hindbrain, respectively, after 1 mM cadaverine. Notably, 0.1 mM cadaverine only induces short-timescale neuronal activity and elevates heart rate transiently, indicating that cascades of signals from intermediate to longer timescales produce persistent behavior. Our preliminary data suggests that movement suppression is diminished in fish with ablation of dopaminergic and noradrenergic neurons. Together, our results show that this internal state induces visuomotor, physiological, and neuronal effects across minutes-long timescales, giving insights into neuronal mechanisms for the generation and maintenance of persistent physiology and behavior.

Amy Nguyen

Business Psychology, ERC

Mentored By Adena Schachner

When walls can talk: People make social inferences from towns' protective features

Human societies are shaped by intentional design. Here, we ask whether people use societal features to make social inferences, specifically focusing on how the presence of protective architectural features influences people's intuitions about towns' residents. In Study 1, U.S. adults (N = 100) were presented with two novel societies – a 'protected' town with walls, locks, and gates, and an 'unprotected' town lacking such features. We manipulated whether residents had chosen or been randomly assigned where to live. Across both conditions, people judged that unprotected society residents felt safer, happier, and were nicer; and that protected society residents dressed more similarly, stayed inside more, and had more rules. Most people preferred to live in the unprotected society. In Study 2, we preregistered and replicated findings from Study 1 with a new sample of adults (n = 120) and are currently collecting data

from 8- and 9-year-old children (n = 35/120) to characterize the developmental origins of this kind of reasoning. Overall, we show that adults use the physical features of built environments to make social inferences on a large scale.

Minh Tuan Nguyen

Economics, ERC

Mentored By Julie Berry Cullen

Accessibility to Firearms and Dynamics of Domestic Violence Homicides in the United States

Domestic Violence (DV) is a rising concern in the U.S. that imposes social costs, such as by lowering productivity and labor force participation. Furthermore, the availability of firearms and deadly weapons elevate the chances of homicides including those from DV incidences. Therefore, states have enacted Extreme Risk Protection Order (ERPO) policies in effort to minimize homicides involving the use of firearms and its impacts. Compared to the state-policy Domestic Violence Restraining Order (restricting to only intimate/dating relationships), this policy allows broader relationships (i.e. extended family and law enforcement) to petition an immediate court order against those being suspected to harm others or themselves from possessing and purchasing firearms. The average effects of ERPO on DV homicides and heterogeneity by gun ownership shares across states will be estimated using an event-study strategy with the panel data from Uniform Crime Report from 2012-2021. After controlling for multiple factors, there is no supporting evidence for the effect of ERPO and DVPO on DV homicides regardless of relationship groups (intimate partner and other family members). The findings of the research will help to inform policymakers to design effective policies against domestic violence.

Brina Nguyen

Bioengineering: Biotechnology, Revelle

Mentored By Miguel Lopez-Ramirez

Artificial intelligence and high-content screening identified FDA-approved drugs for the long-term treatment of cerebral cavernous malformation disease

Cerebral cavernous malformations (CCMs) are neurovascular lesions affecting the brain and spinal cord, mainly caused by loss-of-function mutations in the KRIT1 (CCM1), CCM2, or PDCD10 (CCM3) genes. Increased vascular endothelial growth factor (VEGF) signaling leads to the breakdown of inter-endothelial junctions, causing hemorrhages and vascular leakage in CCM lesions. Recent studies indicate that inflammation and gain-of-function mutations in PIK3CA exacerbate CCM disease. With no current therapeutic options for non-operable lesions, there is a pressing need for new pharmacological treatments. We utilized artificial intelligence (AI) to identify new therapeutic targets for CCM pathology. The platform integrates extensive and diverse data types from various biomedical entities, such as

diseases, genes, tissues, and biological mechanisms, along with transcriptomics derived from our proprietary experimental data. By utilizing this method, we discover new potential targets for therapeutic intervention. AI identified safe and long-term use potential FDA-approved pharmacological agents for CCM disease. Pharmacokinetic, pharmacodynamic, and toxicological studies identify novel, safe, and effective FDA-approved drugs for potential long-term use in treating CCM disease.

Thu Nguyen

Human Biology, Revelle

Mentored By Alice Zemljic-Harpf

In Cardiac Myocytes SGLT2 Inhibition Induces Connexin 43 Re-localization, and Cytoskeletal Reorganization: A Novel Mechanism for Reduced Cytosolic Ca2+ Peaks after Adrenergic Stimulation

Sodium-glucose cotransporter 2 inhibitors (SGLT2i) lower blood glucose in patients with Type 2 diabetes and reduce mortality and heart failure hospitalizations. Although SGLT2 is not expressed in cardiac myocytes (CMC), anti-arrhythmic effects have been reported but no consistent molecular mechanism has been identified. We explored whether the SGLT2i ertugliflozin (ERTU) alters adrenergic stimulation of cytosolic Ca2+ ([Ca2+]cyt) concentration in spontaneously contracting CMCs. CMCs were isolated from 0- to 2-day-old mice and treated for 72 hours with 100 nM or 1uM ERTU, the NHE-1 inhibitor cariporide (CARI, 10 uM), ERTU plus CARI, or vehicle (Ctrl). After 72 hours, cells were either loaded with Fura-2 to record baseline [Ca2+]cyt and the response to phenylephrine (PE, 100 uM), lysed for immunoblotting, or fixed for immunohistochemistry.

In CMCs treated with 100 nM or 1 μM ERTU, [Ca2+]cyt peaks were reduced after PE stimulation. In contrast, CARI increased [Ca2+]cyt at baseline and enhanced peaks after PE. ERTU decreased protein levels of total phospholamban and increased its S16 phosphorylation, upregulated sarcomeric α-actinin2, improved sarcomeric Z-line organization and included re-localization of connexin-43 (Cx-43) to cell-to-cell contacts. CARI did not induce cytoskeletal or Cx43 rearrangement. Our findings indicate that the effects of ERTU on mechanically active CMCs differ from effects of NHE1 inhibition. Considering that disturbed cell-to-cell contacts and Ca2+ overload are a hallmark of heart failure, potential direct cardioprotective effects of the SGLT2i ERTU include lowering of adrenergic driven increases in [Ca2+]cyt, improved cytoskeleton organization, and enhanced intercellular cardiomyocyte communication.

Amy Nguyen

Cognitive & Behavioral Neuroscience and Clinical Psychology, Marshall

Mentored By Leslie Carver

Exploring Stimulus Preceding Negativity in Anticipation of Social vs. Non-Social Stimuli in Neurotypical and ASD Toddlers

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by difficulties in social communication and repetitive behaviors, though its underlying causes remain unclear. One prominent theory, the Social Motivation Hypothesis (SMH), suggests that these challenges stem from an inherent lack of social motivation (Chevallier et al., 2012). Examining the validity of SMH could help unify the field and provide more effective interventions for children. While SMH has been studied through behavioral measures, few studies have examined anticipatory neural responses in ASD. This study aims to address this gap by exploring how neurotypical toddlers and those with ASD (ages 3–4) anticipate social versus nonsocial stimuli. We used Electroencephalogram (EEG) to measure Stimulus Preceding Negativity (SPN), an Event-Related Potential (ERP) linked to the anticipation of rewards, to compare brain responses between the two groups. We hypothesized that neurotypical children would exhibit a larger (more negative) SPN in response to social stimuli compared to children with ASD. By comparing SPN responses between toddlers with and without ASD, this study provides insight into the neural mechanisms underlying social motivation, potentially informing early intervention strategies.

Kathy BA Nguyen

Neurobiology, ERC

Mentored By Christine Smith

Use of a Retrograde Memory News Events Test to Characterize Memory Impairment in a Veteran with History of Traumatic Brain Injury and Epilepsy

Traumatic brain injury (TBI) and epilepsy can cause difficulty learning new information (anterograde amnesia, AA) and difficulty remembering information before onset (retrograde amnesia, RA). TBI is associated with more impairment in recall vs. recognition memory due to frontal lobe damage. This is a case study of a 39-year-old male Veteran with a history of mild TBI (3 IED blasts in one day) followed by onset of epilepsy 6 years later. AA and RA were measured using retrograde memory news events test (RM-NET). Recall and recognition memory accuracy were measured in the Veteran, in adults with normal cognition (controls), pre-surgical epilepsy patients (no TBI), and mild TBI patients (no epilepsy), across the entire adult lifespan. We hypothesized the Veteran would (1) exhibit impaired news events test memory relative to the control groups and (2) exhibit intact remote memory. These effects would be more pronounced for recall vs. recognition. The Veteran exhibited poorer performance on the RM-NET relative to control groups, with recall more impaired than recognition. Compared to controls, the Veteran exhibited RA and AA surrounding his TBI and epilepsy onsets. Recognition memory was intact 6-8 years prior to TBI onset, whereas recall was impaired across all time periods. Compared to the epilepsy group, the Veteran exhibited AA surrounding his TBI onset and their epilepsy onsets and RA for information acquired 0-4 years prior to TBI onset. The RM-NET provided an objective and tractable way of examining RA and AA in a patient who had both TBI and epilepsy history.

MILO NGUYEN

COMPUTER SCIENCE, Warren

Mentored By KARCHER MORRIS

INFLATABLE MULTI-CHAMBERED DILATOR FOR TREATING VAGINAL STENOSIS

Vaginal stenosis (VS) is a common long-term side effect of pelvic radiation therapy for gynecological cancers, characterized by the narrowing and shortening of the vaginal canal. This condition often leads to significant pain and a reduced quality of life for patients.

Current vaginal dilation therapy (VDT) options are frequently reported as painful and uncomfortable, contributing to low adherence and limited treatment success. To address these challenges, an inflatable, multi-chambered vaginal dilator was developed to enhance patient comfort and treatment adherence. Two versions are proposed: a desktop model for supervised in-clinic use and a portable, cost-effective mobile version for self-treatment at home.

Doanh Nguyen

Math-Computer Science, Warren

Mentored By Dr Sarah Creel

Extracting Probabilites from ASR Models

This research investigates the degree to which Automatic Speech Recognition (ASR) models, specifically Whisper and Wav2Vec2, mimic humans' recognition of words. We wished to compare ASR model performance to humans' performance in a task where they hear one word (e.g. lock) and have to select from one of just four possible pictures (e.g. lock rock ship chip). In order to equate the "task" for the ASR models, which are in essence doing free response transcription, we are developing a method to extract the model's probability for a set of four “hotwords”, that consists of the correct word and the other three pictured items, as well as any homophones. By analyzing the distribution of these probabilities, we will assess the models' ability to discriminate between phonetically similar words. This will provide insights into the models' strengths and limitations in auditory processing, as well as the limits of comprehensibility of speech produced by child vs. adult speakers. The current phase of this research is focused on perfecting the probability extraction process from the ASR outputs. Comparable human data will be shown if time and research progress permit.

Amy Nguyen

Chemical Engineering, Seventh

Mentored By David Fenning

Identifying Optimal Processes for Developing Materials & Future Scalability

Due to proprietary information, this abstract has been redacted.

Nathaniel Nono

Neurobiology, Revelle

Mentored By Eiman Abdel-Azim

Investigating Endocannabinoid Influence on Social Pain and Its Neural Overlap with Physical Pain

With the rise of the internet and social media, despite global connectivity, many people experience more loneliness (a type of social pain). Social pain arises when individuals misalign their expectations and reality of social belonging, leading to emotional distress. However, how social pain is processed in the brain remains unclear, though the Pain Overlap Theory suggests it shares neural pathways with physical pain. To test the overlap between the neural circuitry of pain modalities, we generated a novel paradigm coined the FOMO (Fear of Missing Out) task. In this task, we conditioned mice to associate a tone cue with the delivery of a chocolate milkshake reward. Following training, mice undergo Social Exclusion, in which they observe their cagemates collectively consume the reward. Preliminary data suggests that the endocannabinoid (eCB) system is recruited in the anterior insular cortex (aIC) during trials in which excluded mice actively attend to the other side. Thus, we hypothesized that enhanced recruitment of the eCB system will increase “Attending” behavior. To test how endocannabinoids can modulate attending behavior, we pharmacologically injected WIN55,212-2, a synthetic eCB agonist, into the aIC as mice underwent the FOMO task. However, we found no difference in social or physical pain after injecting WIN55, suggesting that CB1R does not necessarily mediate pain behavior, but could be responsible for other aspects of Social Exclusion, such as reward omission. Ultimately, understanding the role of distinct neuromodulators during Social Exclusion will help us disentangle how motivational pain states are represented within the brain and help identify new potential therapeutic targets.

Matthew Nunes

Molecular and Cell Biology, Sixth

Mentored By Deborah Yelon

osr1 acts synergistically with hand2 to promote cardiomyocyte production in zebrafish

Heart formation relies on precise coordination of myocardial differentiation, since ineffective cardiomyocyte production can lead to organ dysfunction. The basic helix-loop-helix transcription factor hand2 is crucial for cardiomyocyte production, and its loss causes significant cardiomyocyte deficits. We demonstrate that osr1, a zinc finger transcription factor, acts synergistically with hand2 to regulate

cardiomyocyte development in zebrafish. Before the heart tube assembles at the embryonic midline, hand2 mutants and hand2;osr1 double mutants seem to have comparably small numbers of cardiomyocytes. However, by the time that the heart tube forms, the hand2;osr1 double mutants display a striking reduction in their cardiomyocyte population, surpassing that seen in hand2 mutants alone. Live imaging experiments are underway to investigate whether apoptosis, change in cell fate, or other cellular mechanisms underlie the cardiomyocyte loss within this critical developmental window. Concurrently, we are analyzing the dynamic expression of osr1 in the anterior lateral plate mesoderm, where osr1 and hand2 appear to have initially overlapping expression patterns that later become complementary. These expression patterns will inform our model for how osr1 interacts with hand2 to regulate cardiomyocyte production.

Megan O'Brien

Marine Biology, Revelle

Mentored By Sara Jackrel

Spatio-temporal Variation in Free-Living and Host-Associated Bacteria of a Glacier System in the Sierra Nevada, CA

As anthropogenic climate change leads to rapid increases in temperatures and subsequent glacier retreat, investigating how free-living and host-associated bacterial communities change over time in alpine lakes becomes crucial since shifts in microbial community structure could have cascading effects on downstream ecosystems. There has been increasing interest in characterizing the microbes in glacier-fed versus snow-fed lakes, however little is known about how phytoplankton microbiomes change temporally and between lake types. Glacier-fed lakes are distinct due to many conditions including the presence of glacier flour, a lesser dependance of water level on seasonal precipitation, and overall colder water temperatures compared to snow-fed lakes. The glaciers in California's Sierra Nevada Mountains are on track to disappear with changing weather patterns. This research explores spatial and temporal variations in microbial communities across lake systems in the mountain range. Water, snow, and ice samples were collected during the summers of 2022, 2023, and 2024. Turbidity, temperature and pH were measured at collection sites when possible. Water samples were filtered to separate the phytoplankton associated microbiome from free-living bacteria and DNA was extracted for 16S rRNA amplicon sequencing during the Fall of 2024. We found that the bacterial community composition sampled below Conness Glacier in 2022 varied between lakes with increasing distance from the glacier being a significant predictor ($F(4,12) = 1.882$, $p=0.036$). Understanding that the microbial communities in alpine lakes are highly source specific sheds light on the dynamics of free-living and host-associated bacterial communities in a unique, dwindling ecosystem.

Ifunanya Okoroma

Data Science, Sixth

Mentored By Justin Meyer

Machine Learning to Identify Key Interacting Mutations During Phage-Bacteria Coevolution

Phages, viruses that target and kill bacteria, offer a promising approach to combating antibiotic-resistant infections. Understanding what promotes phages to infect bacteria is crucial for developing more effective phage-based therapies. When bacteriophage Φ21 is cultured with its host, Escherichia coli, they engage in a coevolutionary arms race. Over time, a complex interaction network between these evolved phages and bacteria emerges. The challenge lies in identifying which mutations and their interactions are responsible for this intricate web of phage-bacterial relationships.

Machine learning can be leveraged to decode these interactions. These algorithms can process complex datasets by weighing the significance of various features—in this case, mutations in phage and bacterial genes. Each feature was designed as a mutation pair: one from the phage genome and one from the bacterial genome, with the outcome being whether phage infection is successful. Using logistic regression and incorporating Lasso regularization to prevent model overfitting predicted infection likelihood and identified a small set of mutation pairs that are most predictive of infection outcomes.

