



2026

# Undergraduate Research Conference

April 18, 2026



# Contents

<b>Welcome Message .....</b>	<b>2</b>
<b>Conference Schedule .....</b>	<b>3</b>
<b>Panel Presentation Schedule.....</b>	<b>5</b>
<b>Panel Details.....</b>	<b>8</b>
<b>Abstracts.....</b>	<b>56</b>
<b>Undergraduate Research Hub Staff .....</b>	<b>175</b>

# Welcome Message

Welcome to the 39<sup>th</sup> Annual UC San Diego Undergraduate Research Conference.

For almost forty years, the Undergraduate Research Hub has celebrated the exceptional work of our students by inviting faculty to nominate them for presentation at this event. This year, more than 180 undergraduates will share findings from research conducted between summer 2025 and the present quarter, representing every major discipline and a rich diversity of backgrounds and ambitions.

We extend our heartfelt gratitude to the faculty mentors, postdoctoral fellows, graduate students, and all research advisors whose guidance makes these accomplishments possible. This conference would not exist without their dedication.

We also thank our campus leaders—Chancellor Pradeep Khosla, Executive Vice Chancellor Elizabeth Simmons, Vice Chancellor of Organizational Transformation Becky Petitt, Assistant Vice Chancellor of Student Retention and Success Maruth Figueroa, Vice Chancellor of Research and Innovation Corinne Peek-Asa, and many others—whose support fuels undergraduate research at UC San Diego.

Thank you for joining us and supporting the next generation of research scholars at UC San Diego.

# Conference Schedule

8:15 AM - 8:45 AM	Check-in, Attendee Registration, - <i>Breakfast in FC Dining Room</i>
8:45 AM – 9:15 AM	Welcome & Opening Remarks
9:30 AM – 10:30 AM	<a href="#">Session I</a>
10:45 AM – 11:45 AM	<a href="#">Session II</a>
11:45 AM – 1:00 PM	Lunch
1:00 PM – 2:00 PM	<a href="#">Session III</a>
2:15 PM – 3:15 PM	<a href="#">Session IV</a>
3:30 PM – 4:30 PM	<a href="#">Session V</a>
4:30 PM – 5:00 PM	Closing remarks in FC Dining Room - <i>Certificate and conference keepsake distribution</i> - <i>Group photo at Sun God</i>

# Panel Presentation Schedule

## Session I, 9:30 – 10:30 AM

<b>Panel #</b>	<b>Panel Name</b>	<b>Location</b>
1	Education, Learning, & STEM Equity	FC - Cnf 1-3
2	Materials Science: characterization, modeling, & manufacturing	FC - Cnf 4-5
3	Molecular Interactions & Epigenetics	Seuss Library
4	Power in the Story	Atkinson Pavillion
5	Emerging Therapeutics & Pathogen-Specific Discovery	Cecil's Lounge
6	Psychology	Peterson 102
7	Academic Stress, Transparency, & Student Well-being	Peterson 103
8	Enzyme Targeting & Environmental Remediation	Cog Sci Bldg 004
9	Astronomy & Astrophysics I	Cog Sci Bldg 005
10	Neurobiology I – Cellular Models & Genome Regulation	Solis 111

## Session II, 10:45 – 11:45 AM

<b>Panel #</b>	<b>Panel Name</b>	<b>Location</b>
11	Policy, Institutions, & Social Systems	FC - Cnf 1-3
12	Diverse Topics in Engineering	FC - Cnf 4-5
13	Mathematics	Seuss Library
14	EEG Research & Autism	Atkinson Pavillion
15	Immune Modulation & Molecular Tools	Cecil's Lounge
16	Mental Health & Clinical Interventions	Peterson 102
17	Understanding People & Systems	Peterson 103
18	Therapeutic Targeting & Cellular Imaging	Cog Sci Bldg 004
19	Astronomy & Astrophysics II	Cog Sci Bldg 005
20	Neurobiology II – Actin Dynamics & Synaptic Signaling	Solis 111

## Session III, 1:00 – 2:00 PM

<b>Panel #</b>	<b>Panel Name</b>	<b>Location</b>
21	Engineered Interfaces for Targeted Delivery & Stretchable Electronics	FC - Cnf 1-3
22	Information Management & Data Assimilation	FC - Cnf 4-5
23	Feminism, Gender, & Representation	Seuss Library
24	Modern South Asian History	Atkinson Pavillion
25	Genome Engineering & Functional Genomics	Cecil's Lounge
26	Maternal Health & Novel Therapeutics	Peterson 102
27	Applications of Chemistry & Physics	Peterson 103
28	Cognitive Science I	Cog Sci Bldg 004
29	Perception, Learning, & Performance	Cog Sci Bldg 005
30	Antimicrobial Discovery & Therapeutic Delivery	Solis 111

## Session IV, 2:15 – 3:15 PM

<b>Panel #</b>	<b>Panel Name</b>	<b>Location</b>
31	E-Cigarette Exposure & Tumor Plasticity	FC - Cnf 1-3
32	Intersections of Cognitive & Data Sciences	FC - Cnf 4-5
33	Digital Culture, Identity, & Social Media	Seuss Library
34	Health, Environment, & Public Policy	Atkinson Pavillion
35	Social Rank, Signaling & Learning	Cecil's Lounge
36	Cellular Stress & Tissue Remodeling	Peterson 102
37	Neuroscience I -- Stress, Gender, & Behavior	Peterson 103
38	Cognitive Science II	Cog Sci Bldg 004
39	Pediatric Tourette Syndrome & Neurodevelopment Imaging	Cog Sci Bldg 005

## Session V, 3:30 – 4:30 PM

<b>Panel #</b>	<b>Panel Name</b>	<b>Location</b>
40	Genomes & Genetics	FC - Cnf 1-3
41	Computer, Information & Data Sciences	FC - Cnf 4-5
42	Vascular Health & Immune Regulation	Seuss Library
43	Youth, Digital Devices & Parental Monitoring	Atkinson Pavillion
44	Ecology & Behavior	Cecil's Lounge
45	Bio-Imaging & Cellular Mechanics	Peterson 102
46	Neuroscience II – Neuroinflammation & Disease Pathology	Peterson 103
47	Cognitive Science III	Cog Sci Bldg 004
48	Vaccination Strategies & Pediatric Clinical Trial Design	Cog Sci Bldg 005

# Panel Details

## Session I

9:30-10:30 AM

### Panel 1: Education, Learning, & STEM Equity

Room: Faculty Club - Conference Rooms 1-3

Moderator: Dr. Amy Bintliff

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

Mentor: Erika Cyphert

**From Classrooms to Communities: Evaluating Bioengineering Experiments for K-12  
STEM Engagement in San Diego Schools**