The algorithm achieved a 66.5% accuracy rate in predicting whether a specific phage could infect a specific bacterium. Notably, mutations ‘N268K’ and ‘S53R’ in the bacterial outer membrane protein F were the most predictive, with ‘N268K’ indicating a higher likelihood of infection and ‘S53R’ suggesting resistance. Given that this baseline classifier outperforms random chance, it demonstrates the potential of machine learning to predict phage-host interactions based on genomic data alone.

Borngreat Omoma-Edosa

Data Science, Warren

Mentored By Bradley Voytek

Synthesizing human neuroimaging data with vision-language models

Neuroimaging research has yielded tens of thousands of peer-reviewed studies investigating the structure, function, and genetics of the human brain. Despite the richness of these findings, These studies all exist as independent entities, making it challenging to perform comprehensive synthesis and multimodal interpretation. Here, we present a framework that leverages models and methods to produce synthetic neuroimages from user-defined queries, bridging disparate datasets and unifying knowledge across studies. Our approach embeds generated images into low-dimensional space, with respect to the input matrix defined by known neuromaps, thereby contextualizing them in terms of morphometry, myelination, gene expression, metabolism, and receptor density. This enables researchers to more easily uncover relationships among diverse neuroimaging modalities and gain deeper insights into brain organization. By providing a scalable, data-driven platform for integrative analysis, our work creates new opportunities for hypothesis generation, improved meta-analyses, and a more holistic understanding of the human brain.

Amelia Orgill

Molecular and Cellular Biology, Marshall

Mentored By Cynthia Hsu

Early detection of liver disease in patients with alcohol use disorder improves long-term abstinence

Excessive alcohol consumption is a major global health concern, contributing to millions of deaths annually and many cirrhosis cases. However, standardized protocols for early identification of alcohol-associated liver disease are lacking. This study examined the prevalence and risk factors for advanced fibrosis in patients with severe alcohol use disorder (AUD) admitted to a residential treatment program and assessed whether liver disease evaluation influenced long-term alcohol consumption and outcomes.

Veterans with AUD admitted to the Substance Abuse Residential Rehabilitation Treatment Program (SARRTP) at San Diego VA between January 2021 and June 2023 were offered liver health screening via blood tests and Fibroscan. Patients with liver stiffness measurement (LSM) ≥10 kPa were referred to hepatology for follow-up and repeat Fibroscan within three to six months. AUD severity was measured using the condensed Alcohol Use Disorders Identification Test (AUDIT-C) at admission, within a year, and over a year after admission.

Of 277 veterans screened, 35 had elevated liver stiffness. Those at high risk for advanced fibrosis were more likely to remain abstinent and had lower AUDIT-C scores after one year. Additionally, 43% of patients with elevated liver stiffness at baseline were later diagnosed with cirrhosis and incorporated into routine hepatology care. Non-invasive liver disease screening in high-risk populations allows for early identification of advanced fibrosis before decompensation. Collaboration between mental health professionals and hepatologists is essential for integrating care for patients with AUD and liver disease.

Yazmin Ortega

Cognitive Science with a Specialization in Neuroscience, Sixth

Mentored By Dr. Lara Rangel

The Impact of Social Interactions on Behavioral and Neurophysiological Stress Responses in Rats

The emotional states of others can influence the behavior of social animals. In stressful situations, group dynamics among rats can involve social transmission or social buffering. This study aimed to determine how social dynamics influence the behavioral and neurophysiological states of rats during stressful situations. Rats were placed in an open arena where predator-like stimuli were placed at the edge of the arena at random times during the session. Rats experienced these conditions alone or with a familiar or unfamiliar conspecific, and were either separated by a divider or allowed to interact with conspecifics. We quantified individual behaviors (e.g. freezing, horizontal head swaying, self-grooming) and social behaviors (e.g. sniffing, following, social grooming) behaviors across conditions and found that the

presence of a conspecific produced a social buffering effect when pairs of rats were allowed to interact. These findings are consistent with previous studies in other social mammals, including humans, in which the presence of a conspecific alleviates the stress of an experience and improves recovery. We also observed larger theta (7-12 Hz) and beta (15-30Hz) oscillations in the basolateral amygdala (BLA), anterior cingulate cortex (ACC), and insular cortex (INS) during fear behaviors when rats experienced stressors alone. This suggests that specific rhythmic circuits are selectively engaged when experiencing stress alone, and that social interactions can alter their recruitment. Understanding the underlying mechanisms of shared emotional states in rats during social buffering provides insight into the complex interplay of influences that shape identity and behavior, particularly an individual's surroundings.

Amy Park

Psychology, Marshall

Mentored By Celeste Pilegard

Do Lapses in Lesson Coherence Lead to a Negative Cascade of Mind Wandering?

Mind wandering occurs when attention shifts away from a target activity. Previous research has shown that lapses in coherence can cause mind wandering. Previous work in this lab showed that students' mind wandering recovered after a lesson returned to high coherence. However, this work did not use a cumulative lesson, possibly explaining the lack of a cascade effect. This study examines the impact of text coherence on mind wandering in a cumulative lesson. College students (target N = 200 based on a priori power analysis; data collection ongoing) watch a three-part cumulative lesson on navigation: Part 1 introduces previous theories of navigation, Part 2 introduces new theories for animal navigation, and Part 3 applies those theories to humans. Participants are assigned to a lapse or control condition. In the control, the lesson remains high in text coherence the whole time. In the lapse condition, Part 2 lapses into low coherence, but the lesson returns to high coherence for Part 3. Participants respond to mind wandering probes at pseudo-random intervals throughout, and their learning is measured through a multiple-choice test after the lesson. We hypothesize that participants will engage in more mind wandering when they experience a lapse in coherence. We also hypothesize that increased mind wandering during the lapse will cause a negative cascade after resuming high coherence such that participants who experienced a lapse will still have increased mind wandering than control. We predict a similar pattern for learning: lower performance in parts 2 and 3 for the lapse condition.

Pooja Parthasarathy

Biology w/ Bioinformatics, ERC

Mentored By Eugene Yeo

Measuring translational efficiency across diverse mRNA coding sequences using RiboSTAMP

Due to proprietary information, this abstract has been redacted.

Sanjana Paul

Psychology, Marshall

Mentored By Charles Taylor

Investigating the Impact of Cannabidiol on Discrepancies Between Self-Rated and Observer-Rated Performance in a Social Stress Task in Individuals with Social Anxiety Disorder

Social Anxiety Disorder (SAD) is a debilitating health condition, impairing social functioning and quality of life. Individuals with SAD often display a bias toward negatively evaluating their performance in social situations compared to objective observers, maintaining anxiety symptoms. Therefore, lower discrepancies between self and observer ratings may reflect more accurate self-perceptions of performance, while higher discrepancies may indicate worse SAD symptoms. Evidence suggests that cannabidiol (CBD) reduces anxiety symptoms during public speaking, but limited research has examined optimal CBD dosing for improving self-evaluation in SAD patients. The proposed study is a secondary analysis from a phase II sub-acute (4-day) steady-state dosing clinical trial involving 61 randomized subjects with SAD. Participants received either CBD 300 mg/day, CBD 900 mg/day, or a placebo, administered twice daily for four days. They completed an anxiety reactivity social stressor (i.e., five-minute impromptu speech) at baseline and day 4. Self-perceived performance during the task was measured using the Social Judgment Questionnaire (SJQS).The primary aim of our study assesses whether CBD impacts discrepancies between observer and self ratings. We hypothesize that CBD improves self-evaluation and reduces discrepancies between self-evaluated and observer ratings on day 4 compared to baseline. No change in discrepancy is expected for the placebo group. Additionally, we hypothesize a dose-dependent effect on discrepancy between ratings, such that higher doses of CBD are associated with less discrepancy. Findings from this study may provide evidence for CBD's potential as a therapeutic intervention for SAD by improving accuracy of self-perceptions.

Autumn Pedranti

Sociology - Science & Medicine, ERC

Mentored By Christena Turner

Bridging the Gap to Success: Humanistic Dynamics of Pre-Medical Students and Organizations in Scientific-Based Medical Education

This thesis is guided by Pierre Bourdieu’s theory of capital, theory of socialization and intersectionality, and taking an interactionist perspective. This study examines how the social and cultural dynamics and demographics of student clubs shape pre-medical students’ understanding of success and access to it. With the revision of the medical curriculum, through the Flexner Report, debates around what should be

taught to these students have been contested. Additionally, student organizations centered around being pre-med (or pre-health, pre-PA, etc.) are a way for students to have the agency to carry out their perceptions of success through their own efforts. Through 14 qualitative, semi-structured interviews with pre-medical students & conducting participant observation, I found that varying levels of social and cultural capital amongst pre-med students contribute to their understanding of success. In addition, being in these student clubs helps enrich that capital, but those students who are not in these clubs miss out on these opportunities for mobility and are left to figure out what it takes to be successful in the context of medical education and beyond. Additionally, with 'pre-med' being an unclear title, students who have at least one parent/relative in a medical-related field have an advantage in knowing what to expect as they go through this path but those who do not are at a distinct disadvantage. Furthermore, in the context of medical education, pre-medical students often need capital that is the kind that isn't acquired in a typical classroom setting and opportunities to access it are unevenly distributed.

Sarah Plummer

Public Health, Revelle

Mentored By Nancy Binkin

Financial Literacy among UCSD Undergraduates

Introduction: Financial literacy (FL) is crucial for college students, who often lack skills to manage their financial resources and avoid serious debt and other financial pitfalls. Little is known about financial literacy among UCSD undergraduates. We therefore conducted a survey to examine rates and risk factors for low FL and student interest in improving their FL skills.

Methods: In February 2025, UCSD undergraduates enrolled in selected Public Health and Economics classes completed a Qualtrics questionnaire that included FL questions. We used EpiInfo 7.2.6 to calculate frequencies of perceived FL, interest in FL topics, and preferred modalities for learning. Prevalence rate ratios (PRR) were calculated to examine sociodemographic risk factors for low FL. Students were assigned FL scores based on self-reported knowledge of budgeting, savings, credit, and student loans; low FL was defined as < 9 points on an 18 point scale.

Results: The response rate was 80%. Of the 775 respondents, 33% met the definition of low FL. Factors associated with low FL included being female (PRR = 2.2), a public health student (PRR = 2.11),Hispanic/Latino (PRR = 1.3), and lower family income (PRR = 2.3). All associations were statistically significant ($p < 0.01$). Families were the main source of FL knowledge (75%), and 78% of students were interested in learning more, especially about financial goals and credit, preferably through online modules, elective courses, and one-on-one counseling.

Discussion: FL among UCSD undergraduates is low, but interest in learning more is high. UCSD should consider implementing a multiple-format program to maximize engagement and participation.

Sierra Pohl

Sociology, Marshall

Mentored By Kevin Lewis

Eras of Femininity: How Taylor Swift and Her Fans Embrace Womanhood

Taylor Swift is one of the most influential artists of her generation, with a fanbase that actively engages with her music, image, and cultural impact. This thesis explores how Swift constructs femininity in her songs and performances and how fans reflect these portrayals. I conducted a content analysis of forty-nine songs performed during the Eras Tour which spanned from Fearless (2008) to The Tortured Poets Department (2024). In addition, I examined fan engagement on the r/TaylorSwift Reddit page, analyzing 25 posts about friendship bracelets and 25 posts showcasing fan costumes. Using both inductive and deductive content analysis, I identified key themes related to femininity. Findings reveal that Swift challenges traditional notions of femininity by embracing a duality in her persona and artistry. She seamlessly blends nostalgic, youthful aesthetics with assertive, mature themes, demonstrating that girlhood and empowerment are not mutually exclusive but coexist within a fluid, evolving identity. Fans reflect this dynamic by reclaiming traditionally "childish" symbols, such as friendship bracelets and elaborate costumes, transforming them into expressions of self-identity, solidarity, and empowerment. Through this interplay of playfulness and agency, Swift and her fans challenge restrictive gender binaries, instead embracing femininity as a dynamic force of both joy and power.

Kris Price

General Biology, Seventh

Mentored By David Holway

Effects of interannual variation in precipitation on native bee body size

Bees, which are important pollinators of many plant species, are threatened by environmental change. In arid ecosystems, interannual variation in precipitation affects the availability of pollen and nectar, which are essential resources for developing bees. Rainfall could thus affect the number of bees that reach maturity or their size through variation in pollen and nectar production. Although the effects of drought depress plant reproduction, its effects on bee body size have never been explored in detail. Here, I use long-term data of native bees in San Diego County to assess how their body size changes in response to interannual variation in winter (November-March) precipitation. Using thorax width to estimate body mass, we evaluated body size variation in 2,680 native bee specimens (18 species,13 genera, 4 families) collected in seven survey years between 2011-2024. Associations between precipitation and body size were observed in four of the 18 species. These findings suggest that interannual variation in floral resources that are driven by rainfall affect bee body size, and provide insight into how variation in precipitation affects pollination services, as changes in body size affect bee foraging distance and how bees interact with plants.

Shiv Puliady

Public Health, Warren

Mentored By Nancy Binkin

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Methods: In February 2025, UCSD undergraduates enrolled in selected Public Health and Economics classes completed a Qualtrics questionnaire that included FL questions. We used EpiInfo 7.2.6 to calculate frequencies of perceived FL, interest in FL topics, and preferred modalities for learning. Prevalence rate ratios (PRR) were calculated to examine sociodemographic risk factors for low FL. Students were assigned FL scores based on self-reported knowledge of budgeting, savings, credit, and student loans; low FL was defined as < 9 points on an 18 point scale.

Results: The response rate was 80%. Of the 775 respondents, 33% met the definition of low FL. Factors associated with low FL included being female (PRR = 2.2), a public health student (PRR = 2.11), Hispanic/Latino (PRR = 1.3), and lower family income (PRR = 2.3). All associations were statistically significant ($p < 0.01$). Families were the main source of FL knowledge (75%), and 78% of students were interested in learning more, especially about financial goals and credit, preferably through online modules, elective courses, and one-on-one counseling.

Discussion: FL among UCSD undergraduates is low, but interest in learning more is high. UCSD should consider implementing a multiple-format program to maximize engagement and participation.

Julie Qian

Chemistry, Muir

Mentored By Olivier George

Chemogenetic Activation of Corticotropin Releasing Factor-Expressing Neurons in the Central Nucleus of the Amygdala Influences Cocaine-Related Behaviors in a Sex- and Session- Dependent Manner

Cocaine misuse in the US has steadily risen throughout recent decades. Negative emotions such as stress and anxiety emerge during cocaine withdrawal, which promotes further drug seeking in a negative feedback loop. The Corticotropin releasing factor (CRF) neuropeptide is enriched in the central amygdala (CeA) and is key at modulating affective states and behaviors related to stress, anxiety, fear, pain, and addiction. Previous studies show an increase in CRF neuropeptide and neuronal activation during cocaine withdrawal. However, the role of CRF neuronal activation during active cocaine intake is not well-understood.

To investigate this, AAV encoding a novel cocaine-activated Cre-dependent chemogenetic Na+ channel (coca-5HT3) was stereotaxically injected into the CeA of CRF-Cre rats. Immediate behavioral and physiological response to intraperitoneal (i.p.) cocaine was measured. Cocaine seeking was then assessed by short access (ShA) and long access (LgA) intravenous self-administration (IVSA) after jugular-vein catheterization. We hypothesized that activation of CeA CRF neurons by cocaine during IVSA could either increase cocaine addiction behaviors by incentive sensitization without distress or decrease cocaine addiction behaviors by positive punishment through learned association between cocaine and CRF-induced negative states.

Here, we show that coca-5HT3 promotes an increased anxiety in females and heart rate in both sexes upon i.p. cocaine injection. Coca-5HT3 didn't affect IVSA cocaine infusions and motivation. However, Coca-5HT3 facilitated an earlier escalation of active lever presses and increased aversion resistance in drug seeking. These results suggest that CeA CRF neuronal activation during cocaine exposure impacts cocaine-related behavioral responses dependent on sex and time-course of IVSA.

Jaynne Quezada-Mares

Developmental Psychology, Sixth

Mentored By Gail Heyman

"What is climate change and what can I do about it?" A survey and educational intervention with 10- to 13-year-olds

This research explores how youth understand and engage in climate change. Many schools introduce climate education by fourth grade, but little is known about children's understanding of climate change and how it relates to their own actions. In the present research, we surveyed a diverse sample of 10- to 13-year olds in Southern California (N = 477), where youth were asked to report their understanding of climate change, their feelings of individual and collective efficacy, their attitudes toward climate action, and their own engagement in actions in the past month. We found that children knew little about climate change and on average reported somewhat positive efficacy and attitudes toward climate action. Around 43% of children, however, stated they hadn't engaged in climate action, and those who did focused on individual actions (e.g. throwing trash). One encouraging finding was that students who felt efficacious about action were more likely to engage in action themselves. Overall, these findings suggest that children have a surface-level understanding of climate change and engage in little climate action. To follow up, we implemented an intervention with a subset of the same children (N = 146), who learned about climate science in their class and later retook the same survey. We found that students reported no higher efficacy or attitudes and there was no change of students engaging in climate action after the intervention. This suggests that children's climate beliefs and actions are resistant to change and point toward opportunities for further research in climate education.

Jorge Ramos

Cognitive Science Specialization in Machine Learning and Neural Computation, Sixth

Mentored By Seana Coulson

Visual Context Facilitates Multimodal Continuous Speech Processing: A Study in Monolingual and Bilingual Speakers

Prior studies have shown that multi-modal information (e.g., visual, audio, texts, etc.,) facilitate speech processing and comprehension. However, these studies primarily focus on monolingual speakers and rarely explore these effects on bilinguals. Researchers found that those who learn another language later in life often experience difficulties in second language (L2) conversation, potentially due to the failure of properly integrating L2 multi-modal information such as cultural reference, visual cues, tonal differences and many more.

In this study, we aimed to explore whether visual context influences continuous speech comprehension in both monolingual and bilingual speakers. We recruited 24 monolinguals (English) and 24 bilinguals (Mandarin-English) who underwent a verbal fluency test on each of their known languages and EEG data was collected as they viewed continuous speech in audio only and audio-visual format. The data were analyzed by using a temporal response function to decode the subject's sensitivity to acoustic and semantic information. We found that bilingual speakers' ability to track audio envelope was enhanced from visual context while monolingual speakers' ability for surprisal tracking benefitted from visual cues. These results are such that bilingual speakers may dedicate more cognitive resources on integrating visual cues, and therefore lacking the required resources to further process semantic information. In conclusion, we found that the effects of visual context on continuous speech comprehension differs by language experience.

Seema Rida

Cognitive Science Spec. Machine Learning and Neural Computation, Muir

Mentored By Andrea Chiba

AI Classroom

This project aims to understand the biopsychosocial development of children in early childhood (TK) by developing an embedded system that collects physiological, visual, and auditory data using biosensors, cameras, and microphones. We plan to use these three data streams as measures of well-being, an important factor in long-term academic performance. The data we collect will support behavioral predictions using a network with low latency and live synchronization. Eventually, the system will be deployed in classroom settings to improve our understanding of how environmental factors, such as stress, may negatively impact students' mental health and academic outcomes.

Leilani Rivera

Microbiology, Warren

Mentored By Matthew Daugherty

CARD8 homologs serve as host- and virus-specific innate immune sensors of viral deubiquitinases

Due to proprietary information, this abstract has been redacted.

Simon Roberts

Political Science - Public Law, Warren

Mentored By Pamela Ban

Marijuana and Policing: The impact of reform and partisanship on marijuana arrest practices

In 2016, California voted to legalize marijuana possession with Proposition 64. But as a growing literature argues that drug reform is ineffective at reducing arrest rates for drug crime, can Proposition 64 truly be credited with reducing arrests for marijuana? Do external factors, like the partisanship of a city's mayor, impact the arrest practices for marijuana offenses? I hypothesize that Proposition 64 was successful in significantly reducing the arrest rate for marijuana related crimes, as its policies were targeted at legalizing common marijuana possession instances. I further hypothesize that cities with Democrat mayors make less arrests for marijuana related offenses. To test this hypothesis, I run a linear regression analyzing marijuana arrest rates in the 30 most populous cities in California before and after the passage of Proposition 64, while also considering factors such as the mayor's partisanship. I find that Proposition 64 did lead to a decrease in city's marijuana arrest rates, but find no significant difference across partisan lines. These results find that Proposition 64 was successful in reducing the marijuana arrest rate to a significant level, suggesting that reforms that legalize drug possession as opposed to decriminalize possession are more effective in decreasing policing of the drug, like arrests. No significant relationship between mayoral partisanship and marijuana arrests is uncovered, suggesting that although often vocal about their policies on policing, mayors do not have as tangible an impact in practice when looking at arrests.

Katelyn Rode

Neurobiology, Sixth

Mentored By Miranda Koloski

Utilizing a Neurofeedback Paradigm to Modulate High Frequency Activity in Rats

Neurofeedback, a type of biofeedback in which participants can learn to volitionally modulate their own neural activity, is a potential alternative treatment for many neuropsychiatric disorders including depression. Compared to current forms of brain stimulation treatments, neurofeedback would optimally

engage functional circuits to prevent unwanted side effects in a cost/ time efficient manner. First, preclinical rodent models employing neurofeedback are needed to develop protocols and understand its mechanisms of action. Toward that goal, we trained 7 female rats on a neurofeedback paradigm in the gamma frequency range 80-150 Hz as it is associated with increases in cell activation. Analysis of electrophysiology data from learner and non-learner animals, where learning was defined as 3 consecutive training sessions with over 30% increase of brain modulation during real (paired with tone) trials compared to fake (no tone) trials, provides several insights into frequency correlations during volitional modulation and ways to optimize the neurofeedback paradigm. To further understand if neurofeedback can effectively activate neural networks, c-fos protein expression, a known neural marker for cell activation, will be imaged in rats that successfully learned the task and compared to those that did not, using a confocal microscope and Image J analysis. Future studies will evaluate other markers of cell activation and examine the spread of neurofeedback activation and long changes in brain states last. This is a critical first step toward understanding how neurofeedback may compare as a potential therapeutic option.

Elijah Khalil Rosales

Biochemistry, Marshall

Mentored By Gene Yeo

Benchmarking differential mRNA translation efficiency using RiboSTAMP

Due to proprietary information, this abstract has been redacted.

Jasmin Rosato

Psychology, Muir

Mentored By Christine Smith

Retrograde memory for news events in epilepsy: examination of the temporal extent of retrograde amnesia

Background: Individuals with epilepsy exhibit severe retrograde memory (RM) impairment according to clinical measures of personal episodic (autobiographical memory) and personal semantic memory. For personal semantic memory, only recent time periods are impaired and early adult and childhood memories are intact. Patients also exhibit severe impairment according to novel measures of semantic memory (e.g., news event memory, famous personalities), but the extent of retrograde amnesia has not yet been examined in presurgical patients.

Methods: Using a novel test of news event memory (RM-NET), we obtained measures of recall and recognition memory accuracy in presurgical epilepsy patients (N=13, 38.5 years old) and controls (N=19, 38.3 years old) across the entire adult lifespan, separated into 3-5 year time periods. We

compared mean accuracy on the RM-NET across the groups and estimated the extent of retrograde amnesia.

Results: The epilepsy group exhibited significantly poorer mean recall and recognition memory accuracy for news events relative to controls. The epilepsy group exhibited poorer memory for news events across all nine 3-year time periods examined (27 years). The findings were similar when time periods were separated into those that happened before epilepsy onset (retrograde amnesia) and after epilepsy onset (anterograde amnesia).

Conclusions: The RM-NET was sensitive to RM impairment in epilepsy. Similar to an earlier postsurgical study (Leeman et al., 2009), all time periods representing the adult lifespan were affected. Together, these findings suggest that the severe retrograde amnesia in epilepsy results from epilepsy itself and not from surgical treatment for epilepsy.

Sam Roxas

Cognitive and Behavioral Neuroscience, Warren

Mentored By Sarah Creel

A Window On The Perception-Production Relationship Across Accent Differences

The relationship between a speaker's perception of others' speech and their own production of speech is one that is tightly intertwined. Being able to understand how speakers of varying language backgrounds perceive their own vs. others' speech of the second language can enhance the teaching of second languages and contribute to improved cross-accent communication. We investigate whether second-language speakers (L2), have a better understanding of their own speech, compared to a monolingual speaker (L1), while speaking the second language. The Self-Specialization hypothesis argues that we are optimized to understand ourselves best, meaning second-language speakers, and monolingual speakers should be able to understand themself better than the other speaker. The Production Lag Hypothesis suggests L1 Mandarin speakers will understand L1 English speakers better, and L1 English speakers will understand themselves better than L1 Mandarin speakers, since L2 speakers' production ability (to produce motor patterns to generate intended auditory outcomes) is less advanced than their production. The study was run in pairs (one L1 Mandarin, one L1 English). Participants were both recorded naming a set of pictures. They then saw four pictures at a time, and heard their own and the other speaker's recordings played back, as they attempted to select the named picture. Our expectations are that L2 and L1 speakers are better at understanding themselves than the other person, supporting the Self-Specialization hypothesis, but that there may be a larger self-benefit for the L1 speakers as their production skills may be more attuned to their perceptual skills.

Kira Ruffner

Sociology - Law and Society, Marshall

Mentored By Michel Estefan

Echoes of Exclusion: The Historical Continuity of Voter Suppression Tactics in Georgia

This thesis covers the continuities and changes in voter suppression tactics in the state of Georgia across time, focusing on how tactics have changed, what has caused the change, and how the throughline of exclusion has remained despite real concrete changes to the American electoral system. This is accomplished through a comparative socio-historical analysis through the framework of Michelle Alexander's The New Jim Crow, arguing that the electoral system is inherently exclusionary; and remains so through adaptations to gains made by minority groups. The thesis uses a mixed-methods approach that identifies and compares tactics in Georgia across American history.

Split across five chapters, the thesis examines the evolution of voter suppression in Georgia by analyzing key historical periods - Reconstruction, Jim Crow, the Civil Rights Movement, the passage and gradual erosion of the Voting Rights Act, and the post-Shelby County v. Holder era - focusing on how systemic shocks, such as legal and social reforms, have been absorbed through institutional adaptations that sustain exclusion, with a particular emphasis on the role of laws, institutions, political actors, and critical elections (1962/1964 and 2018/2020) in shaping the persistent disenfranchisement of Black voters. Each chapter covers the national and local contexts of voter suppression during American history to set the stage for an in-depth analysis of systemic adaptation.

By mapping historical and contemporary voter suppression in Georgia, this thesis underscores the resilience of exclusionary structures and the adaptability of voter suppression in the face of legal and social progress.

Kate Ruiz

Neurobiology, Warren

Mentored By Diane Jacobs

Diagnosing dementia in Spanish-Speaking U.S. Latinos: Potential implications of using self-reported education vs. grade-equivalent reading level for normative referencing of cognitive tests

Background: Normative references for neuropsychological tests commonly adjust for years of education; however, this may not adequately capture full educational achievement. Grade-equivalency scores from reading tests provide additional information about learning experience. Therefore, we explored the impact of adjusting cognitive test results for years of education vs. estimated grade equivalency in Spanish-speaking U.S. Latinos.

Method: 140 Spanish-speaking Latinos with subjective cognitive decline were referred by a community-based neurologist for objective cognitive testing. Participants were aged 47-88 (M=70.6, SD=8.0) with an average of 9.1 self-reported years of education (SD=4.5, range=0-20). Participants completed a battery of standardized neuropsychological tests. The Woodcock-Muñoz Letter-Word Identification Test was used to estimate grade-equivalency. Standardized scores (Z-scores) that adjusted for age, sex,

language of testing, and either self-reported years of education or Woodcock-Muñoz grade-equivalency were obtained for each cognitive test. The two sets of Z-scores were compared using paired samples t-tests.

Results: Grade equivalency estimated by the Woodcock-Muñoz (M=13.5, SD=4.6; range=1.7- 18) was significantly higher than self-reported years of education (M=9.1, SD=4.5; t [139]=10.9, p < .001). For all neuropsychological tests, adjusted Z-scores derived using grade equivalency were significantly lower than those derived using self reported years of education.

Conclusions: Education-adjusted norms appeared to underestimate level of impairment in Spanish-speaking U.S. Latinos who presented to a neurologist with cognitive complaints. Self-reported years of education may not adequately reflect the educational experiences of this diverse group. Although additional validation is needed, these results indicate caution is warranted when interpreting education-adjusted test scores for Spanish-speaking U.S. Latinos.

Brandon Saiki

Molecular and Cellular Biology, Revelle

Mentored By Eniko Sajti

Unraveling Myeloid Cell Response to Hyperoxia: Genetic Variation and Implications for Resilience Against Neonatal Lung Injury

Bronchopulmonary dysplasia (BPD), a major complication of preterm birth, manifests with varying severity. The role of myeloid cells in shaping disease susceptibility remains poorly understood. Objectives: This study investigates how natural genetic variation influences BPD severity by exploring myeloid cell gene expression and gene regulation differences in two mouse strains with contrasting susceptibility to oxidant stress. Methods: Bone marrow-derived macrophages (BMDMs) from hyperoxia-sensitive C57BL/6J (B6) and hyperoxia-resistant DBA/2J (DBA) mice were exposed to 95% oxygen for 24 hours. RNA-seq, ChIP-seq, and Western blot were used to analyze transcriptomics, epigenetics, and p53 expression. Data were analyzed using HOMER and Prism. Results: Hyperoxia induced distinct gene expression profiles in each strain, with only a small subset of commonly regulated genes, mostly linked to inflammation. Genes uniquely upregulated in B6 but suppressed in DBA were enriched in apoptotic pathways (e.g., Bcl2l1, Trp53inp2, Cdkn1a). Western blot confirmed increased p53 nuclear translocation in B6 BMDMs. ChIP-seq identified thousands of p53 binding sites, with hyperoxia exerting a reduced impact on p53 binding in DBA mice. This suggests maladaptive p53 activation in B6 mice. Conclusion: Genetic differences influence myeloid cell responses to hyperoxia, with excessive p53 activation potentially driving lung injury in hyperoxia-sensitive mice. This highlights the p53 axis as a key regulator of pathological immune responses in BPD and suggests genetic variability may shape individual susceptibility, providing a basis for targeted therapies.

Darleen Salameh

Neurobiology, Sixth

Mentored By Lindsay Burnett

Pain from Birth Trauma is Socially Transferred to Partners

Despite its joyous perception, childbirth causes posttraumatic stress in 1 in 5 women, impacting mothers, families, and healthcare teams, emphasizing the need for recovery strategies amid the healthcare-worker mental health crisis. This study aimed to explore whether the social transfer of pain occurs in a preclinical mouse model of simulated birth injury (SBI). Early pregnant (E8.5) C57/Bl6 mice were randomly housed to two groups: solo or with a nulliparous non-pregnant female bystander (BY). In late pregnancy (E16.5), the pregnant mice underwent an SBI using foley balloon distension, mimicking traumatic human childbirth, and delivering naturally. Pain-sensitivity, anxiety-like behavior, and depressive-like behavior were assessed using Von Frey up-down (VF), elevated plus maze (EPM), and tail suspension testing (TST), respectively. Data were analyzed with a 2-way ANOVA, post-hoc tests ($p=0.05$). All groups demonstrated reduced VF scores 2 days postpartum compared to baseline (SBI 1.324 vs. 0.442; PARSBI 0.979 vs 0.489; BY 0.781 vs 0.396), $p=0.0005$), with negligible difference between groups ($p=0.1603$). On postpartum day 8, EPM testing revealed high closed-arm time (SBI 96%; PARSBI 92%; BY 88%) indicating anxiety-like behavior, though BY spent less time than SBI or PARSBI ($p=0.0366$). On postpartum day 9, TST revealed negligible differences in immobility across groups ($p=0.374$). Pain sensitivity and anxiety-like behavior were socially transferred to bystanders, but having a bystander did not reduce pain-sensitivity in birth-injured animals, suggesting partner type or injury severity may influence social buffering.