**Izabella Vasquez - Neurobiology**

Mentor: Amy Bintliff

**Biology Education and Engagement in East Africa**

**Sam Johnson - Clinical Psychology**

Mentor: Melinda Owens

**Effects of Scientist Identity in Student Responses to Scientist Spotlight Assignments**

**Will Davison - Sociology**

Mentor: Kevin Lewis

**The Democratization of College Knowledge: The Community College Method  
as the Great Equalizer**

## Panel 2: Materials Science: characterization, modeling, & manufacturing

Room: Faculty Club - Conference Rooms 4-5  
Moderator: Luca Hartmann

**Olivia Hawrysh - Mechanical Engineering**

Mentor: Maziar Ghazinejad

**Transfer Learning for Automated Vision-Based Metrology in Additively Manufactured Steels**

**Marc Levy - NanoEngineering**

Mentor: Olivia A. Graeve

**Thermal conductivity of water-based titania nanofluids: Experimental results and modeling framework**

**Alexander Xiong - Chemical engineering**

Mentor: Ping Liu

**Enhancing Reversibility in Aqueous Iron Batteries through Electrolyte Environment Modification**

**Dylan Thomas - Physics**

Mentor: Tenio Popmintchev

**Attosecond-Femtosecond Sensing of Strongly Correlated Electrons in Atomic, Molecular Systems, and Nanomaterials for Quantum and Neuromorphic Computing**

## Panel 3: Molecular Interactions & Epigenetics

Room: Faculty Club - Seuss Library

Moderator: Dr. CJ Litif

**Tonkhla Dankul - Molecular and Cell Biology**

Mentor: Galia Debelouchina

**Characterizing the Interactions between HP1**

**Ellen Wu - Molecular and Cell Biology, Global Health**

Mentor: George Sen

**Epigenetic Rescue of Foxp3 Stability Through HDAC Inhibition in Hnrnpu-Deficient  
Regulatory T Cells**

**Satvik Bandi - Bioengineering: Bioinformatics &**

**Curtis Furukawa - Bioengineering: Biotechnology**

Mentor: Irina Kufareva

**The C-terminal PDZ-binding motif of Cx40 is regulated by phosphorylation and required  
for the formation of functional intercellular channels**

## Panel 4: Power in the Story

Room: Faculty Club - Atkinson Pavillion

Moderator: Carl Schmitz

**Izze Keith-Mahler - Literature/Writing**

Mentor: Ariana Ruíz

**Breaking Writing Norms: Experimental Writing Practices in Bio-Prose and Poetry**

**Aydin Pappas - History**

Mentor: Verónica Martínez-Matsuda

**Indentured Servitude in the 21st Century: An Examination of  
America's J-1 Visa Program**

**Meilani Hollenbeck - History**

Mentor: Verónica Martínez-Matsuda

**“Bridge or Wedge”: Asian Americans and the  
Affirmative Action Debate in Higher Education**

# Panel 5: Emerging Therapeutics & Pathogen-Specific Discovery

Room: Faculty Club - Cecil's Lounge

Moderator: Dr. Elisabet Bjanes

**C.J. Rees - Biochemistry**

Mentor: Elizabeth Villa

**Purification and Mechanistic Characterization of Dual-Activity  
RNase H in a Nucleus-Forming Jumbo Phage**

**Kaia Robinson - Molecular and Cell Biology**

Mentor: Irina Kufareva

**AI-powered discovery, annotation, and deorphanization of G protein-coupled receptors in  
the parasitic flatworm *Schistosoma mansoni***

**Nandhana Nair - Molecular and Cell Biology & Probability and Statistics  
& Arushi Sangal - Human Biology and Public Health (Concentration in Medicine Sciences)**

Mentor: Elisabet Bjanes

**Molecular iodine acts as a non-staining, broad-spectrum antiseptic, providing a new, high-  
performance solution to fight resistant hospital pathogens**

## Panel 6: Psychology

Room: Peterson 102

Moderator: Ms. Leanne Liaw

**Takuya Kitamura - Psychology BS. With Specialization in Cognitive Psychology**

Mentor: John Wixted

**The Independent Source Rule on Trial: Lineups Rewrite the Witness's Memory of the Perpetrator**

**Samantha Clinton - Clinical Psychology**

Mentor: John Wixted

**The Diagnostic Utility of Eyewitness Confidence in the Accuracy of Composite Sketches**

**Selina Wang - Cognitive Science, Joint Math/Economics**

Mentor: John Serences

**Expectation Effects in RNNs: Evidence for Criterion Shifts Over Sensitivity Changes**

## **Panel 7: Academic Stress, Transparency, & Student Well-being**

Room: Peterson 103

Moderator: Professor Philip Roeder

### **Romalyn Escalada - Human Biology**

Mentor: Isabella Maita

**Low Clarity, High Anxiety: Student's Emotional and  
Coping Responses to Classroom Uncertainty**

### **Sara Tan - Human Biology**

Mentor: Isabella Maita

**The Big 5: Focus group interviews with STEM students identify  
5 common academic stressors**

### **Devan Velji - Mathematics & Economics**

Mentor: Aram Grigoryan

**Aftermarket Class Swap System: An Extension Of The TTC Algorithm To University  
Course Enrollment**

### **Amanda Marquez - Sociology: Law and Society**

Mentor: Michel Estefan

**Divorce Stories: The Role of Parental Divorce on College Life**

## Panel 8: Enzyme Targeting & Environmental Remediation

Room: Cognitive Science Building 004

Moderator: Dr. Granton Jindal

**Lauren Kaiser - Microbiology**

Mentor: April Lukowski

**Uncovering Enzymatic Degradation of Toxic Polybrominated Compounds**

**Antonio Puron Guerrero - Molecular & Cell Biology**

Mentor: April Lukowski

**Structural drivers of substrate specificity in aromatic single-component Flavin-Dependent Halogenases.**

**Yuran Choi – Biochemistry  
& Kyle Rich - Biochemistry and Microbiology**

Mentor: Michael Bukart

**Solvatochromic probes capture inter-domain interactions in carrier protein-dependent biosynthesis**

## Panel 9: Astronomy & Astrophysics I

Room: Cognitive Science Building 005

Moderator: Professor Adam Burgasser

### **Jack Green - Astronomy & Astrophysics (B.S.)**

Mentor: Karin Sandstrom

**Mapping the Emission from Aromatic and Aliphatic Hydrocarbons in a Low Metallicity<sup>1</sup>  
Photodissociation Region in the Small Magellanic Cloud**

### **Vivian Liu - Physics**

Mentor: Adam Burgasser

**Near-Infrared Spectral Classifications of Previously Unclassified Nearby Low Mass Stars  
and Brown Dwarfs**

### **Lucas Aldea - Physics specializing in Astrophysics**

Mentor: Griffin Hosseinzadeh

**Verifying Core-Collapse and Shock-Cooling Models through Photometric and  
Spectroscopic Analysis of the Type II SN 2024phv**

### **Julian Jackson - Astronomy and Astrophysics**

Mentor: Adam Burgasser

**Crazy Cool Quasars: An Infrared Spectra Survey of Quasars**

# Panel 10: Neurobiology I – Cellular Models & Genome Regulation

Room: Solis 111

Moderator: Dr Barbara Calabrese

**Aiden Momtaz - Bioengineering: Bioinformatics**

Mentor: Shankar Subramaniam

**Comparison of the development of neural organoids derived from ESCs vs. iPSCs with  
scRNA-seq analysis**

**Nadia Burciu - Human Biology**

Mentor: Xin Jin

**Mapping Structural Alterations in Cortical Neurons from ASD-Risk Genes using Perturb-  
CLEAR**

**Zakir Alibhai - Bioinformatics**

Mentor: Cole Ferguson

**Regulation of chromatin conformation by the histone deubiquitinase BAP1 in the brain**

**Kenton Tsang - Molecular and Cell Biology**

Mentor: Elizabeth Villa

**Identifying Hitchhiking Ribosomes for Cryo-ET Analysis of Translational Regulation**

## Session II

10:45-11:45 AM

### Panel 11: Policy, Institutions, & Social Systems

Room: Faculty Club - Conference Rooms 1-3

Moderator: Dr. Amy Bintliff

#### **Demir Khawaja - International Business**

Mentor: Munseob Lee

#### **Service as Strategy: Conscription, Human Capital, and Civic Development in South Korea and Israel**

#### **Jiaying Liu - Undeclared (Intended to Anthropology)**

Mentor: Saiba Varma

#### **“\$1 = 2 Meals?” NGOs and the Governance of Food Insecurity**

#### **Kristin Antonio - Education Sciences**

Mentor: Amanda Solomon Amorao

#### **“We’re more American than they’ll ever be”: Race, Citizenship, and Patriotism Among San Diego Fil-Ams**

#### **Sharon Kim - Education Science**

Mentor: Amy Bintliff

#### **The Long Road to AP: How EL Designation Shapes Academic Trajectories**

# Panel 12: Diverse Topics in Engineering

Room: Faculty Club - Conference Rooms 4-5

Moderator: Luca Hartmann

**Sebastian Willis Sugiyama - Electrical Engineering**

Mentor: Parinaz Naghizadeh

**Benchmarking Influence for Centrality Measures**

**Sara Wickenhiser - Mechanical Engineering**

Mentor: Michael Yip

**ARCSnake V2: Mechanical Adaptations For An Amphibious Multi-Domain Screw-Propelled Snake-Like Robot**

**Emma Huang - Electrical Engineering**

Mentor: Michael Yip

**Reeling It In: Flexible Needle Pick Up via Thread Manipulation for Autonomous Suturing**

**Thomas Nghiem - Computer Engineering**

Mentor: Yuanyuan Shi

**Experimental Testbed for Building Airflow Control**

## Panel 13: Mathematics

Room: Faculty Club - Seuss Library

Moderator: Ms. Katelyn Lee

### **Michael Hoffman - Mathematics**

Mentor: Aaron Pollack

**Conjecture of Gross - Fourier Coefficients on  $G_2$  and Cubic Twist L-Values Part I**

### **Maya Chang - Mathematics**

Mentor: Aaron Pollack

**Conjecture of Gross - Fourier Coefficients on  $G_2$  and Cubic Twist L-Values Part II**

### **Shiven (Steven) Hu - Applied Mathematics**

Mentor: JiaWang Nie

**A Hybrid Explicit-Implicit Gradient Descent Ascent Framework for Nonconvex-Nonconcave Min-Max Optimization**

## Panel 14: EEG Research & Autism

Room: Faculty Club - Atkinson Pavillion

Moderator: Dr. CJ Litif

**Emma Chen - Cognitive Science MLNC**

Mentor: Virginia de Sa

**EEG Neural Correlates of Attention to Multifinger Vibrotactile Stimuli: A Pilot Study**

**Mac Carroll - Psychology**

Mentor: Leslie Carver

**Implicit Prediction in Autistic Adults**

**Natalie Schafer - Clinical Psychology**

**& Joshua Cervantes - Neurobiology and Clinical Psychology**

Mentor: Leslie Carver

**EEG Signatures of Dynamic Emotional Face Processing in Autism Spectrum Disorder.**

## Panel 15: Immune Modulation & Molecular Tools

Room: Faculty Club - Cecil's Lounge

Moderator: Professor Alexis Komor

**Davi Salles Leite - Bioengineering: Biotechnology**

Mentor: Alexis Komor

**Enhancing Base Editing Efficiency Through Nuclease-Mediated DNA Processing**

**Naomi Hoang - Molecular and Cell Biology**

Mentor: Eduardo Fricovsky

**Inhibition of Lactate Dehydrogenase by Traditional Chinese Medicines (TCM)**

**Michelle Tang - Human Biology  
& Bryan Liao - Molecular and Cell Biology**

Mentor: Miguel Lopez-Ramirez

**Effects of Anti-CD25 Antibody mPC61 on Regulatory T Cell Differentiation**

## Panel 16: Mental Health & Clinical Interventions

Room: Peterson 102

Moderator: Ms. Leanne Liaw

**Faith Chen - Neurobiology**

Mentor: Jyoti Mishra

**Meditative Neurofeedback to Treat Depression**

**Saurabi Sakthivel - Biochemistry**

Mentor: Kevin Kuehn

**A Multi-Dimensional Analysis of Engagement and Patterns of Missing Data in a Personalized Digital Intervention for Suicidal Thoughts and Behaviors**

**Soobin Jones - Cognitive and Behavioral Neuroscience**

Mentor: Lisa Eyler

**Cognitive Subgroups in Bipolar Disorder and Their Distinct Sleep Profiles**

**Crystal Hernandez - Psychology- Specialization in Clinical Psychology**

Mentor: Cindy Chang

**Clinician and Veteran Perspectives on The Role of Trauma in Providing Mental Health Care and Suicide Prevention to LGBTQ+ Veterans at Risk of Suicide**

## Panel 17: Understanding People & Systems

Room: Peterson 103

Moderator: Professor Philip Roeder

**Kira Lavine - Anthropology Archaeology Concentration**

Mentor: Zachary Dunseth

**Camelid Coprolites: Reconstructing Virú Pastoralism through Phytolith Analyses of Chicama Valley Archaeobotanical Taxa**

**Violet Wu - Mathematics-Economics**

Mentor: Lilly Irani

**Investigating Global Think Tank Influence**

**Laura Avila - B.S Psychology with Specialization in Clinical Psychology; B.A. Global Health**

**& Yolanda Yunluan Feng - Neurobiology**

Mentor: Claire Meaders

**How do we achieve agreement? Exploring the purpose of consensus meetings in a classroom observation study**

# Panel 18: Therapeutic Targeting & Cellular Imaging

Room: Cognitive Science Building 004

Moderator: Dr. Granton Jindal

**Ahri Chung - Molecular and Cell Biology**

Mentor: Scott Biering

**Inhibition of dengue virus NS1-induced endothelial barrier disruption and vascular leakage by glycan-targeting antiviral lectins**

**Ajay Ben Tovim - Global Health and Human Biology**

Mentor: Shiri Gur-Cohen

**Investigating the Role of a Pro-lymphangiogenic Cues in Tumor Progression and Metastasis**

**Makenna Holst - Neurobiology**

Mentor: Nathan Shaner

**Developing an improved red fluorescent calcium sensor for cellular imaging**

# Panel 19: Astronomy & Astrophysics II

Room: Cognitive Science Building 005

Moderator: Professor Adam Burgasser

**Arick Collander - Mathematics**

Mentor: Eve Lee

**How the Adiabatic Index Governs the Size and Evolution of Exoplanets**

**Sam Wang - Applied Mathematics**

Mentor: Griffin Hosseinzadeh

**Early Observations and Progenitor Constraints of the Type II Supernova SN 2024pxg**

**Marylin Loritsch - Astronomy & Astrophysics**

Mentor: Adam Burgasser

**Identifying and Characterizing Low-Temperature Stars and Brown Dwarfs in Deep JWST Spectroscopic Surveys**

**Justin Mascari - Physics w/ Specialization in Astrophysics**

Mentor: Karin Sandstrom

**Mapping CO-dark H<sub>2</sub> in Local Group Galaxies**

# Panel 20: Neurobiology II – Actin Dynamics & Synaptic Signaling

Room: Solis 111

Moderator: Dr Barbara Calabrese

## **Yeshi-Wangmu Sherpa - Neurobiology**

Mentor: Shelley Halpain

**Role of CAP in INF2-mediated actin reorganization in neurons exposed to glutamate excitotoxicity**

## **Spencer Parks - Neurobiology**

Mentor: Shelley Halpain

**Characterizing actinification: structural insights into cytoskeletal remodeling and stability induced by glutamate excitotoxicity**