Amanda Salatino

Interdisciplinary Computing and the Arts Major, Psychology B.A, Sixth

Mentored By Dino Dinco

The Eccentric Subconscious

Through the use of visual storytelling, my art practice aims to explore spirituality, identity, and nostalgia to answer the question: What does it mean to be human? My narratives focus more around poetry and emotion rather than presenting itself in a clear or linear structure. To do this, I intertwine my own artwork, writing, childhood videos, and past experiences to invoke a raw and authentic exploration of humanity. I will discuss my creative process, psychological and media-related influences, and technical skills.

Davi Salles Leite

Bioengineering: Biotechnology, Warren

Mentored By Alexis Komor

Genome Editing for Precision Cell Line Generation in Radiogenomics Applications

Isogenic cell lines harboring disease-relevant variants have emerged as a promising alternative to traditional studies comparing patient groups for variant classification, enabling tailored evaluation in a controlled laboratory setting. Traditional genome editing approaches, such as CRISPR-Cas9, suffer from high rates of random insertions and deletions, making cell line generation an arduous and rarely successful process. Next-generation CRISPR-Cas9 systems, such as base and prime editors, enable higher efficiency and precision of single-nucleotide changes. By integrating these advanced editing strategies with fluorescence-activated single-cell sorting, we can efficiently generate isogenic lines carrying specific variants. This approach is particularly valuable in radiogenomics, which seeks to improve radiotherapy outcomes by identifying patient-specific genetic markers predictive of treatment response. Here, we optimize a prime editing system and generate several isogenic cell lines to characterize a highly prevalent single nucleotide variant (rs1800720) in intron 5 of the TSC2 gene. Although traditionally classified as benign, we show that this mutation is implicated in decreased activation of a key cell signaling pathway (mTOR) and leads to significantly increased radiation sensitivity as measured by apoptosis and cell proliferation.

Nargiz Salmanova

Sociology & CGS, Warren

Mentored By Kevin M. Lewis

Personal and Political: Reproductive Justice and a Woman's Pursuit of Liberty in the United States

Law, sex, and social norms are interconnected, cyclical dynamics within an autopoietic system that has shaped reproductive policies in the United States. The language of "Liberty" is vaguely defined in the Constitution, leaving it open to interpretation. This interpretation is influenced by social factors, particularly patriarchal power structures. Today, reproductive justice and a woman's pursuit of liberty– her freedom, equality, and autonomy –remain inferior to a man's. Through a historical comparative content analysis of Roe v. Wade (with reference to Planned Parenthood v. Casey) and Dobbs v. Jackson, I examine the discourse of arguments and logic used to persuade the Supreme Court Justices of the United States (SCOTUS) in their rulings on abortion. I argue that the Dobbs decision was shaped not just by legal reasoning but by the political, religious, and philosophical biases of the Court– despite justices swearing an oath to administer impartial justice. It is crucial to understand the social forces shaping these decisions to better comprehend the autopoietic relationship between law and society. For the sake of effective action in the fight for a woman's liberty, it is imperative to recognize how the law is being used to push history backward, legally positioning women as second-class citizens.

McKayla Dasha Sarmiento

Human Biology/Public Health, ERC

Mentored By Nancy Binkin

Making Ends Meet: How UC San Diego Students Pay for their Education and Overcome Financial Gaps

Introduction: While financial aid packages provide grants and scholarships, they often include loans. To learn more about student loan attitudes and practices, we conducted a survey to assess the number of students who were offered and who accepted loans, anticipated total debt, the extent to which the loans alleviate financial insecurity, and concerns about their impact.

Materials and Methods: In February 2025, a multi-purpose Qualtrics survey that included a debt module was administered to undergraduate Public Health and Economics students at UCSD. EpiInfo 7.2.6 was used to calculate frequencies and prevalence rate ratios.

Results: The response rate was 80%. Of the 774 respondents, 440 (57%) received a financial aid package, of whom 35% were offered Federal loans. Of those offered loans, 74% accepted. Forty percent of students with loans believed they will accumulate loan debts greater than $20,000 by graduation. Despite the additional funds that loans provide, students with loans were still 1.3 times more likely to face financial difficulties than students with other forms of financial aid (53% vs. 41%; $p < 0.01$). Common reasons among respondents for rejecting loans are fear of accruing debt (27%) and insufficient knowledge of student loans (14%).

Discussion: Many students rely on loans to meet rising attendance costs, although students are reluctant to take out loans, and current loans are not adequate to prevent financial insecurity. To ensure student needs are met, additional aid and resources on loan repayment and long-term financial wellness should be implemented.

Jessica Sauceda

Clinical Psychology, Muir

Mentored By Charles Taylor

Does a Positive Mindset Predict the Treatment Process for Depressed or Anxious Populations?

Individuals with anxiety and depression face challenges with fully engaging in therapy, potentially limiting treatment effectiveness. Past research identifies three treatment process factors predictive of treatment response: outcome expectancies (belief in treatment helpfulness), working alliance (patient-therapist bond strength), and homework compliance (engagement in assigned treatment exercises). Little is known, however, about what influences these treatment process factors, hindering optimal therapeutic benefits. This study examines whether a positive mindset can predict outcome expectancies, working alliance, and homework compliance during psychotherapy in adults with anxiety or depression. Using pre-collected data from 109 treatment-seeking individuals with clinically elevated anxiety or depression, positive mindset was assessed through a composite score of pre-treatment measures: positive affect (Positive and Negative Affect Schedule), tendency to approach positive or rewarding stimuli or contexts

(Approach-Avoidance Temperament Questionnaire), and resilience, or ability to adapt and thrive when confronted with adversity and challenges (Connor-Davidson Resilience Scale). Treatment process factors were measured using patients' Credibility/Expectancy Questionnaire, assessed after the presentation of treatment rationale; Homework Rating Scale-II, completed at the beginning of each treatment session; and Working Alliance Inventory-Short Revised, completed following session 3. Preliminary analyses indicated that a positive mindset is significantly correlated with participants' outcomes expectancies ($r(102)= .263$, $p= .007$) and homework compliance ($r(98)= .351$, $p < .001$), but not session 3 working alliance ratings ($r(91)= -.001$, $p= .989$). These findings provide further insight into how a positive mindset may enhance therapy outcomes and aim to contribute to developing more effective therapeutic interventions for depressed or anxious populations.

Kelsey Schilling

Clinical Psychology, ERC

Mentored By Dr. Victoria Merritt

Traumatic Brain Injury, Environmental Exposures, and Subjective Cognition in Post-9/11 Veterans Enrolled in the VA Million Veteran Program

Due to proprietary information, this abstract has been redacted.

John Schwarz-torres

Human Biology, Warren

Mentored By WIlliam Pelham III

Expectation Violation, Learning via Punishment, and Parental Discipline

This paper concerns an apparent paradox in punishment learning. On the one hand, the basic science of learning asserts that punishments have larger effects when they are surprising - that is, they violate the organism's expectations. On the other hand, the applied science of parental discipline asserts that punishments have larger effects when they are consistent - that is, the child knows what is coming and has their expectations confirmed. To resolve this apparent paradox, we show that when discipline scholars use the word "consistency," they are often actually referring to the probability of punishment occurring, not its consistency. In fact, the probability of punishment and its consistency are dissociable: punishment schedules can be devised that are (a) high-probability, low-consistency or (b) low-probability, high-consistency. The upshot is that in the urge to be "consistent" with parental discipline, we may be forgoing opportunities to use surprise (i.e., expectation violation) that the basic science of punishment learning says would increase the efficacy of punishments. We sketch how an element of surprise might be integrated into parental discipline plans and how critical experiments could test its impact.

Nina Sediki

Mechanical Engineering, Warren

Mentored By Tania Morimoto

HaptOGrasp: A Soft Haptic Origami Grasper for Rendering Grip Force Feedback

Most commercially available haptic interfaces lack grip force feedback, which can hinder users' ability to properly judge the amount of force applied to virtual or remote objects. Recent work has explored the creation of grip force feedback devices that operate using electromechanical actuators. However, the reliance on motors and rigid components tend to result in bulky or heavy devices. In this work, we present the Haptic Origami Grasper (HaptOGrasp)– a novel lightweight, origami haptic grasper that renders kinesthetic grip force feedback via pneumatic actuation. The actuator takes the form of the Yoshimura origami pattern, which allows for linear expansion and compression. At varying grasp widths, air pressure is adjusted to reliably render between 0 N to 8 N of force to mimic normal forces felt when grasping objects. We conducted a preliminary user study, in which participants used HaptOGrasp to grip a virtual object with a specified level of force, demonstrating the potential of the device to help with telemanipulation tasks requiring specific target forces during grasping.

Sarah Segall

Psychology, B.S., Revelle

Mentored By Gail Heyman

Developing Best Practices for AI Use in Education

As high school students and teachers navigate AI tools in their classrooms, it is important to understand the learning dynamics that shape their AI uses. This study uses an interactive learning theory (Chi & Wylie, 2014) to understand how students and teachers learn and engage with AI tools. This research covers how students and teachers currently use generative AI, their attitudes about appropriate use, how they share AI knowledge with peers, and the benefits and challenges they have faced. This ongoing study includes interviews and surveys with high school students and teachers from diverse socioeconomic backgrounds. The analysis will include descriptive statistics and natural language processing to identify patterns.

Pilot interviews (n=19) show students primarily use AI for brainstorming and structuring essays but avoid it for math and science subjects. Some teachers are starting to include AI literacy in their curricula, while some do not mention AI in their classes. Without AI literacy education, students may develop overconfidence in AI detection, revealing the need for critical evaluation skills. Both groups remain uncertain about appropriate AI use.

These findings reveal that students are actively learning through AI interactions, but there is no systematic approach across classrooms. Schools can shape guidelines around student and teacher engagement with generative AI to strengthen metacognitive awareness, digital literacy, and critical thinking skills. The interview and survey results will inform upcoming classroom experiments comparing AI-integrated lessons with traditional instruction to determine the most effective strategies for student learning.

Cadence Seymour

Molecular Synthesis, Sixth

Mentored By Eniko Sajti

Neonatal hyperoxia exposure derails the normal development and the physiological aging of the lung

Background: Premature infants often develop life-long health issues, particularly those with bronchopulmonary dysplasia (BPD), who are at risk for chronic respiratory dysfunction. Disrupted organ development and accelerated decline in function contribute to these complications. Neonatal hyperoxia plays a key role in BPD pathogenesis, yet the mechanisms driving long-term lung dysfunction remain unclear.

Methods: Newborn C57BL/6 mice were exposed to 75% oxygen for 2 weeks, followed by recovery in room air. Lungs were analyzed at 2 weeks, 8 weeks, 6 months, and 18 months. Alveolar simplification was assessed via mean linear intercept (MLI) scoring, and gene expression changes were examined using RNA sequencing.

Results: Neonatal hyperoxia led to persistent lung structural changes, with an initial increase in MLI. While MLI improved at later time points, hyperoxia-exposed mice continued to show significant differences from controls. Transcriptomic analysis revealed age-specific hyperoxia-induced gene expression changes. In young mice, hyperoxia upregulated apoptosis-related genes, while in older mice, vascular smooth muscle and extracellular matrix genes were altered. Notably, aging-induced gene programs were disrupted, with enhanced Nakba signaling and inflammation in hyperoxia-exposed aging lungs. Immunofluorescent staining of the lungs from young mice, shows that neonatal hyperoxia results in increased apoptosis in both alveolar type 2 cells and immune cells.

Conclusion: Neonatal hyperoxia has lasting effects on lung structure and gene expression, altering normal aging processes. Suppression of vascular development genes suggests long-term vascular impairment. Heightened inflammation in ageing hyperoxia-exposed mice underscores the need for targeted therapies to mitigate long-term complications of BPD.

Shivani Sharma

Human Developmental Sciences, ERC

Mentored By Cheryl Anderson

Behaviors and Perceptions of Mental Health Among South Asian College Students

In South Asian culture, the topic of mental health is extremely stigmatized. For young adults who are susceptible to facing various obstacles that impact their mental well-being, it is important to examine the cultural factors that contribute to the stigma surrounding this topic. Delving into the behaviors and perceptions of South Asian college students uncovers the multitude of intertwined influences that impact the development of one's mental health. This study aims to answer the question, "What are the behaviors and perceptions surrounding mental health for UC San Diego students who are South Asian?" An online survey was implemented to collect data from 148 South Asian students at UC San Diego, introducing a mixed-method design to draw findings. The results revealed that mental well-being is significantly shaped by the interaction of sociocultural factors, such as family dynamics and pressures, experiences of stereotyping, comfortability with discussing mental health, and expectations surrounding sexuality and gender identity. These findings bring awareness to the significant stigma surrounding mental health topics in South Asian culture and reflect the interventions needed to destigmatize this topic. This study sheds light on the cultural stigma that this community faces, presenting the critical need for strategies to create safe environments for South Asian young adults to express their mental well-being.

Risha Sharma

Human Biology, Muir

Mentored By Maripat Corr

Sex Differences in a Murine Model of Arthritis

Due to proprietary information, this abstract has been redacted.

Nishant Sharma

Bioengineering: Biotechnology, Revelle

Mentored By Geoffrey Chang

UnaG Protein-based ligand-gated fluorescent system for small molecule biosensing

This research project aims to engineer UnaG, a ligand-gated fluorescent protein isolated from freshwater eel, into biosensors for small molecule detection. Wild-type UnaG naturally fluoresces upon binding with bilirubin at 488nm excitation. Through targeted, site-directed mutations of key active site residues, we hypothesize it can be modified to fluoresce when binding with other, distinct, small molecules.

A class of small molecules of interest are cannabinoids, which have a strong potential for treating pain, obesity, and other diseases. Extracting them in large quantities is costly, and labor-intensive. Recently, a

pair of marine bacterial Berberine-bridge-like (BBE-like) enzymes were discovered to be capable of producing the products CBCA, CBDA, and THCA. These bacterial enzymes share similarities with synthase enzymes found in the plant Cannabis sativa.

By co-expressing these engineered UnaG variants with bacterial BBE-like enzymes (which produce cannabinoids similar to Cannabis sativa) in E. coli, we can develop a high-throughput screening system for cannabinoid production. This approach creates an optical selection workflow where cells producing enzyme variants with higher cannabinoid yields exhibit stronger fluorescence and can be rapidly isolated. The system would enable the screening of trillions of enzyme variants daily, dramatically outpacing conventional methods like gas chromatography. Such technology could revolutionize the biotechnology sphere by developing a functional screening process for trillions of random enzyme variants per day, rather than a few dozen a month.

Alina Siddiqui

Neurobiology, Revelle

Mentored By Timothy Gentner

The Role of Motor-Auditory Communication in Vocal Flexibility Differences Across Songbird Species

Vocal flexibility – the ability to modify, combine, and learn new vocal expressions – is an ability that few species possess. It has been theorized to depend on bi-directional interactions between auditory sensory and motor brain regions. Humans and European starlings display this ability in speech and song, respectively. In songbirds, there are natural variations in vocal flexibility between species. Zebra finches are closed-ended vocal learners; they learn their song as juveniles, after which they lose all vocal flexibility. Previous studies have found an auditory-motor projection from auditory center NCM to pre-motor nucleus HVC in zebra finches that exists during the developmental phase, but fades after this period. The disappearance of this auditory-motor projection coincides with the loss of vocal flexibility in finches. European starlings are open-ended learners, possessing lifelong vocal flexibility. We hypothesized that starlings possess a persistent bi-directional projection between NCM and HVC, allowing them to maintain vocal flexibility. To determine if projections exist between these two areas, we injected retrograde tracers into neurons in HVC and NCM of adult European starlings. Information transfer between auditory and motor brain regions in adult starlings may explain how some species maintain vocal flexibility, while others do not. This study provides insights into neural mechanisms that arise from functional connectivity between auditory and motor areas to govern vocal flexibility, a key element of human speech and language.

Pranav Singh

Data Science, ERC

Mentored By Andrea Chiba

Using LLMs for Audio Analysis

Audio predictive analysis using machine learning has advanced significantly over the past decade, driven by improvements in signal processing techniques and the growth of audio datasets. Recent models such as OpenAI's Whisper have substantially outperformed previous approaches across multiple benchmarks, including word error rate and multilingual comprehension. Despite these advances, many state-of-the-art models are optimized specifically for Automatic Speech Recognition (ASR) rather than broader acoustic analysis.

Our research investigates the encoder component of OpenAI's Whisper model to determine whether its tensor outputs effectively represent fundamental acoustic features such as formants and harmonic-to-noise ratio. We compare these representations against both traditional signal processing techniques and alternative models like Google's Phonetisaurus.

By examining the Whisper encoder's vector outputs through targeted classification tasks, we aim to uncover correlations between specific outputs and the acoustic properties of their corresponding audio samples. This approach enables us to gain insights into the interpretability of this typically black-box model component while evaluating its potential for specialized audio analysis applications.

The broader outcomes of this research are to assess the Whisper encoder's capability for acoustic feature representation and to evaluate its applicability to specialized audio analysis tasks, including stress detection and phonetic analysis for identifying speech delays in children. Our findings may reveal how encoder architectures can generate acoustic features with richer contextual information than traditional signal processing methods alone.

Jose Enrique Siono Gutierrez

Electrical Engineering, Marshall

Mentored By Karcher William Morris

Enhancing Music Education with the Fourier Transform: Mapping Sound into Color Patterns

This research examines how audio signals can be converted into dynamic LED displays through the application of the Fourier Transform. It analyzes voice inputs by breaking them down into frequency components, which are mapped to specific colors to create a visual sound representation. The project uses the DOIT ESP32 DEVKIT V1 board with the latest FFT libraries in Arduino to record audio signals.

This creates an inclusion for visual learners and other individuals that have different styles of learning. As a result, it can become possible to understand musical concepts through colors. This approach offers an alternative for learners who find conventional music notation and audio-based methods challenging.

The preliminary work has enhanced frequency-to-color mappings and created a reliable system for signal acquisition and processing. Future work includes focus on settings optimization for various voice types, together with game development that enables users to learn a piece or music theory concepts

through their voice and color feedback. The project showcases an innovative blend of digital signal processing with interactive visual displays which creates opportunities for new applications in artistic and educational fields.

Venkataram Sivaram

Computer Science, Warren

Mentored By Ravi Ramamoorthi

Projective Shape Metamorphosis Using Optimal Transport

We explore the use of optimal transport theory for inverse rendering of mesh-based geometry. Existing gradient-based methods from differentiable rendering literature can often recover mesh-based geometry successfully. However, the efficacy of these methods typically falls behind our perceptive expectations due to their local nature. We demonstrate that this can be improved by taking a global approach guided by optimal transport.

Grace Smith

Media, Muir

Mentored By DINO DINCO

Mending Distance

Due to proprietary information, this abstract has been redacted.

Ginger Smith

Computer Science, ERC

Mentored By Gerald Soosairaj

Retention of Women in Computing at UCSD

At UCSD, women make up 49% of STEM majors, but only about 28% of Computer Science majors. This reflects demographics in computing roles, where women make up around 27% of employees. Research on women in computing focuses broadly on two areas: recruitment and retention. Much of past research on retention asks why women leave computer science, or ‘leak’ out of the STEM ‘pipeline’, rather than why they stay in the field. We interviewed 10 third and fourth year undergraduate women from six majors: Computer Science, Computer Engineering, Data Science, Cognitive Science, Interdisciplinary Computing and the Arts (ICAM), and Math Computer Science. The goal was to

understand why they persisted in their major thus far. Three students felt they mostly belonged in their major, and 7 said they fully belonged, noting gender, race, and age as parts of their identity that influenced their answer. The experience that most impacted their development in their major varied, including research, jobs, group projects, and real world connections with school. Students felt they had access to enough resources, if they sought them out. We can use their stories to help understand interventions that have been successful, and improve institutional practices, culture, and CS education to retain women.

Gabriel Soberón Nelson

Music and Theatre, Revelle

Mentored By Karola Obermüller

Universal Aesthetics Theorem

Due to proprietary information, this abstract has been redacted.

Katharine Sohn

General Biology, Revelle

Mentored By Ellen Breen

GGTA1 gene inactivation in mice: Effects on running endurance and muscle strength

A major question of human evolution is how we evolved to become more proficient long-distance runners than our primate ancestors. The cytidine monophospho-N-acetylneuraminic acid hydroxylase (CMAH) gene was inactivated in hominids ~ 2-3 Million years ago (Mya), and the GGTA1 gene, encoding α1–3-galactosyltransferase (α1–3GT), was inactivated at an earlier time during evolution in Old World Monkeys. Our experiments are designed to elucidate the role of these two glycan modifying genes in endurance exercise capacity. To test this hypothesis, skeletal muscle oxygen delivery and utilization parameters were evaluated in mice with the combined deletion of these two genes (aGal/Cmah-/-), deletion of only the Cmah gene (Cmah-/-) or WT (C57Bl6N). Forced treadmill testing showed increased endurance running times for aGal/Cmah-/- and Cmah-/- mice compared to WT in male mice ($p=0.002$). For female mice only aGal/CMAH -/- ran for longer times than the Cmah-/- mice ($p=0.005$). In ex vivo muscle contractile function tests, average maximal force was significantly lower in male aGal/Cmah-/- soleus muscles than Cmah-/- ($p=0.02$). No significant differences in average maximal force were detected in female soleus from the different genotypes ($p=0.31$). Ex vivo fatigue tests did not reveal differences between genotypes for soleus isolated from male ($p=0.61$) and female ($p=0.49$) mice. Further testing will be done to examine capillary number and in situ fatigue resistance in the gastrocnemius complex between these genotypes.

Emma Starkey

Communication, Revelle

Mentored By Elana Zilberg

The Ecology of Aid at Whiskey 8 and the Border Security Industrial Complex: Documenting Human Rights Violations and the Humanitarian Aid Response by American Friends Service Committee (AFSC) at the US-Mexico Tijuana River Valley Open-Air Detention Sites

This study investigates the creation of sites along the US-Mexico border known as Open Air Detention Sites. These sites began in early 2023, where migrants were held in outdoor prisons between the primary and secondary walls for days at a time, without food, water, bathrooms, or access to any form of shelter. After the community recognized this injustice, humanitarian aid organizations stepped in, specifically the American Friends Service Committee (AFSC), to provide basic needs to people migrating while they were detained in these spaces. Over the next two years, AFSC has supplied round-the-clock aid and documented the human rights violations constantly taking place in these spaces. In this research, I trace the creation of these spaces as a product of the increasingly neoliberal policies being implemented and as an outcome of the anti-immigrant sentiment in the US. I discuss the impacts and growth of the Border Security Industrial Complex and the effects of privatization on the process, highlighting state violence, Border Patrol aggression, and the effects on migrants through the lens of a volunteer within these spaces. I emphasize the importance of community organizing and the impact of humanitarian aid work on the lives of people within these spaces. Additionally, I discuss the network of aid within San Diego and the growth of the care economy surrounding migrant communities. Finally, I reflect on the importance of building community and documenting these abuses.

Colin Stengle

NanoEngineering, Warren

Mentored By Tod Pascal

All-atom MD simulations to model the stress-strain response, degree of crystallinity, and thermomechanical properties of biodegradable, bioderived thermoplastic polyurethane polymers.

The importance of true sustainability and biodegradability has never been clearer, as the production and consumption of plastic products increase while microplastics proliferate in the environment. Developing bioderived and biodegradable polymers is crucial in supplanting the status-quo of petroleum derived plastics. This study investigates the thermomechanical properties of four bioderived and biodegradable thermoplastic polyurethanes, by combining all-atom molecular dynamics simulations and post processing, with the aim of reproducing experimentally determined properties. We characterize the crystallinity, phase separation, and stress-strain response of our molecular models of these bioderived TPUs, and present a workflow that can be implemented to characterize the thermomechanical properties of other polymer chains. All-atom molecular dynamics are performed in LAMMPS to equilibrate TPU

chains. After this, we calculated the structure factor, order parameters, radial distribution functions, and correlation functions of the simulated TPU chains to quantify the crystallinity and phase separation and compare to experimental results. Finally, steered molecular dynamics is performed using LAMMPS to retrieve the stress-strain curves for these TPUs. The data is then extrapolated and compared with known experimental results. By reproducing experimental results, this model can be extended to predict the thermomechanical properties of other polymers of a similar class.

Connor Stratman

Physics, ERC

Mentored By Tongyan Lin

Daily modulation of low-energy nuclear recoils from sub-GeV dark matter

At sufficiently low nuclear recoil energy, the scattering of dark matter (DM) in crystals gives rise to single phonon and multiphonon excitations. In anisotropic crystals, the scattering rate into phonons modulates over each sidereal day as the crystal rotates with respect to the DM wind. This gives a potential avenue for directional detection of DM. The daily modulation for single phonons has previously been calculated. Here we calculate the daily modulation for multiphonon excitations from DM in the mass range 1 MeV–1 GeV. We generalize previous multiphonon calculations, which made an isotropic approximation, and implement results in the DarkELF package. We find daily modulation rates up to 1–10 percent for an Al2O3 target and DM mass below 30 MeV, depending on the recoil energies probed. We obtain similar results for SiC, while modulation in Si, GaAs and SiO2 is negligible.

Alanna Sun

Human Biology, Marshall

Mentored By Jessica Wang-Rodriguez

The Effects of Hypertension Drugs on Alzheimer's Disease Incidence and Progression

Alzheimer's disease (AD) is the seventh leading cause of death, with over 6.7 million cases, in the United States. AD, the most common form of dementia, is a brain disorder that is characterized by cognitive decline and memory loss. Diabetes, obesity, high cholesterol levels, and hypertension are all prevalent risk factors amongst AD cases and especially known to accelerate cognitive decline. Previous research has demonstrated associations between antihypertensive drugs, such as diuretics, ACE inhibitors, and Angiotensin II Receptor Blockers (ARBs), with a lower risk of AD. It has been suggested that these drugs may play a role in preventing deteriorating cognitive function and interrupt inflammatory pathways in AD. The use of type 2 diabetes medication has demonstrated a reduction in dementia, including AD. Statin treatments were also found to improve cognition for AD patients. Overall, these findings were limited to smaller cohorts, thus limiting the understanding of the influence

of drug efficacy on treating risk factors and influence on AD incidence and progression across larger, more diverse populations. This study examines the relationship between various drug efficacy of treating risk factors and AD incidence and progression. We plan to analyze data from 393,596 participants in the All of Us Research Program, and compare AD incidence between individuals taking risk factor treatment drugs and the general population. Ultimately, this study will contribute valuable insights to the understanding of preventative care for AD.

Alana Tamayo

Biochemistry, ERC

Mentored By Paula Aristizabal

Depression and anxiety in adolescents and young adults newly diagnosed with cancer; Prevalence and screening

Alana Tamayo[1,2] ; Kayleigh Kornher, MPH[3] ; Paula Aristizabal, MD, MAS[2, 4, 5, 6, 7]

Adolescents and young adults (AYA) with cancer face significant psychological challenges, yet research on prevalence and screening remains limited.

We assessed prevalence of depression and anxiety in AYAs diagnosed with cancer at Rady Children's Hospital San Diego (RCHSD) and investigated the performance of the Patient Health Questionnaire-PHQ9.

AYA (ages 13-21) with cancer diagnosed between February 2021 and December 2023 at RCHSD completed the Beck Youth Inventories (BYI) for Anxiety and Depression and the PHQ-9. Sociodemographic factors were measured via questionnaire. Associations were measured using Fisher's Exact, Mann-Whitney U, correlation, and logistical regression tests.

Among 39 AYAs, 10 (25.6%) had elevated anxiety and 8 (20.5%) depression scores. Correlation between PHQ9 and depression and suicidal ideation were rho=0.24, p=0.15; and rho = -0.06, p=0.70, respectively. Sociodemographic factors were not significantly associated with elevated anxiety or depression scores. In multivariable analysis, increased anxiety and severity were associated with household income below the mean, and household material hardship (OR=10.6, p=-0.019, and OR=7.0, p=0.032, respectively).

We found increased prevalence of anxiety and depression in AYA with cancer at RCHSD and significant associations with income and hardship. PHQ9 did not correlate with depression and suicidal ideation, suggesting underperformance in this population. Our findings underscore the need for targeted mental health screening and support in AYA with cancer.

Lauren Taylor

Literatures in English, Revelle

Mentored By Andrea Mendoza

Permeating Racial Boundaries: The Multiracial's Deconstruction of Colonial Racialization Via the Third Space

In this thesis, I analyze the work of Nina Mingya Powles through a critical mixed race lens. Powles is a multiracial author and poet who writes about her experiences navigating multiracial girlhood as she travels to and lives in various locations tied to her heritages. Focusing on Powles's use of water imagery, I examine how both her prose (Small Bodies of Water) and poetry (Magnolia) illustrate the multiracial body's fluid nature. I argue that the multiracial body is a fluid entity that permeates racial boundaries via its occupation of peripheries, allowing it to exist beyond the rigid classification of colonial racial categories. Through this occupation, multiraciality exists in and moves through the contested in-between space, deconstructing socially constructed categories of identity that dictate power hierarchies within the colonial framework. Although multiracial fluidity serves as a site of colonial deconstruction, I also argue that this mutability leaves the multiracial body vulnerable to external racial exploitation. I term this multiracial malleability, theorizing that the multiracial body's racial ambiguity is a source of manipulation on both an individual and institutional level. I argue that this malleability may be the root of multiracial fetishization, as it allows external forces to shape the multiracial body into the desired racial entity. In my theory, the multiracial mythic serves as an embodiment of both multiracial fluidity and malleability by occupying the borders between concretely defined entities, therefore existing within the in-between and blurring discrete categories of identity.

Caroline Terry

Communication, Seventh

Mentored By Elana Zilberg

A Garden in the Desert: The Influence of Collective Memory on Japanese American Identity and Environmental Placemaking at the Manzanar National Historic Site

Scholars have seen the WWII incarceration of Japanese Americans as a marked example of environmental injustice. During the enforcement of WWII incarceration, however, Japanese Americans participated in environmental placemaking, strategically altering and improving the landscapes to better support their community. In the desert environment of the Manzanar camp, incarcerated Japanese Americans created community gardens and constructed a baseball field in acts of placemaking. This study seeks to understand how and why Japanese Americans during incarceration sought particular methods of environmental placemaking in Manzanar, and how these events influence the collective memory of the Japanese American community today. Furthermore, this paper investigates how the Japanese American community in California engages with Manzanar as a site of environmental placemaking today.

Sivagunalan Thamilarasan

Bioengineering, Seventh

Mentored By Bernhard Palsson

A Machine Learning Model of Bacterial Translation Efficiency from DNA Sequence for Protein Production Applications

Our project addresses the challenges of predicting translation efficiency (TE) in E. Coli, a critical factor in protein synthesis for biotechnology and pharmaceutical development. Despite extensive research, the mechanisms regulating TE are complex and remain incompletely understood, making optimization of protein production difficult.

We developed and evaluated different machine learning models to predict TE based on multiple factors, including mRNA transcript features, tRNA availability, and codon usage. Using Elastic Net Cross-Validation as our final approach, we integrated features such as the Codon Adaptation Index, tRNA Adaptation Index, and many others. We systematically evaluated the importance and effect of our feature set through iterative research and testing to improve model performance.

The result shows our model achieved an R2 value of 0.35 with a mean squared error of 0.06. Key factors influencing TE included TAI, MFE, and many other factors. Correlation analyses using Pearson, Spearman, and Kendall methods, along with Shapley values, helped identify feature importance.

We conclude that TE is regulated by a combination of interacting factors rather than a single primary mechanism. While our model demonstrated predictive power, the R2 value suggests further improvements.

Further directions include refinding features to better capture TE-affecting factors, obtaining higher quality TE datasets with less noise, and exploring non-linear models that better represent the complex biological interactions. These can potentially enhance the predictive power of our model and potentially make it applicable to more diverse organisms, ultimately contributing to more efficient protein production.

Ashley Thorshov

Physics w/Specializ Mtrls Phys, Seventh

Mentored By Alex Frañó

Fabricating and Characterizing Hybrid Thin-Film Magnet-Superconductor Patterned Nanowires

The integration of superconducting materials into logic and memory devices has the potential to significantly enhance the field of quantum computing. Topologically superconducting states are ideal for such applications due to their robust and stable nature in the presence of environmental perturbations.