## **Son Dinh - Cognitive Science | Neuroscience**

Mentor: Kim Dore

**Protein kinase C alpha is recruited to dendritic spines in Alzheimer's disease model mice neurons**

## **Samantha Sokolowski - Neurobiology**

Mentor: Christina Sigurdson

**The Role of mGluR5 in Prion Disease Pathology**

# Session III

1:00-2:00 PM

## Panel 21: Engineered Interfaces for Targeted Delivery & Stretchable Electronics

Room: Faculty Club - Conference Rooms 1-3

Moderator: Dr. Darren Casteel

**Allison Woo - Biochemistry**

Mentor: Lalit Deshmukh

**Ubiquitination of HIV-1 p6 Enhances ALIX Recruitment  
via Avidity-Driven Interactions**

**Kit Bailey - Bioengineering**

Mentor: Ester Kwon

**Peptide-Targeted Lipid Nanoparticles for Neuronal Delivery  
following Traumatic Brain Injury**

**Tristan Tjussardi - Electrical Engineering,  
Eric Yi - Electrical Engineering,  
& Joseph Nguyen - Electrical Engineering**

Mentor: Abdoulaye Ndao

**Heterogeneous Modulus Transparent Substrate for Zero Poisson's  
Ratio Stretchable Displays**

# Panel 22: Information Management & Data Assimilation

Room: Faculty Club - Conference Rooms 4-5

Moderator: Luca Hartmann

**Wynn Li - Applied Mathematics**

Mentor: Kathleen Fisch

**A Streamlit-Based Laboratory Information Management System (LIMS) for  
Whole-Genome Sequencing Logging**

**Roshan Sood - Computer Science**

Mentor: Onat Gungor

**EAGER: Edge-Aligned LLM Defense for Robust Cybersecurity Question Answering**

**Rama Chunduri - Computer Science**

Mentor: Qipeng Liu

**Time Space Tradeoffs for Collision Finding and Element Distinctness**

**Lorenzo Beronilla - Applied Math**

Mentor: Matthias Morzfeld

**Data Assimilation, Neural Networks, Computational Methods**

## Panel 23: Feminism, Gender, & Representation

Room: Faculty Club - Seuss Library

Moderator: Dr. Christine Hunefeldt

**Amber Zhang - Sociology**

Mentor: Christena Turner

**Negotiating Masculinity in Chinese K-pop Fandom: Feminist Interpretations  
and Subtle Resistances in Fan Discourses**

**Maria Cortes-Morton - Communication**

Mentor: Andrew deWaard

**“Women Can't Drive”: A Feminist Analysis of how the Political Economy of F1,  
Sponsorship Politics, and Misogynistic Fan Culture Create  
Limited Opportunities for Women in Racing**

**Melanie Barney - Sociology**

Mentor: Kevin Lewis

**Understanding ADHD Through a Sociological Lens: Gender,  
Identity, and Relationship Dynamics**

**Nicole Macias - Media Industries and Communication**

Mentor: Andrew deWaard

**Can You Be Sexier and More Likable: The Affective Feedback Loop of Neoliberal  
Feminism and Conservative Backlash in the Popular Music of Hayley Williams, Olivia  
Rodrigo, and Taylor Swift**

## Panel 24: Modern South Asian History

Room: Faculty Club - Atkinson Pavillion

Moderator: Professor Aniket De

### **Ananya Giri - Ecology, Behavior and Evolution**

Mentor: Aniket De

### **How to Kill a Tiger: British and Adivasi Ways of Seeing Wild Animals in Eastern India, c. 1860–1910**

### **Rishi Antoo - History**

Mentor: Aniket De

### **A Criminalizing Mission: Tribes and the Law in Colonial India, 1818-1871**

### **Kokoro Igawa - History & Sociology**

Mentor: Aniket De

### **When Two Roads Diverged: The Roots of Tagore and Noguchi's Pan-Asian Disagreement**

### **Iris Hochwalt - History**

Mentor: Aniket De

### **Modern Wife, Modern Marriage: The Construction of the Ideal Woman in the Satires of Parashuram**

# Panel 25: Genome Engineering & Functional Genomics

Room: Faculty Club - Cecil's Lounge

Moderator: Professor Alexis Komor

## **Kelli Childs - Biochemistry**

Mentor: Alexis Komor

### **High-Throughput Base Editor Screen Validation in Human Fibroblasts and Epithelial Cells**

## **Noah Kim - Human Biology**

Mentor: Karl J. Wahlin

### **Optimized Safe Harbor Site Integration for Sustained Gene Expression in Pluripotent Stem Cell Derived Models**

## **Laura Liang - Neurobiology**

Mentor: Karl J. Wahlin

### **Construction of a Temporal microRNA Atlas of Human Retinal Development Using Transcriptional Reporter-Guided 3D Organoid Models**

## **Arya Krishna - Microbiology**

Mentor: Sergey Kryazhimskiy

### **Fitness effects of spontaneous mutations in budding yeast vary across strains and environments**

## Panel 26: Maternal Health & Novel Therapeutics

Room: Peterson 102

Moderator: Dr. Gopal Chandrasekaran

### **Makena Massey - Human Biology**

Mentor: Kathleen Fisch

#### **Fibronectin Mutations in Preeclamptic Pregnancies and Their Effect on Cell Adhesion**

### **Mridu Karanam - Molecular and Cell Biology**

Mentor: Lars Bode

#### **Nutrient Composition of Human Milk for the Premature Infant: Macronutrient Analysis of Pre and Post Enteral Feed**

### **Saba Taheri - General Biology**

Mentor: Fadel Zeidan

#### **Randomized Controlled Study Investigating a High Cannabidiol (CBD) Botanical Extract for Complex Regional Pain Syndrome**