This talk will introduce the physics of topological superconductors and Majorana bound modes before exploring a UC San Diego based project focused on the fabrication and characterization of hybrid thin-film magnet-superconductor patterned nanowires to explore tunable superconducting phases. By systematically varying magnetic material composition, film thickness, and nanowire dimensions, this work aims to elucidate the role of magnetic spin structures in stabilizing superconducting states. Device characterization will include transport measurements to assess superconducting properties, and will likely be further supported by synchrotron-based x-ray and neutron scattering techniques.

Praharshitha Thumati

Biochemistry, Muir

Mentored By J. Andrew McCammon

Using Computational tools to find more optimized drug candidates to treat TB

Mycobacterium tuberculosis (Mtb), the bacteria that causes tuberculosis (TB), is estimated to affect a quarter of the world's population and kills more than a million people per year. The current treatments for TB can take six months or longer. Computational tools can optimize and discover drugs, which can lead to a more efficient and faster cure. Cytochrome bd, which is an oxidase found in the electron transport chain (ETC) of Mtb, is a drug target that will be the focus of this project. Previous research on this project has discovered three drug candidates that inhibit the function of cytochrome bd, which would in effect kill the bacteria. Over the summer, I will be running Molecular Dynamic (MD) simulations on the new drug candidates that were tested experimentally by our collaborators. From these MD simulations, we can determine the potential of the various ligands as TB drugs, optimize the binding by adding customized top-hit fragments, and potentially find a better cure for TB.

Marissa Todesco

Cognitive and Behavioral Neuroscience, Revelle

Mentored By Timothy Gentner

The Role of Motor-Auditory Communication in Vocal Flexibility Differences Across Songbird Species

Vocal flexibility – the ability to modify, combine, and learn new vocal expressions – is an ability that few species possess. It has been theorized to depend on bi-directional interactions between auditory sensory and motor brain regions. Humans and European starlings display this ability in speech and song, respectively. In songbirds, there are natural variations in vocal flexibility between species. Zebra finches are closed-ended vocal learners; they learn their song as juveniles, after which they lose all vocal flexibility. Previous studies have found an auditory-motor projection from auditory center NCM to pre-motor nucleus HVC in zebra finches that exists during the developmental phase, but fades after this period. The disappearance of this auditory-motor projection coincides with the loss of vocal flexibility in

finches. European starlings are open-ended learners, possessing lifelong vocal flexibility. We hypothesized that starlings possess a persistent bi-directional projection between NCM and HVC, allowing them to maintain vocal flexibility. To determine if projections exist between these two areas, we injected retrograde tracers into neurons in HVC and NCM of adult European starlings. Information transfer between auditory and motor brain regions in adult starlings may explain how some species maintain vocal flexibility, while others do not. This study provides insights into neural mechanisms that arise from functional connectivity between auditory and motor areas to govern vocal flexibility, a key element of human speech and language.

Gio Torres

Aerospace Engineering, Marshall

Mentored By Michael Tolley

Design of a Waterproof Enclosure for an Untethered Underwater Soft Robot

Soft robots are highly flexible, deformable robotic systems made from compliant materials, unlike traditional rigid robots constructed from metal and hard plastics. Their inherent flexibility and deformability allow for safer and more gentle interactions with delicate marine ecosystems, making soft robotics particularly beneficial for underwater exploration tasks. Despite these advantages, underwater soft robotics faces significant challenges, particularly related to sealing and waterproofing for long-term operation at greater depths. This research presents the iterative design process of a waterproof enclosure for an untethered underwater soft robot, aimed at reliably protecting sensitive onboard electronics from water ingress. The study examines the effectiveness of various gasket materials (NBR versus Viton), gasket cross-sectional designs (O-ring versus X-ring), enclosure modifications through 3D printing, and cable penetration techniques. Additionally, an epoxy layer was applied to reinforce internal surfaces to further enhance sealing performance under high pressures. Testing conducted at depths of up to 0.7 meters for durations of up to 30 minutes resulted in a face-seal compression ratio of 28% and achieved an IPX7 waterproof rating. This research contributes towards scalable and reliable waterproofing strategies, supporting the advancement of underwater operation for deep-sea exploration, inspection, and autonomous marine applications.

Jarvis Tran

Urban Studies and Planning, Seventh

Mentored By Amy Lerner

Something's Wrong with the Neighborhood: The Implications of Urban Planning and Design on Resident Socialization in the North University Neighborhood

Urban theorists, observers, and planners have long explored what defines a successful and vibrant city. Today, the dominant urban planning and design paradigm suggests that compact cities, characterized by the combination of high density, mixed land uses, and public transit, facilitates the creation of successful urban places which produce tangible and intangible benefits for residents. Notably, compact urban neighborhoods have the potential to promote community socialization and the formation of social ties. This project utilizes a mixed-methods approach combining a survey questionnaire with open-ended resident interviews to conduct a case study of North University, a dense residential neighborhood in San Diego directly adjacent to the University of California, San Diego. This study examines the impact of the neighborhood's urban planning and design on resident socialization, focusing specifically on "third spaces", community places in cities which provide the setting for socialization, and comparing the differences in socialization between student and non-student residents. Findings reveal that the dense residential nature of North University hinders resident socialization. Third spaces are crucial for community social activity but are lacking in terms of quantity and quality in North University. Unique from non-student residents, student residents are more likely to socialize within the neighborhood because of their existing connection to UCSD's campus, which forms the basis of their social networks. This project builds on work studying the characteristics of a successful and social city and identifies potential weaknesses of dense residential neighborhoods without mixed land uses.

Connie Tran

Bioengineering: Biotechnology, Marshall

Mentored By Dr. Elizabeth Winzeler

Malaria Drug Discovery Pipeline

Malaria remains a major global health threat, causing over 500,000 deaths annually. The emergence of drug-resistant malaria strains underscores the urgent need for novel antimalarials with new molecular targets. To address this, an efficient drug development pipeline has been established. Large compound libraries are screened for liver- and blood-stage activity, followed by IC_{50} determination and toxicity profiling against human cells. Promising candidates are then subjected to resistance generation assays to identify molecular targets and guide optimization strategies. However, inducing resistance can be challenging, often requiring multiple approaches. Currently, lead compounds LG-0020561, MMV665941, and MMV1805007-06 have successfully progressed through early screening and are in the resistance generation phase, where their effects on malaria parasites are being systematically explored. These efforts aim to develop effective next-generation antimalarials to combat resistance and improve malaria treatment.

Nhi Tran

Human Biology, Warren

Mentored By Marygorret Obonyo

Expression of Type I Interferon-Stimulated Genes in Gastric Cancer Patients in San Diego County

Gastric cancer is one of the most lethal and difficult malignancies to treat, with chronic Helicobacter pylori (H. pylori) infection as its primary risk factor. To investigate its progression, we established a Helicobacter-induced rapid disease progression model.

Using this gastric cancer mouse model, we performed RNA-sequencing on mouse gastric tissue, revealing that a majority of the upregulated genes (by volcano plot) were type I interferon (IFN-I)-stimulated genes (ISGs). As ISGs haven't been previously linked to Helicobacter-induced gastric cancer, we first reanalyzed a publicly available human gastric transcriptomic dataset from H. pylori-infected patients with atrophic gastritis. Then, to further connect these findings, we created heat maps of these upregulated ISGs and compared them with a previously published dataset of another cancer type. The overlap in ISG expression trends supports a potential link between ISGs and gastric cancer progression.

Our research aims to investigate the presence of key overexpressed ISGs in gastric cancer patients. We obtained gastric biopsy samples from the UCSD Moores Cancer Center Biorepository, primarily sourced from local San Diego County communities, and performed qRT-PCR on patient tissue samples to quantify the significance of ISG expression in gastric cancer.

Our qRT-PCR results indicate that specific ISGs are consistently upregulated in both our mouse model and patient datasets. Future research will determine whether specific targeted ISGs are either drivers of gastric cancer progression or indicators of gastric cancer presence. Understanding the role of these overexpressed ISGs is crucial in finding breakthroughs for future therapeutics to treat gastric cancer.

Julie Tran

General Biology, Revelle

Mentored By Erika Cyphert

Validating a reproducible in-vitro microbiome culture for high throughput drug screening

Pathogens can significantly disrupt the natural balance of the gut microbiome and can lead to antibiotic resistance, which is a major gut health issue. Microbial derived metabolites can directly influence bacterial physiology and metabolism and have been shown to impact antibiotic resistance by influencing interspecies competition. Stool-derived in-vitro cultures (SICs) are a useful method to analyze how the gut microbiome responds to novel therapies (such as microbial metabolites) in a cost-effective and high-throughput manner. The main objective of this study is to validate a stable stool-derived in-vitro microbiome platform that is controllable and reproducible for high-throughput drug screening. Along with the creation of a pseudo-gut microbiome using brain heart infusion (BHI) media, fresh stool samples from healthy C57BL/6 mice serve as a template for how microbial communities flourish in a controlled environment. To validate this model, fecal pellets were collected from C57Bl/6 mice with an unaltered microbiome, transferred to anaerobic conditions, and cultured in BHI media over 72 hours per passage. Following each 72 hour passage, the optical density (OD) was measured to quantify microbial

growth relative to blank media controls. OD measurements revealed consistent and reproducible growth across passages of replicates. Additional culture optimization experiments are ongoing to validate the replicability of future experimental results and to establish an SIC platform for microbiome communities that are disrupted with antibiotics. Development of a reproducible SIC model can improve understanding of how pathogens evolve and build resistance in complex microbial consortia.

Kayanne Tran

Data Science, Marshall

Mentored By Monique Smith

Social Behavior Dynamics Following Food Deprivation in Mice

This research project aims to investigate the impact of food deprivation on social interaction using mouse models. We will employ pose estimation machine learning algorithms (SLEAP) to analyze kinematic differences between mice in pain and 'bystander' mice as well as food deprived and fed bystander mice. Additionally, we will focus on sex differences within these conditions. Our primary analytical tools will include SLEAP and Key Point MoSeq to capture and interpret movement patterns.

Carter Tran

Data Science, Math-Economics, Sixth

Mentored By Dr. Hoameng Ung

Fine-Tuning NeuroGPT for EEG-Based Real-Time Seizure Detection

Electroencephalography (EEG) is a test for diagnosing and monitoring neurological disorders, including epilepsy. Recent advances in deep learning have enabled transformer-based models to achieve sophisticated performance in sequence modeling tasks. In this study, we fine-tune NeuroGPT, a foundational transformer model trained on large-scale EEG datasets, for real-time seizure detection. We aim to improve the model’s sensitivity in identifying seizure onset while minimizing latency, thereby facilitating clinical applications.

To achieve this, we employ a labeled dataset of EEG recordings from epilepsy patients at UC San Diego (UCSD) and apply transfer learning techniques to adapt NeuroGPT for seizure detection. Fine-tuning is performed using a combination of supervised learning and self-supervised pretraining, leveraging domain-specific augmentations and temporal attention mechanisms to improve feature extraction. Model performance will be evaluated on a held-out test set and benchmarked against conventional deep learning baselines, including convolutional (CNNs) and recurrent neural networks (RNNs).

A key focus of our ongoing work is the reduction of false positive rates, which remains a significant challenge in real-time seizure detection. NeuroGPT is being trained on EEG data collected from the

UCSD Health Epilepsy Monitoring Unit (EMU) and Intensive Care Unit (ICU) to ensure adaptability to the target patient population. By consolidating our approach into a replicable pipeline, we aim to create a framework for seizure detection that can be deployed across other clinical settings. Future research will focus on refining model generalizability, incorporating uncertainty estimation, and exploring model compression techniques for efficient real-time clinical deployment.

Sophia Trujillo

Molecular and Cell Biology, Seventh

Mentored By Dr. Jill Wildonger

Investigating the Effects of Microtubule Acetylation on Neuronal Development and Behavior in Drosophila Melanogaster

Microtubules are a fundamental part of the cytoskeleton that shapes cell structure, organization, intracellular transport, and development. Microtubules consist of alpha- and beta-tubulin dimers, which attach together to form a tubular structure. The dynamic nature of microtubules directly affects the structure of developing neurons and their ability to function properly. The stability and dynamics of microtubules can be regulated by post-translational modifications, such as acetylation. Multiple conserved lysine (K) residues in alpha-tubulin are acetylated, but the significance of acetylation at many of these sites is still unknown. We mutated three of these sites in alpha-tubulin (K326, K370, K401) to prevent their acetylation and assayed for effects on microtubule stability, neuromuscular junction development, and larval crawling. We found that mutagenesis of K326 decreases microtubule stability, reduces the number of boutons at the neuromuscular junction, and disrupts larval locomotion. In contrast, mutagenesis of K370 or K401 did not affect microtubule stability, although neuromuscular junction development was perturbed. Our data suggest that K326, and potentially its acetylation, plays a role in regulating the stability and dynamics of the microtubule cytoskeleton in a way that impacts the development and function of the neuromuscular junction.

Alexis Truman

Cognitive & Behavioral Neuroscience, ERC

Mentored By Anne Beatty-Martínez

Social Networks as a Measure of Bilingual Language Experience

This study investigates how personal social networks shape language use patterns among Spanish-English bilinguals in San Diego, California. Utilizing egocentric network analysis, I examine the relationship between network structure, language communities, and bilingual language behaviors, particularly code-switching. While traditional approaches to measuring bilingual experience rely on generalized self-report measures that fail to capture contextual dynamics, our methodology applies

network science metrics to quantify the intricate interpersonal relationships that influence language use. I hypothesize that bilinguals with more Spanish speakers in their social networks will display higher Spanish proficiency, while bilinguals who serve as crucial bridges between language communities will demonstrate more frequent Spanish usage and code-switching. I further postulate that language use will vary systematically across communicative contexts and interpersonal relationships, with heritage speakers using more English in formal domains with less emotionally close individuals and more Spanish in informal settings with more emotional closeness between individuals. Through contextualized instruments paired with objective measures of proficiency, this research aims to characterize the dynamic sociolinguistic experiences of Spanish heritage speakers at UC San Diego. By understanding these patterns, we can better support heritage language maintenance across generations in linguistically diverse communities.

Ruby Tseng

Neurobiology, Muir

Mentored By Kay Tye

Neuromodulated mixture of experts: A prefrontal cortex inspired architecture for lifelong learning.

Due to proprietary information, this abstract has been redacted.

Rebecca Tseng

Bioinformatics, Seventh

Mentored By Kyle Gaulton

Determining the role of pancreatic beta cell stress responses in type 1 diabetes

Pancreatic beta cell death is central to the development of type 1 diabetes (T1D), and the response of beta cells to external exposures and stress is a key factor in beta cell death and the progression of T1D. However, the specific stressors that drive T1D in beta cells, and the gene regulatory programs that respond to these stressors, are not well understood. Therefore, we aimed to fill this knowledge gap by exposing the pancreatic beta cell line EndoC-βH1 in vitro to a panel of eight different stressors and performing ATAC-seq and RNA-seq assays. We conducted differential gene expression and chromatin accessibility analysis to investigate responses to each exposure and performed pathway enrichment analysis on stress-responsive genes and candidate cis-regulatory elements (cCREs). There were highly specific genomic responses of beta cells to different stressors, such as interferon signaling and IRF factors in proinflammatory cytokine exposure and unfolded protein response and ATF factors in ER stress exposure. We then leveraged genome-wide association study (GWAS) data for T1D to understand the role of beta cell stress responses in T1D risk, which revealed enrichment of T1D risk in pathways that respond to specific cytokines. Overall, we defined stress responses in beta cells which revealed

highly distinct responses to different stressors and revealed responses that likely play a role in risk of developing T1D.

Julianna Vega Perez

Biochemistry, Revelle

Mentored By Eric Bennett

RIOK3 Ubiquitin Binding Capacity is Necessary for 40S Ribosomal Subunit Degradation

Amino acid starvation or large ribosomal subunit (60S) biogenesis disruption activates the initiation ribosome-associated quality control (iRQC) pathway, in which RNF10 ubiquitylates the small ribosomal subunit (40S) proteins uS3 and uS5, leading to the degradation of the entire 40S. Recent research in our lab has implicated RIOK3 as a critical factor in this process. While complete RIOK3 knockout (KO) blocks 40S degradation, rescue with a mutant RIOK3 lacking its N-terminal region fails to degrade the 40s. Sequence conservation and AlphaFold structural predictions suggest that the N-terminal region of RIOK3 contains two putative ubiquitin-binding MIU domains. To investigate their role in 40S degradation, we mutated key hydrophobic residues within the predicted binding sites to polar residues: A44 and L47 in MIU-1, and L80, A81, and L84 in MIU-2. We expressed MIU-1, MIU-2, and MIU-1-2 mutant variants of RIOK3 as rescue constructs in RIOK3 KO cells. Cells were then treated with siRNA targeting the 60S biogenesis factor GTPBP4 to activate iRQC, followed by whole-cell proteomics to assess 40S degradation. Our results indicate that mutations in MIU-2 led to the most significant reduction in 40S degradation, suggesting that MIU-2 is critical for RIOK3-mediated ribosome quality control.

Marcus Velasquez

Aerospace Engineering, Muir

Mentored By Olivia Graeve

Immobilization of laccases on CuO and ZnO nanoparticles and their dye degradation applications

Laccases are enzymes capable of oxidizing a large variety of organic compounds, including textile dyes, making them suitable for bioremediation of industrial wastewater. However, their low stability hinders their use in real industrial conditions. One method to address this shortcoming is by immobilizing the laccase onto a substrate such as metallic nanoparticles. In this study, we immobilized Coriolopsis gallica laccases on CuO nanoparticles and ZnO nanoparticles by covalent attachment. The activity of the immobilized laccase on the nanoparticles was measured using UV-Vis spectroscopy. The results demonstrate an increase in the catalytic activity of immobilized laccase compared to free laccase.

Kenneth Visk

Bioengineering: Biotechnology, Marshall

Mentored By Kiana Aran

Microfluidic Device for Erythrocyte Analysis

Erythrocytes(Red Blood Cells) are characterised by unique physical properties determining their deformability and membrane properties, which can be associated with physiological and pathological conditions of the donor. Traditional methods of assessing red blood cell biophysical and membrane properties are lengthy, labor-intensive, or require expensive equipment. An emerging technique in single cell analysis of red blood cells involves the use of microchannel constrictions to squeeze a red blood cell while using optical and electrical measurements to gather information about the properties of the cell. We propose a microfluidic device using electrical impedance spectroscopy(EIS) to determine both the amount of time a red blood cell spends in transit through microfluidic construction and the total impedance amplitude measured with the red blood cell in the constriction. These values will yield information relevant to the state of an individual's red blood cells and provide valuable insights into characterizing differences in red blood cell's biophysical properties.

Siddharth Vyasabattu

Data Science, Sixth

Mentored By Seana Coulson

Mind the Formants: Decoding Accents from Brainwaves

Accents in English, whether local or foreign, are often characterized by systematic deviations in phonetic features, particularly in formant frequencies—the resonant frequencies shaped by the vocal tract. These acoustic variations influence speech perception in native listeners, raising questions about their neural representation. In this study, we investigate whether EEG signals can be used to reconstruct formant frequencies of accented speech using Temporal Response Function (TRF) analysis. EEG data were collected from native American English speakers as they listened to speech from local and foreign accented speakers. By applying TRF modeling, we analyze how neural activity tracks the spectral properties of speech and whether formant representations differ based on accent. Our findings aim to reveal the neural correlates of phonetic variation and contribute to understanding how the brain processes accented speech. This research has broader implications for cognitive linguistics and applications in speech recognition and assistive communication technologies.

Angela Wang

Biochemistry, Revelle

Mentored By Xi Fang

The role of AGK in the heart and cardiomyopathy

Sengers syndrome is an autosomal recessive mitochondrial disease that causes death from heart failure and/or cardiac arrest. Over 85% of Sengers syndrome patients are diagnosed with congenital heart defects (CHD) with symptoms including hypertrophic cardiomyopathy (HCM) (the most common form), dilated cardiomyopathy (DCM), left ventricular non-compaction (LVNC), and electrocardiographic (ECG) abnormalities at infant stages, and die by three years of age. Mutations resulting in complete or partial loss of function in the acylglycerol kinase (AGK) gene cause Sengers syndrome. Thus far, there is no curative therapy for CHD in Sengers syndrome and its molecular pathology remains largely unknown. Moreover, the requirement for the kinase activity of AGK in maintaining normal cardiac structure and function has yet to be determined. To address these questions, we have successfully generated Agk global knockout (gKO) mice and Agk kinase-inactive (KI) mutants. Our preliminary data revealed that Agk gKO mice displayed sudden death beginning at postnatal day (P) 45, with no gKO mice surviving beyond P63. In contrast, Agk KI mutants survive to at least 2 months of age. Interestingly, in the cardiomyocyte-specific knockout (cKO) we generated, we observed a sex difference in the phenotype of mice beyond P45. This study will investigate the detailed molecular mechanism in which kinase-independent and kinase-dependent roles of AGK and how impaired aspects of AGK function lead to cardiac defects by histological, physiological, biochemical, and molecular analyses of Agk gKO and KI mice.

Linda Wei

Molecular and Cell Biology, Muir

Mentored By Trey Ideker

The Effects of Integrin Knockouts in 2D vs. 3D Environments

This year, there have been over 2 million cancer diagnoses and over 600,000 cancer deaths in the United States. This alarming statistic highlights the need for novel therapeutic approaches which target cancer in order to induce cell death. One interesting target is integrins, a family of transmembrane receptors which can help mediate interactions between the tumor cell and the extracellular matrix (ECM) to stimulate shape, motility, growth, and survival.

Previously, it has been shown that CRISPR Cas9-knockout of integrins can induce cell death in some cancer models. In my studies, I have found that the knockout of Integrin Alpha V or Integrin Beta 5 in pancreatic cell lines prevents growth, but not in others like colorectal cell lines. This data suggests discrepancies of how cancer cells use integrins for survival. However, these experiments were done in 2D culture conditions which do not accurately represent normal physiological conditions perhaps confounding our data.

Integrin function is linked to their binding to ECM components such as collagen, fibronectin, laminin, or other cells. These effects are not well captured in 2D conditions in which a cell is only exposed to ECM on one side. Therefore, I investigated the importance of integrins to cancer cell growth when grown in 3D ECM environments, specifically Collagen I, and compared these results to 2D growth conditions. By understanding the impact of integrin knockouts in 3D environments, we can more accurately determine how integrins control cancer cell survival.

Zach Weiner

Biophysics, Eighth

Mentored By Andrea Chiba

No Free Lunch: A Proposition to Revitalize Audio-Centric Machine Learning with Classical Mathematical Methods

Stress in vocal communication has been a central topic of research for decades. Yet, complexities in measuring stress, individual variability, immature technology, and contextual factors have limited our understanding of the relationships between stress and human speech. Our research explores the relationship between acoustic features of human speech and allostatic load— stress expressed through tension throughout the nervous system. We apply mathematical signal processing methods to parse out these acoustic features and compare them with physiological data that are conventional biomarkers of stress (e.g., galvanic skin response, heart rate variability).

Nowadays, mapping the relationship between human speech and other phenomena has lost touch with the classical mathematics of signal processing, relying instead on over-simplistic mathematical models (i.e. linear mixed models) or large language models (i.e. Open AI's Whisper) which are missing key features to properly understand the audio.

By leveraging and studying Praat's (an audio processing program widely used in academia) classical signal processing tools through Python-based implementations, we analyze speech using metrics such as formants, fundamental frequency (F0), harmonic-to-noise ratio (HNR), jitter, and shimmer. These acoustic features provide a nuanced understanding of voice and better equip systems (a large language model for example) to understand speech. The overall desired outcome of this research is to revitalize modern machine learning with classical signal processing to explore a potential non-invasive and accessible method of measuring allostatic load in children– with measuring children (specifically) being an underrepresented research topic.

Danielle Wiedefeld

Psychology, Marshall

Mentored By Dr. Leslie Carver

Exploring Stimulus Preceding Negativity in Anticipation of Social vs. Non-Social Stimuli in Neurotypical and ASD Toddlers

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by difficulties in social communication and repetitive behaviors, though its underlying causes remain unclear. One prominent theory, the Social Motivation Hypothesis (SMH), suggests that these challenges stem from an inherent lack of social motivation (Chevallier et al., 2012). Examining the validity of SMH could help unify the field and provide more effective interventions for children. While SMH has been studied through behavioral measures, few studies have examined anticipatory neural responses in ASD. This study aims to address this gap by exploring how neurotypical toddlers and those with ASD (ages 3–4) anticipate social versus nonsocial stimuli. We used Electroencephalogram (EEG) to measure Stimulus Preceding Negativity (SPN), an Event-Related Potential (ERP) linked to the anticipation of rewards, to compare brain responses between the two groups. We hypothesized that neurotypical children would exhibit a larger (more negative) SPN in response to social stimuli compared to children with ASD. By comparing SPN responses between toddlers with and without ASD, this study provides insight into the neural mechanisms underlying social motivation, potentially informing early intervention strategies.

Madison Wong

General Biology, Marshall

Mentored By Maripat Corr

Symptom severity monitoring by unprovoked behavioral testing in a murine model of arthritis

Due to proprietary information, this abstract has been redacted.

Katelyn Wong

Mathematics and Economics, ERC

Mentored By Prof. Hidalgo-Gonzalez

Optimizing Electricity Tariff Structures to Minimize Market Inefficiencies and Promote Equity and Sustainability

Due to proprietary information, this abstract has been redacted.

Anica Xie

Art History, ERC

Mentored By William Tronzo

Medieval to Contemporary: Economics and Participatory Spectatorship

Fragmentation, despite being relatively invisible to the naked eye, exists with significance as a primeval mechanism that society uses to traverse and define the world. It is reflected in art history through four binaries: Paganism/Christianity, object/body, ancient/medieval, and collection/display. This research explores collection/display by drawing connections to Chapter 6 “The Circulation of Medieval Relics” in Patrick Geary’s Sacred Commodities, comparing the economic context and symbolism of medieval relics with contemporary installation. Despite deriving from separate histories–with modernity gravitating towards more secular, universal messages–both echo the other through parallels. Each functions as a participatory exhibition which connects the mind and spirit to otherwise intangible higher ideals through object presentation. Relics of the past emotionally connected with pilgrims through the saint archetypes of the martyr and confessor, two categories still followed by contemporary artists to forward revolutions or promote camaraderie amongst viewers. The participatory presentation of symbolic object-art in contemporary installation and medieval relics, in the broader scheme of economics, indicates links between spirituality and commodity exchange, where the soul and personal bonds are manufactured by value-based transactions. These similarities between medieval and present are significant because they have only recently emerged from the hegemony of encyclopedic museums like the Victoria and Albert Museum, institutions that display a breadth of spolia by piling them into nameless conglomerates, illustrating national power while negating the individual experience of each object’s identity both culturally and spiritually. This regression, thus, is indicative of an active anti-colonial shift in the art world.

Sophia Xie

General Biology, Muir

Mentored By Jing Yang

The Role of TPM2 in Matrix Stiffness-Driven EMT and Metastasis in Breast Cancer

Breast tumors are often detected by their hardness, resulting from increased extracellular matrix (ECM) deposition and remodeling, creating a fibrotic microenvironment. This stiffness is associated with poor prognosis, metastasis, and reduced survival. Tropomyosins (TPMs), particularly TPM2, are actin filament-binding proteins expressed in breast epithelial cells and linked to transformation. This research aims to elucidate how TPM2 senses ECM rigidity and influences invasion and metastasis in breast cancer. To investigate TPM2's role in breast cancer, a 3D culture system mimicking the breast tissue microenvironment will be used. Breast cancer cells with varied TPM2 expression will be cultured on hydrogels with different stiffness levels. In vivo studies will involve orthotopic injections of GFP labeled MCF10DCIS cells into immunodeficient NSG mice to observe tumor growth and metastasis. Preliminary results indicate that TPMpm2 knockdown significantly increases matrix stiffness-driven EMT and invasion in 3D culture. The in vivo results also show that TPM2 knockdown promotes tumor growth and metastasis. The results suggest that TPM2 plays a crucial role in breast cancer metastasis

through sensing matrix stiffness. Understanding this mechanism can lead to targeted interventions and the development of anti-metastasis treatments, improving survival rates in cancer patients. Future research will focus on validating these findings and exploring therapeutic applications.

Connie Xie

Clinical Psychology and Cognitive Behavioral Neuroscience, Marshall

Mentored By Dawn M. Schiehser

Automated Mild Cognitive Impairment Detection (MCI-PDx) in patients with Parkinson's Disease

Diagnosis of Mild Cognitive Impairments (MCIs) in Parkinson's Disease (PD) for research purposes typically requires clinical expertise by licensed professionals , which can be time-consuming, resource-intensive, and not always available. To streamline this process, various auto-diagnostic tools have been developed. Of importance is the use of machine learning for cognitive assessment analysis, natural language processing to detect speech and language impairments associated with cognitive decline, and signal processing to extract notable features from voice recordings. However, despite these advancements, existing models often require prior technical expertise, and have rigid data input requirements, which limit their usability.

MCI-PD Classifier (MCI-PDx) has been created as a beginner-friendly, customizable, open source tool (i.e., code and website) to facilitate the automated diagnosis of Normal Cognition vs. MCI in individuals with PD. The algorithm follows the Litvan et al. (2012) Movement Disorder Society criteria for PD-MCI, which delineated diagnostic criteria that includes a subjective complaint of cognitive decline, impairment on at least two neuropsychological assessments, and an absence of significant functional decline. In addition to general MCI diagnosis, a subclassification of amnestic (impairment in the memory domain) and non-amnestic has been created alongside an experimental feature for the diagnosis of Parkinson's Disease-associated dementia (PD-D).

MCI-PDx is currently undergoing validation for accuracy, reliability, and customizability using two clinician-diagnosed MCI datasets (n = 181; n = 145). Unlike existing classification models, MCI-PDx was designed as a customizable tool for quick and flexible MCI assessment to bridge the gap between machine learning advancements and real-world usability.

Emily Xie

Mathematics-Computer Science, Sixth

Mentored By Hoameng Ung

Fine-Tuning NeuroGPT for EEG-Based Real-Time Seizure Detection

Electroencephalography (EEG) is a test for diagnosing and monitoring neurological disorders, including epilepsy. Recent advances in deep learning have enabled transformer-based models to achieve sophisticated performance in sequence modeling tasks. In this study, we fine-tune NeuroGPT, a foundational transformer model trained on large-scale EEG datasets, for real-time seizure detection. We aim to improve the model's sensitivity in identifying seizure onset while minimizing latency, thereby facilitating clinical applications.

To achieve this, we employ a labeled dataset of EEG recordings from epilepsy patients at UC San Diego (UCSD) and apply transfer learning techniques to adapt NeuroGPT for seizure detection. Fine-tuning is performed using a combination of supervised learning and self-supervised pretraining, leveraging domain-specific augmentations and temporal attention mechanisms to improve feature extraction. Model performance will be evaluated on a held-out test set and benchmarked against conventional deep learning baselines, including convolutional (CNNs) and recurrent neural networks (RNNs).

A key focus of our ongoing work is the reduction of false positive rates, which remains a significant challenge in real-time seizure detection. NeuroGPT is being trained on EEG data collected from the UCSD Health Epilepsy Monitoring Unit (EMU) and Intensive Care Unit (ICU) to ensure adaptability to the target patient population. By consolidating our approach into a replicable pipeline, we aim to create a framework for seizure detection that can be deployed across other clinical settings. Future research will focus on refining model generalizability, incorporating uncertainty estimation, and exploring model compression techniques for efficient real-time clinical deployment.

Nomy Xin

Molecular and Cell Biology, Seventh

Mentored By Weg Ongkeko

Evaluation of Alcohol, Tobacco, and HPV's Synergistic regulation of HNSCC's Potential Treatment Response to PD-L1 Checkpoint Inhibitor Treatment

Due to proprietary information, this abstract has been redacted.