## Panel 27: Applications of Chemistry & Physics

Room: Peterson 103  
Moderator: Sako Srapyan

**Ely Dawson - Oceanic and Atmospheric Science**

Mentor: Daniel Rudnick

**Observing Offshore Oxygen with the Spray Glider**

**Amit Kannan - Physics**

Mentor: Yi-Zhuang You

**Autoregressive Transformer Decoders for Quantum Error Correction**

**Angelina Ye - Chemical Engineering,  
Genevieve Almanza – Biochemistry,  
& Gabriella Ching - Chemical Engineering**

Mentor: Justin Opatkiewicz

**Student-Led Product Development of a Scalable Lip Gloss Formulation  
for the Collegiate Market**

## Panel 28: Cognitive Science I

Room: Cognitive Science Building 004

Moderator: Professor Seana Coulson

### **Mariana Garcia - Cognitive and Behavioral Neuroscience**

Mentor: Deanna Greene

**Investigating Brain Cortical Thickness of the  
Somato-Cognitive Action Network in Children**

### **Kit Jack Chan - Double major: Cognitive Science with a Specialization in Neuroscience; and Music**

Mentor: Gedeon Deák

**Effects of Added Tonal Context and Increased Realism of  
Auditory Stimuli on Mode Perception**

### **Son Dinh - Cognitive Science | Neuroscience**

Mentor: Seana Coulson

**Multisensory Effects of Speech Tracking by Speech Filtering  
and Co-speech Movement Kinematics**

### **Shruthi Subramaniyan - Developmental Psychology**

Mentor: Leslie Carver and Karen Dobkins

**Sex differences in face processing in typical and atypical development**

## Panel 29: Perception, Learning, & Performance

Room: Cognitive Science Building 005

Moderator: Professor Steve Barrera

**Elaine Chuang - Cognitive Science spec. Neuroscience**

Mentor: Gedeon Deak

**A Major Investigation into Musical Modal Discrimination  
Through a Minor Musical Feature: Harmonic Overtones**

**J Hernandez - Cognitive Psychology B.S.**

Mentor: Celeste Pilegard

**Education and Eye Tracking: Examining the Interaction of Expertise and Spatial  
Contiguity and Impact on Meaningful Learning via Multimedia Models**

**Minh-Nha Kawamura - Neurobiology and Global Health**

Mentor: Sherry Hayes

**The Evolution of the Gender Gap in Olympic Swimming Performance**

## Panel 30: Antimicrobial Discovery & Therapeutic Delivery

Room: Solis 111

Moderator: Dr. Granton Jindal

**Ruhini Saha - Pharmacological chemistry**

Mentor: Professor Debnath

**Bioactivity of a Marine Natural Product-Derived Compound against the “Brain-eating Amoeba” Naegleria fowleri**

**Abby Babikian - Bioengineering: Biotechnology**

Mentor: Erika Cyphert

**Drug Delivery via Thermoresponsive Hydrogels for the Treatment of Bacterial Vaginosis**

**Marissa Sheehy - Biochemistry**

Mentor: Erika Cyphert

**Testing Antimicrobial Metabolites Against BV-Associated Bacteria**

## Session IV

2:15 - 3:15 PM

### Panel 31: E-Cigarette Exposure & Tumor Plasticity

Room: Faculty Club - Conference Rooms 1-3

Moderator: Dr. Darren Casteel

**Zephyra Zhao - Human Biology**

Mentor: Laura E. Crotty Alexander

**Effects of Flavored In Vitro E-Cigarette Exposure on  
Inflammatory Response in Macrophages**

**Aditya Verma - Biology with a Specialization in Bioinformatics**

Mentor: Shiri Gur-Cohen

**Lymphatic Signaling Promotes Tumor Plasticity in Squamous Cell Carcinoma**

**Vivek Sudarshan - Public Health: Medicine Sciences  
& Arantza Montoya - Biology**

Mentor: Laura E. Crotty Alexander

**Immuno Profiling of Nasal Mucosa in Nicotine E-cigarette Users**

## Panel 32: Intersections of Cognitive & Data Sciences

Room: Faculty Club - Conference Rooms 4-5

Moderator: Conan Minihan

**Borngreat Omoma-Edosa - Data Science**

Mentor: Bradley Voytek

**NeuroVLM: Translating neuroimage images to text**

**Nicolas Leedy - Cognitive Science w/ Specialization in Machine Learning and Neural Computation**

Mentor: Andrea Chiba

**Model comparison via nested cross-validation: influence of hippocampal replay in decision making modeled with Classic and Meta Reinforcement Learning models**

**Lasya Yadlapati - Data Science &  
Seema Rida - Cognitive Science Spec. Machine Learning and Neural Computation**

Mentor: Andrea Chiba

**Designing Wearable Biosensor Pipelines Around Individual Variability**

## Panel 33: Digital Culture, Identity, & Social Media

Room: Faculty Club - Seuss Library

Moderator: Dr. Christine Hunefeldt

### **Caroline Wang - Sociocultural Anthropology**

Mentor: Saiba Varma

**'Brainrot' and Dark Humor: The Hidden Power of Gen Z Laughter  
and Collective Identity Making**

### **Christian Lopez-Castro - Sociology: Law & Society and Social Psychology**

Mentor: Kevin Michael Lewis

**Backstage Behind Backstage: How College Students Reconstruct Privacy on Instagram**

### **Darya Massih - Sociology**

Mentor: Christena Turner

**Connected Yet Alone**

## Panel 34: Health, Environment, & Public Policy

Room: Faculty Club - Atkinson Pavillion

Moderator: Hart Hornor-Jones

**Aaliyah Vaden - Neurobiology**

Mentor: Amy Non

**HIV Disparities between BIPOC and White American Communities  
of People living with HIV**

**Ellen Wu - Molecular and Cell Biology, Global Health**

Mentor: Vi Nguyen

**Advancing Climate and Health Advocacy Through Multi-Institutional Collaboration: The  
American Academy of Pediatrics District VIII Climate Health Symposium**

**Grace Lu - Molecular and Cell Biology & Global Health**

Mentor: Vi Nguyen

**Cheap Clothes, High Cost: A Survey-Based Framework for Examining Public Perceptions  
on the Environmental Health Effects of Fast Fashion**

**Tamanna Gandhi - Human Biology**

Mentor: Cheryl Anderson

**Assessment of Healthy Dietary Patterns that Promote Cardiovascular Health  
in South Asian Immigrants**

## Panel 35: Social Rank, Signaling & Learning

Room: Faculty Club - Cecil's Lounge

Moderator: Dr. CJ Litif

**Nacho Espinoza - Psychology B.S. with specialization in Clinical Psychology**

Mentor: Celeste Pilegard

**Training for Transfer: Using Worked Examples  
to Teach the Deep Structure of Science**

**Ali Al Radhi - Cognitive Science with a Specialization in Design and Interaction**

Mentor: Drew Walker

**Ensemble coding vs Social Signaling, what mechanism Influences  
the Group Attraction Effect?**

**Desiree Yang - Cognitive Behavioral Neuroscience  
& Madison Yu - Neurobiology**

Mentor: Kay Tye

**Prefrontal Encoding of Social Rank-Dependent Strategies**

## Panel 36: Cellular Stress & Tissue Remodeling

Room: Peterson 102

Moderator: Dr. Gopal Chandrasekaran

**Santiago Cabrera Almanza - Bioengineering (Biotechnology)**

Mentor: Cherqui

**Characterizing Two Novel Mouse Models of Cystinosis**

**Pooja Parthasarathy - Biology w/ specialization in Bioinformatics**

Mentor: Pradipta Ghosh

**A two-hit mechanism locks alveolar progenitors in a pro-fibrotic transitional state**

**Anny Huang - Double Major in Human Biology and Psychology**

Mentor: Xi Fang

**The role of Mitochondrial Stress Response in Cardiomyopathy.**

## Panel 37: Neuroscience I -- Stress, Gender, & Behavior

Room: Peterson 103

Moderator: Dr. Marsida Kallupi

**Moumen Gabir - Neurobiology and Cognitive Science (Spec. Machine Learning and Neural Computation)**

Mentor: Kay Tye

**Stress, Coping, and Sex: Why Studying Females Changes the Story**

**Chista Niknam - Human Biology**

Mentor: Miranda Koloski

**Brain Network Disruptions May Underlie Heightened Anxiety-Like Avoidance Following Controlled Cortical Impact**

**Deen Nair - Neurobiology**

Mentor: Kim Dore

**Behavioral experiments in old mice to characterize resilience to aging and Alzheimer's disease**

## Panel 38: Cognitive Science II

Room: Cognitive Science Building 004

Moderator: Professor Seana Coulson

### **Daria Kouzminova - Cognitive Science**

Mentor: Lieselot Carrette

#### **Visualizing Individual Variability in the Brain as Microstructural Differences Across Rat Strains**

### **Noemi Salmeron - Cognitive Science and Linguistics**

Mentor: Seana Coulson

#### **Activation of Sensorimotor Features during Language Comprehension**

### **Meghan Brosnan - Cognitive Science & Anika Satya - Psychology BS**

Mentor: Douglas Nitz

#### **Linking Global Map-Like and First Person Perspectives in Rodent Models**

# Panel 39: Pediatric Tourette Syndrome & Neurodevelopment Imaging

Room: Cognitive Science Building 005

Moderator: Lieselot Carrette

**Julia Wang - Cognitive Behavioral Neuroscience**

Mentor: Steven Barrera

**Cerebello-cortical Functional Connectivity in Pediatric Tourette Syndrome and Typically Developing Children**

**Michelle Lee - Cognitive Science**

Mentor: Deanna Greene

**Characterizing Tic Expression During fMRI Scanning in Pediatric Tourette Syndrome**

**Aisha Cinar - Cognitive Science with a Specialization in Neuroscience**

Mentor: Deanna J Greene

**Relating Brain Network Topography and Functional Connectivity to Psychiatric Symptoms in Neurodevelopmental Disorders Using Precision Functional Mapping**

# Session V

3:30 – 4:30 PM

## Panel 40: Genomes & Genetics

Room: Faculty Club - Conference Rooms 1-3

Moderator: Dr. Darren Casteel

### **Fabrizio Malatesta - Bioinformatics**

Mentor: Sanchez-Roige

**The Genetic Architecture of Wisdom: A Genome-Wide Association Study**

### **Jonathan Qiu - Bioengineering**

Mentor: Heidi Cook-Andersen

**Changes in splice site utilization with inhibition of nonsense-mediated decay in an embryonic stem cell model**

### **Nam Anh Nguyen - Cell and Molecular Biology**

Mentor: Julian Schroeder

**Modulation of Stomatal Response using CRISPR-based Guard Cell-Specific Knockout technique**

## Panel 41: Computer, Information & Data Sciences

Room: Faculty Club - Conference Rooms 4-5

Moderator: Conan Minihan

**Sofia Tkachenko - Applied Mathematics**

Mentor: Robert J. Webber

**Shattered Gradients: Exploring Neural Network Behavior under an Infinite-Depth Limit**

**David Culver - Physics and Math**

Mentor: Matthias Morzfeld

**Using Sinusoidal Neural Networks to create Representations of Nearshore Ocean Waves from Irregularly Spaced LiDAR Data**

**Rong Xing - Math- Computer Science**

Mentor: Melinda Owens

**Exploring Natural Language Processing for Deductive Thematic Analysis of Scientist Spotlight Assignments**

**Alexis Garcia - Mathematics - Computer Science**

Mentor: Bradley Voytek

**Visual Question Answering via Small Language Models with Neuroscience Priors**

## Panel 42: Vascular Health & Immune Regulation

Room: Faculty Club - Seuss Library

Moderator: Kellen Cavagnero

**Lily Ji - Microbiology**

Mentor: Scott Biering

**Calprotectin inhibits dengue virus nonstructural protein 1/matrix metalloproteinase 9-triggered vascular leak**

**Jack Ye - Public Health**

Mentor: Scott Biering

**Zinc Sequestration Inhibits MMP-9 Mediated Vascular Leak in Dengue Virus Disease**

## Panel 43: Youth, Digital Devices & Parental Monitoring

Room: Faculty Club - Atkinson Pavillion

Moderator: Hart Hornor-Jones

**Cuixia Hong - Psychology B.S.**

Mentor: Adena Schachner

**Do Children's Beliefs About Digital Devices as Informational Sources Influence Their Learning Outcomes?**

**Carolyn Foo - Human Biology**

Mentor: William Pelham

**Mediators of the link between parental monitoring and youth adjustment: a review of the evidence**

**Helena Yang - Cognitive and Behavioral Neuroscience  
& Kayla Mitchiner - Neurobiology**

Mentor: William Pelham

**Digital Location Tracking and Adolescence**

## Panel 44: Ecology & Behavior

Room: Faculty Club - Cecil's Lounge

Moderator: Dr. Jonathan Dickey

**Ian Hicke - Ecology Behavior and Evolution and Education Studies**

Mentor: Patrick Rohner

**Comparison of Insect Assemblages in Native and Non-Native Plant Communities**

**Arunima Prakash - Ecology, Behavior & Evolution**

Mentor: Patrick Rohner

**Diet and Temperature Affect Brood Ball Construction in the  
Dung Beetle *Onthophagus taurus***

**Leo Harris - Ecology, Behavior, and Evolution**

Mentor: Maria Vernet

**Explorations of Plastics and Prey in Gut Contents of  
Northern Fulmars (*Fulmarus glacialis*)**

## Panel 45: Bio-Imaging & Cellular Mechanics

Room: Peterson 102

Moderator: Dr. Boyu Meng

### **Leo Costanza - Biochemistry**

Mentor: Nathan Shaner

**Development of mLEO: A Bright, Monomeric, and  
Photostable Orange Fluorescent Protein**

### **Aaron Barber - Neurobiology**

Mentor: Nathan Shaner

**Directed Evolution of psmOfo: Optimizing Spectral Overlap for  
Enhanced Calcium Influx Recording**

### **Samantha Nasser - Molecular and Cell Biology**

Mentor: Shiri Gur-Cohen

**Lymphatic-mediated mechanical cues direct stem cell fate decisions  
during tissue regeneration**

# Panel 46: Neuroscience II – Neuroinflammation & Disease Pathology

Room: Peterson 103  
Moderator: Dr. Marsida Kallupi

**Raina Cheng - Neurobiology**

Mentor: Nicole Coufal

**Lysosomal Dysfunction in Down Syndrome Microglia and Implications for Neuroinflammation**

**Thalia Crawford - General Biology**

Mentor: Christina Sigurdson

**Synapse loss and neuronal hyperactivity are accompanied by mGluR5 loss in a humanized mouse model for Alzheimer's disease**