Henry Xu

Data Science, Marshall

Mentored By Lily Weng

Building Faithful and Interpretable Deep Neural Network models

Concept Bottleneck Models (CBMs) enhance model interpretability by having an intermediate Concept Bottleneck Layer (CBL) with neurons correspond to human-understandable concepts. However, existing CBMs still fall short in that the concept neurons fail to predict concepts accurately or are fitted to the

class instead of the actual concept, raising faithfulness concerns. Motivated by these limitations, we propose a novel Faithful CBM framework to ensure accurate and faithful concept prediction. First, we measure the faithfulness of concept neurons by aligning visually grounded concept annotations with saliency maps from attribution methods. Second, we refine the concept set to be standardized and comprehensive. Lastly, we fine-tune the CBM with saliency loss to enable faithful concept prediction. Extensive evaluations across three standard benchmarks show that our method significantly improves the model's spatial faithfulness while maintaining comparable accuracy.

Jiawei Yao

Public Health - Biostatistics, Marshall

Mentored By Nancy Binkin

Financial Literacy among UCSD Undergraduates

Introduction: Financial literacy (FL) is crucial for college students, who often lack skills to manage their financial resources and avoid serious debt and other financial pitfalls. Little is known about financial literacy among UCSD undergraduates. We therefore conducted a survey to examine rates and risk factors for low FL and student interest in improving their FL skills.

Methods: In February 2025, UCSD undergraduates enrolled in selected Public Health and Economics classes completed a Qualtrics questionnaire that included FL questions. We used EpiInfo 7.2.6 to calculate frequencies of perceived FL, interest in FL topics, and preferred modalities for learning. Prevalence rate ratios (PRR) were calculated to examine sociodemographic risk factors for low FL. Students were assigned FL scores based on self-reported knowledge of budgeting, savings, credit, and student loans; low FL was defined as < 9 points on an 18 point scale.

Results: The response rate was 80%. Of the 775 respondents, 33% met the definition of low FL. Factors associated with low FL included being female (PRR = 2.2), a public health student (PRR = 2.11), Hispanic/Latino (PRR = 1.3), and lower family income (PRR = 2.3). All associations were statistically significant ($p < 0.01$). Families were the main source of FL knowledge (75%), and 78% of students were interested in learning more, especially about financial goals and credit, preferably through online modules, elective courses, and one-on-one counseling.

Discussion: FL among UCSD undergraduates is low, but interest in learning more is high. UCSD should consider implementing a multiple-format program to maximize engagement and participation.

Nitya Yerabandi

Human Biology, Muir

Mentored By Lars Bode

Exploring the Functional Diversity of the Yanomami Gut Microbiome through HMO and Bile Acid Metabolism

The modern diet, high in fat and low in fiber, along with a sedentary lifestyle have been linked to gut dysbiosis. Conversely, the Yanomami people of the Amazon practice a traditional subsistence lifestyle, including a high-fiber, low-fat diet, hunter-gatherer lifestyle, and prolonged breastfeeding, which may shape their gut microbiome through extended exposure to human milk oligosaccharides (HMOs). Studying the Yanomami gut microbiome offers valuable insight into the functional profile of the gut prior to diet and lifestyle modernization. Growth assays were performed on fecal bacterial strains from five Yanomami adults under no treatment, pooled HMOs (pHMOs), bile acid, or pHMOs+bile acid. Cell-free spent media from pHMOs and pHMOs+bile acid conditions were analyzed by High Performance Liquid Chromatography (HPLC) to determine HMO utilization profiles. Results indicated that several species beyond the Bifidobacterium and Bacteroides genera thrived in pHMO-rich environments by hydrolyzing HMOs. Despite the known antimicrobial properties of bile acids, several isolates demonstrated optimal growth in their presence and many tolerated bile-induced stress, indicating microbial resilience or evolutionary adaptations to bile acid detoxification. Some species that preferred pHMOs+bile acid over pHMOs lacked significant differences between their two HMO degradation profiles, implying that growth is enhanced by a pathway independent of HMO catabolism. Comparison with published data revealed that HMO profiles of select species from Yanomami adults resembled those of healthy, post-weaned children in industrialized regions. This study demonstrates that gut microbes from Yanomami adults retain HMO degradation abilities and maintain functional diversity levels similar to those of children closer to weaning.

Ray Yin

Psychology, Sixth

Mentored By William E. Pelham III.

Intervening to Address Discouragement and Dropout in Therapy: An Application to Behavioral Parent Training

Though BPT is a well-established and efficacious treatment for children with disruptive behavioral disorders, engagement is a pervasive barrier: 13% of enrolled parents prematurely terminate treatment, and only 48% of between-session homework is completed (Chako et al., 2016). Why do parents become disengaged from therapy, and how can we increase treatment adherence? I posit that disengagement, and thus premature termination, stems from 6 core cognitions. To address these cognitions, I developed an intervention framework and a manualized treatment for addressing therapeutic discouragement and treatment disengagement, focused specifically on parents enrolled in Behavioral Parent Training (BPT). The intervention is designed to be administered within-session, minimizing the impact discouragement has upon the course of BPT. I will also address practical issues regarding intervention implementation, such as how it may be structured around individual or group therapy, when it should be triggered or discontinued, and how overlapping cognitions should be addressed.

Ray Yin

Psychology, Sixth

Mentored By Adena Schachner

Laptops are for Learning, Tablets are for Fun: Children's Information Seeking Relates to Belief in Distinct Device Functions

How do children seek information from digital devices? We test the hypothesis that children view laptops as more trustworthy information sources than tablets and believe these devices have distinct functions (laptops for learning; tablets for entertainment). In a preregistered experiment, N=60 6-7-year-old children were presented with a laptop and tablet and asked which device the experimenter should use to answer an esoteric question; which device was more for learning/fun; and which device they typically used at school/home. Children reliably chose to seek information from the laptop over the tablet, and reported differing functions for the devices, identifying laptops as for learning, and tablets as for fun. Children's experience aligned with this pattern, reporting laptop use at school, and tablet use at home. Young school-age children prefer laptops over tablets as information sources and believe these devices have distinct functions, potentially impacting children's learning from digital devices. In our second experiment, we explore how these findings affect real-world learning and imitation outcomes.

Matthew Young

Neurobiology, Sixth

Mentored By Gedeon Deak

Impact of Extraneous Motions on Joint Attention Bids in Caregiver-Infant Interactions

Joint attention episodes are significant for early learning as they can help older infants and toddlers associate an adult's attentional focus with informative input (Baldwin, 1991). Caregivers can produce a variety of behavioral cues to attempt to engage in a joint attention episode with their infant towards a shared focal point. These informative behaviors can be multimodal, including visual and auditory stimuli; thus far, in previous video analyses of caregiver-infant interactions, our research team has observed that a common method of joint attention is for the caregiver to use a combination of "gaze" (visual attention-eliciting) and "speech" (verbal attention-eliciting) cues while maintaining a direct pointing motion towards the target. However, our Joint Attention project specifically investigates whether the more infrequent cases of extraneous motion cues, defined as attention-eliciting and directing cues involving repetitive and oscillatory hand movements, may yield a higher rate of success in directing the infants' attention towards the intended target ("hits"). We predict that there will be a positive correlation between extraneous motion cues and the rate of successful joint attention bids between

caregivers and younger infants (i.e. 4-9 months) in naturalistic home environments, and that extraneous stimuli will produce statistically significant increases in “hits” compared to gaze, speech, and point cues.

Zayne Yousef

Neurobiology, Sixth

Mentored By Paula Desplats

Effects of a Circadian-Modulating Intervention in a Parkinson's Disease Mouse Model

Non-motor symptoms are highly prevalent in Lewy Body Diseases (LBD) and are severely debilitating for patients. Cognitive deterioration is the hallmark of Alzheimer’s disease-related dementias (ADRDs) like Parkinson’s disease (PD) dementia and Dementia with Lewy bodies (DLB), which are characterized by alpha-synuclein (αSyn) pathology. Importantly, circadian disruption and sleep alterations are widespread in LBD, but these non-motor features are often undertreated. Research has demonstrated that PD patients exhibit reduced activity amplitude, increased intraday variability, and disrupted rest-activity rhythms. Sleep disorders are pervasive in LBD, including insomnia and excessive daytime sleepiness. Non-motor symptoms can start decades before the onset of movement alterations, implying that the circadian dysfunction associated with these symptoms may be an early pathophysiological event. We have shown that αSyn overexpressing mice (ASO) present age-related decline in daily and circadian rhythms, a progressive phenotype that alters total activity, power, fragmentation, precision of activity onset, and sleep patterns. Using spatial transcriptomics, we uncovered age-associated alterations of clock-regulated transcription in wild-type mice, involving pathways and brain regions directly implicated in LBD pathology. These findings suggest that circadian alterations may increase susceptibility to synucleinopathies. Notably, we have established that circadian-modulating interventions mitigate pathology, increase the clearance of protein aggregates, and improve behavioral outcomes in mouse models of neurodegeneration. Despite the crucial role that circadian regulation may have in LBD, the potential of targeting the clock to modify disease trajectory has not been investigated. The objective of the current proposal is to evaluate the potential of circadian modulation to rescue LDB phenotypes.

Emily Yurkevich

Human Biology, Warren

Mentored By Alain J.-J. Cohen

Sequence 22, Fleeting Feigned Love, to Overall Interpretation of Jean-Luc Godard’s "Le Mépris"

In his 1963 quintessential French New Wave film, "Le Mépris" (Contempt), Jean-Luc Godard subtly communicates the story and character emotions through less conventional methods for the era, contributing to its continued cinematic relevance. Godard engulfs his audience in his filmic world, forcing "Le Mépris" viewers to analyze his characters and anticipate the plot just as his onscreen persona

and other production team members did whilst creating their film, Odysseus. By conducting a sequence-by-sequence breakdown on the entire film, it is evident that Sequence 22, the last “happy” moments of the Javal marriage, is critical to understanding the irreversible deterioration of the relationship between wife Camille Javal (Brigitte Bardot) and husband Paul (Michel Piccoli) featured throughout "Le Mépris". Upon analyzing this sequence shot-by-shot, we see that it can serve as a case study of the technical methods Godard employs to indirectly foreshadow and reveal genuine, unobstructed character desires. Through such review, the importance of Sequence 22 to deeper understanding of "Le Mépris", including the elucidation of true character motivations, and the technical elements utilized throughout the film to convey hidden meaning, are made clear.

Ian Zane

Cognitive Science, Sixth

Mentored By Lara Rangel

Behaviorally Dependent Hippocampal Interneuron Entrainment to Multiple Rhythms

Hippocampal CA1 interneurons crucially engage with and shape local oscillatory activity. Behavioral demands and sensory inputs help to shape local rhythmic dynamics and the recruitment of interneurons into these inhibitory circuits. Using spiking and local field potential collected from rats in a context-dependent odor sampling task, the relative activity of these interneurons to their local circuit dynamics can be analyzed. These interneurons follow predictable patterns of engagement to rhythms based on behavioral context. Additionally, their activity within lower frequency (Theta) oscillations predicts spike timing in and between higher frequency bands (Low and High Gamma). These combined indicate that CA1 interneurons are recruited into stable temporal roles within circuits and that the behavioral and sensory factors alter recruitment, as opposed to altering the role within a circuit.

Carolina Zarate Calleros

General Sociology, Muir

Mentored By Christena Turner

Bridging Restorative Practices and Social-Emotional Learning: Implications for School Climate and Academic Achievement

This study explores how integrating restorative practices and social-emotional learning (SEL) influences school climate and academic achievement in elementary schools. While both restorative practices and SEL have been used to address behavioral and emotional issues, limited studies examine their intersectional impact in early childhood, the foremost foundation in a human being’s development. This research uses a mixed-methods approach, including semi-structured interviews, non-participant observation, and surveys, all informed by symbolic interactionism and professionals from the field of

education such as current faculty. By focusing on one Title I elementary school, Langu Elementary in San Diego, California, which incorporates both restorative practices and SEL, I examine how these approaches shape school climate and academic performance by observing grades K-6. Preliminary findings suggest that the integration of restorative practices and SEL fosters a positive school climate, improves student behavior, and supports academic achievement. SEL, defined as the developmental process through which individuals regulate emotions, set goals, practice empathy, build healthy relationships, and make good decisions (Paolini, 2020), plays a key role in these outcomes. This research contributes to the growing body of evidence showing that academic success is closely linked to social-emotional development. Future research, which I plan to embark upon, should examine how these practices affect diverse school populations and explore longitudinal impacts on academic outcomes and school climate.

Sophie Zhang

ICAM, ERC

Mentored By DINO DINCO

Demonic: A Continuous Archive

Over the course of my life so far, I have been continuously building an archive of characters and worlds of my own invention. Through the whimsical exploration of their mindsets and societies, I generate various art pieces, poetry, and films. My absorption and processing of everyday, literary, and artistic phenomena is compiled into this archive, which I wish to share with the world at large throughout my years as a creator. I hope to generate various communities through different stages of my life where I can share my findings on life and understand a definition of beauty. Thus, my and my characters' collective future holds an ever growing story with infinite potential in its artistic expression holding the culmination of my research and insight.

Daisy Zhang

Sociology, Sixth

Mentored By Mary Blair-Loy

Fantasy as Resistance Chinese Feminism and the Subversive Appeal of the Romance Game Love and Deepspace

Under Chinese state censorship, sexual content catering to women's pleasure and feminist movements are frequently suppressed. The unexpected commercial success of "Love and Deepspace" (LnD), an 18+ Chinese romance game designed for heterosexual women, represents a significant divergence from these censorship practices, attracting a growing feminist player base. While research on romance genres has primarily focused on Western populations, this study examines Chinese feminist players' engagement

with LnD through surveys (N=379), interviews (N=11), and group observation of three players, employing quantitative analysis and content analysis methodologies.

The research demonstrates that LnD offers diverse emotional engagement without demanding excessive investment, while providing a fantasy space where players reimagine and subvert dominant sexual scripts in Chinese culture. The game's technical innovations—including 3D realistic rendering, open narrative structures, transmedia extensions, and flexible gender expressions—create unprecedented possibilities for player agency. Furthermore, players actively extend experiences from the game into their real lives, prolonging the emotional support derived from gameplay.

This thesis argues that LnD creates a virtual space where Chinese feminists use creative engagement, agency, and pleasure to navigate resistance to state control and traditional gender norms. It also raises critical questions about the implications of players blurring boundaries between digital fantasy and lived reality as potential resistance to heteronormative patriarchal relationships in real life.

Louie Zhao

Bioengineering, Marshall

Mentored By Dr. Miguel Lopez-Ramirez

Genetic Regulation of Endothelial KRIT1 Ameliorates Inflammatory Arthritis

Rheumatoid arthritis (RA) is an autoimmune disease causing joint inflammation, pain, and disabilities in 1% of the population. Synovial fibroblast and immune cell activity contribute to cartilage and bone destruction in RA. Vascular permeability and inflammatory crosstalk between the endothelium, fibroblasts, and immune cells play crucial roles in RA progression. Enhancing endothelial function and reducing vascular inflammation may alleviate RA symptoms. Endothelial Krüppel-like factors 4 and 2 (KLF4 and KLF2) are transcription factors essential for vascular barrier integrity and preventing leukocyte adhesion. Genetic inactivation of endothelial Krit1 (Krev1 interaction trapped gene1, also known as CCM1) has been shown to upregulate KLF4 and KLF2. This upregulation increases vasoprotective and anti-inflammatory proteins like endothelial nitric oxide synthase (eNOS) and thrombomodulin (TM). We hypothesize that endothelial Krit1 inactivation, by upregulating KLF2 and KLF4, protects against RA-induced joint inflammation and destruction. To test this, we performed endothelialspecific conditional Krit1 knockout in adult mice and used the K/BxN serum-transfer arthritis model to evaluate protection against synovial inflammation and joint destruction. We assessed arthritis pathology, conducted histological analyses, and performed gene expression studies in endothelial cells. Our experiments aim to elucidate the mechanisms of RA-induced inflammation, generating knowledge to develop innovative therapeutic approaches for inflammatory joint diseases.

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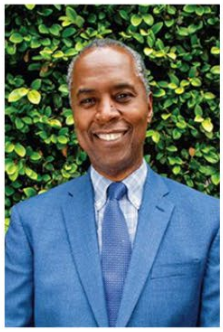

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