**Marlenne Gutierrez - Human Biology**

Mentor: Kim Dore

**Linking Brain Protein Palmitoylation in Different Sub-Cellular Fractions to Performance in Memory Tests**

**Natasha Bercy - Molecular and Cell Biology**

Mentor: Galia Debelouchina

**Exploring Amyloid-Beta Interactions in Disease Calcifications**

## **Panel 47: Cognitive Science III**

Room: Cognitive Science Building 004

Moderator: Professor Seana Coulson

**Ashley Lee - Cognitive & Behavioral Neuroscience**

Mentor: Seana Coulson

**Is Memory Encoding Shaped by Different Perceptual Associations?**

**Caroline Hall-Sherr - Cognitive Science and Linguistics**

Mentor: Sarah Creel

**Perception and Production of R/W Contrasts in Preschool Aged Children**

**Talisa Wines - Cognitive and Behavioral Neuroscience  
& Rosa Cerritos Lara - Cognitive Science**

Mentor: Anne Beatty-Martínez

**Using Personal Network Surveys to Understand  
Heritage Speaker Variability and Processing**

# Panel 48: Vaccination Strategies & Pediatric Clinical Trial Design

Room: Cognitive Science Building 005

Moderator: Sako Srappyan

**Riya Fernando - Computer Engineering**

Mentor: Tal Einav

**Using summer vaccination to boost antibody durability from  
influenza vaccination in the fall**

**Kalil Barnes - General Biology**

Mentor: Paula Aristizabal

**Barriers and Facilitators to Enrollment in Clinical Trials among Adolescents and Young  
Adults at Rady Children's Health: A Qualitative Exploration**

**Shayna Salerno - Human Biology  
& Jayden Marquez - Human Biology**

Mentor: Jeremy Landeo-Gutierrez

**Participant Background Characteristics on Pediatric  
Obstructive Sleep Apnea Clinical Trials**

# Abstracts

Ali Al Radhi

Cognitive Science with a Specialization in Design and Interaction, ERC

Mentored by Drew Walker

*Ensemble coding vs Social Signaling, what mechanism Influences the Group Attraction Effect?*

This study investigates the Group Attractiveness Effect, the well-replicated finding that faces are judged as more attractive when presented in a group than in isolation. The originally proposed mechanism is ensemble coding, whereby observers automatically form an averaged representation of grouped faces, biasing individual faces toward a more attractive mean. However, social signaling, or the implicit cues of likability and social acceptance conveyed by appearing with others, may also contribute. To disentangle these mechanisms, participants rated the same face across three conditions: alone, in a group with other faces visible, and in a group with other faces occluded to prevent ensemble coding while preserving social context. Preliminary results indicate that the attractiveness boost persists even when accompanying faces are covered, suggesting that social signaling plays a role in the cheerleader effect beyond ensemble coding alone.

Lucas Aldea

Physics specializing in Astrophysics, Revelle

Mentored by Griffin Hosseinzadeh

*Verifying Core-Collapse and Shock-Cooling Models through Photometric and Spectroscopic Analysis of the Type II SN 2024phv*

We present the high-cadence early light curve data of Type IIP SN 2024phv observed in NGC 3936. The analysis utilizes photometric and spectroscopic techniques to constrain characteristics of the red super-giant progenitor. The SN was detected and classified 18.2 hours after the estimated explosion time. The shock-cooling model was fitted to the first 18 days of the explosion, and yielded a radius estimate of 530 Solar Radii and explosion time MJD 60501.24. Black-body fitting estimated temperature and radius evolution,

allowing us to cross-verify the validity of the shock cooling model. Spectra captured 1.78 and 2.72 days after the explosion time reveal narrow emissions of Hydrogen and Helium, likely caused by a moderate amount of circumstellar material, the effects of which can be seen in the shock-cooling model. As the model does not account for circumstellar material, it cannot quite fit the light curve for the first 10 days, the temperature and radius estimates also deviate from the black-body fitting slightly in this period. Importantly, the shock-cooling model was pushed to its limits under the presence of circumstellar material, valuable to improving the model.

## Zakir Alibhai

Bioinformatics, Muir

Mentored by Cole Ferguson

### *Regulation of chromatin conformation by the histone deubiquitinase BAP1 in the brain*

BAP1 is a tumor-suppressor gene that removes the histone modification H2AK119ub, traditionally understood to mediate gene repression. Its loss causes severe neurodevelopmental defects including epilepsy, but how it shapes the three-dimensional folding of the genome has never been characterized in the brain. Given that H2AK119ub has been found to modulate active enhancer levels, we used Hi-C to map the physical contacts of DNA regions. We found genome-wide chromatin interactions to be perturbed in our BAP1 mutant, where 1 in 5 detected chromatin loops were dysregulated in the adult mouse cerebellum. At over 200 loci, long range loops associated with repression were preferentially lost in exchange for shorter range contacts. Additionally, the presence of H2AK119ub strongly predicted this distance-dependent loop-loss: if the histone modification was present at an anchor, contacts were ten times more likely to become disrupted. Analysis of differentially expressed genes revealed repression of developmental and synaptic genes where connections to enhancers were broken. This effect was progressive over neurodevelopment, expanding from under 200 differential loops in early development to almost three thousand in adulthood. These findings indicate that BAP1 is required for organization of the 3D genome in the developing brain, and its loss leads to architectural changes resulting in dysregulated synaptic gene expression. We propose that elevation of H2AK119ub, as a result of BAP1 loss, collapses long-range developmental loops, replacing them with proximal repressive contacts.

## Genevieve Almanza

Biochemistry, Warren

Mentored by Justin Opatkiewicz

*Student-Led Product Development of a Scalable Lip Gloss Formulation for the Collegiate Market*

Due to proprietary information, this abstract has been redacted.

## Kristin Antonio

Education Sciences, Marshall

Mentored by Amanda Solomon Amorao

*“We’re more American than they’ll ever be”: Race, Citizenship, and Patriotism Among San Diego Fil-Ams*

While notable research has been done into the history of Filipina/o/x American (Fil-Am) communities in Southern California (Espiritu, 2003; Bonus, 1997), many of these analyses fail to take into account the unique construction of San Diego’s Fil-Am community as a result of two primary factors: enlistment into the U.S. Navy as a dominant avenue for Filipino immigration to San Diego and San Diego’s physical proximity to the U.S.-Mexico border during an anti-immigrant political climate. This particular historical and geographic context has positioned enlistment into the U.S. Navy as a “common sense” mode of being Fil-Am in San Diego through the perception of military service as a means of becoming an ideal immigrant-citizen (in stark contrast to the image of an “illegal alien”). Through analyzing the historical conditions of Filipina/o/x American immigrants, veterans, and military-affiliated communities from the beginning of the 20th century to the present day, this paper aims to explore the specific political alignment of the San Diego Fil-Am community to unravel the connections between race, citizenship, and patriotism and imagine alternative configurations of Fil-Am identity grounded in collective liberation. This paper also briefly explores the potential of grassroots, community-based youth mentorship initiatives to push back against the seemingly de facto enlistment of these community members into the military. Such analysis is crucial for challenging White supremacist logic that conflates proximity to Whiteness with “worthiness” of a place in the United States.

Rishi Antoo

History, ERC

Mentored by Aniket De

*A Criminalizing Mission: Tribes and the Law in Colonial India, 1818-1871*

In the nineteenth century, the idea of the “criminal tribe” emerged as a ubiquitous category of criminality in British colonial law in India. This project in legal history investigates the influence of colonial legal frameworks, particularly that of criminal tribes, on the subjugation of indigenous tribes in Western India between the East India Company’s conquest of Bombay (1818) and the British Government of India’s Criminal Tribes Act (1871). It argues that, during their respective tenures as the colonial Governors of the Bombay Presidency, Mountstuart Elphinstone and John Malcolm defined their ideology of criminal tribes around studies of tribal behavior, society, and culture. Their ideas influenced the framing of Thomas Macaulay’s Indian Penal Code (1837) around a principle of collective criminal intent which eventually enabled and justified colonial rule. Lastly, colonial governance of tribes in Bombay was prototypical of an emerging strategy of “frontier governance.” Legal histories most often approach the study of colonial laws and indigenous communities through frameworks of political consciousness, settler colonialism, or political sovereignty. But unlike the native nations of the United States or indigenous communities in South Africa, tribes in colonial Western India were neither seen by the colonial state as sovereign political bodies nor violently subjugated by white settlers. Instead, they were treated as societies of criminals whose occupations and cultures, rather than intrinsic nature, fostered criminality. The case study of criminal tribes in Western India therefore invites new ways of thinking about colonial law and the subjugation of indigenous peoples during the nineteenth century.

Laura Avila

B.S Psychology with Specialization in Clinical Psychology; B.A. Global Health, Seventh

Mentored by Claire Meaders

*How do we achieve agreement? Exploring the purpose of consensus meetings in a classroom observation study*

Structured classroom observation protocols are tools developed to systematically characterize a specific aspect of an instructor's teaching. As part of a larger research study, we observed college STEM courses using three protocols to generate data on teaching practices as a form of instructional feedback. Trained

observers coded class sessions by identifying and documenting behaviors defined by each protocol. Because each session was coded by two independent observers, we needed to establish consistency between those judgements. This is called inter-rater reliability (IRR). In this presentation, we describe the process of reaching IRR across our research team.

IRR was evaluated using percent agreement and Cohen's kappa. Percent agreement captures the proportion of coded units on which two independent coders agree, whereas Cohen's kappa accounts for agreement by chance. We discuss the thresholds used to establish acceptable agreement and the iterative process required to reach them. Central to this process were regular consensus meetings, which created opportunities for coders to share their reasoning and discuss challenging codes. We also describe best practices for documenting decisions from these meetings to maintain consistency in coding over time.

Establishing high interrater reliability ensures that our findings are reproducible and minimizes variability introduced by individual coders. This reduces bias in the interpretation of results and strengthens the credibility of our conclusions within our overarching research study. The approach we used to reach consensus highlights the process required to reach agreement in projects involving qualitative or observational analysis, and offers a model for similar research contexts.

Abby Babikian

Bioengineering: Biotechnology, Seventh

Mentored by Erika Cyphert

*Drug Delivery via Thermoresponsive Hydrogels for the Treatment of Bacterial Vaginosis*

Due to proprietary information, this abstract has been redacted.

## Kit Bailey

Bioengineering, Marshall

Mentored by Ester Kwon

### *Peptide-Targeted Lipid Nanoparticles for Neuronal Delivery following Traumatic Brain Injury*

Traumatic brain injury (TBI) has a variety of effects on nervous tissues, leading to long-term impairment and damage to the brain. One such symptom is the disruption of the blood-brain barrier, creating a temporary window for therapeutics to access injured tissue. mRNA therapeutics are a potential means of minimizing the complex secondary injury cascade of TBI by regulating inflammatory cytokines. Lipid nanoparticles (LNPs) are the most clinically advanced non-viral nucleic acid delivery platform, offering low immunogenicity and a tunable chemical design to enhance targeted delivery. We found LNPs accumulate in the injured hemisphere 1-48 hours post-injury, primarily targeting and transfecting astrocytes and endothelial cells. LNPs containing mRNA cargo were functionalized with the rabies virus glycoprotein (RVG) peptide to enhance neuronal targeting. We found a 6.4-fold increase in neuronal transfection in the injured brain with similar targeting to non-neuronal brain cells as untargeted LNPs. Off-target organs such as the liver, lungs, kidney, heart, and spleen were assessed for changes in LNP accumulation and transfection of cargo mRNA post injury for untargeted and RVG-targeted LNPs. While most organs remained stable across the conditions, hepatic expression decreased, while spleen expression increased. These findings highlight how peptide targeting of LNPs influences systemic distribution and behavior.

## Satvik Bandi

Bioengineering: Bioinformatics, Seventh

Mentored by Irina Kufareva

### *The C-terminal PDZ-binding motif of Cx40 is regulated by phosphorylation and required for the formation of functional intercellular channels*

Due to proprietary information, this abstract has been redacted.

Aaron Barber

Neurobiology, Muir

Mentored by Nathan Shaner

*Directed Evolution of psmOfo: Optimizing Spectral Overlap for Enhanced Calcium Influx Recording*

Calcium signaling plays a critical role in a wide range of cellular functions, making the ability to record calcium signaling history broadly useful for neuroscience and cell biology. Here we describe efforts to optimize a photoswitchable monomeric protein derived from *Olindias formosus* (psmOfo) to enable efficient Förster resonance energy transfer (FRET) with a bioluminescent calcium indicator. Upon calcium-triggered reconstitution of a luciferase protein, transfer of excited-state energy from the now-active luciferase induces switching of psmOfo from a dark “off” state to a bright “on” state, durably and quantitatively marking cells that experience high-calcium events. A key limitation of the initial prototype system is poor spectral overlap between the luciferase emission and psmOfo absorbance, which reduces the FRET efficiency and lowers sensitivity.

To generate protein variants with altered off-state absorbance spectra, we employed error-prone mutagenesis (EPM) of psmOfo to identify mutations that red-shifted its absorbance spectrum to be closer in alignment with RLuc emission. EPM libraries were generated, expressed in bacteria, screened, and selected for sequencing to identify mutations. This allowed us to identify “hotspots” to target in subsequent site-directed mutagenesis libraries in an iterative process. From this pipeline, we identified a promising variant carrying a T144L mutation in psmOfo, which exhibits a red-shifted absorbance spectrum with substantially increased overlap with RLuc emission. This variant represents a next step toward improving the sensitivity of this calcium event recording system.

## Kalil Barnes

General Biology, Muir

Mentored by Paula Aristizabal

### *Barriers and Facilitators to Enrollment in Clinical Trials among Adolescents and Young Adults at Rady Children's Health: A Qualitative Exploration*

**Background:** Participation in clinical trials is linked to better clinical outcomes in adolescents and young adults (AYAs) with cancer. However, AYAs are underrepresented in cancer research. Navigating the informed consent process for therapeutic clinical trials is overwhelming for AYAs with cancer. Patient navigation has been proposed as an intervention to improve clinical trial recruitment. Effective implementation of patient-facing interventions for AYAs requires engagement of AYAs prior to intervention design and implementation to facilitate uptake.

**Methods:** To assess barriers and facilitators to enrollment in cancer clinical trials among AYAs, we conducted a focus group with four AYAs and semi structured qualitative interviews with 10 AYAs who had received treatment for childhood cancer at the Peckham Center for Cancer and Blood Disorders. Thematic analysis was carried out with predetermined codes based on grounded theory to explore decision-making among AYAs with cancer and barriers and facilitators to effective informed consent and patient navigation for clinical trials.

**Results:** Barriers to clinical trial participation included concerns about side effects of clinical trials, burdens of parents' interpretation needs, parents' conflicting opinions regarding research participation, and feelings of isolation and loneliness after a cancer diagnosis. Facilitators identified included peer navigators providing emotional support, trust in providers', recognizing altruism of participating in clinical trials, and empowering AYAs to engage in decision-making.

**Conclusion:** AYA stakeholders identified key barriers and facilitators to informed consent for cancer clinical trials. Our findings will inform implementation of patient navigation targeted to AYAs, by facilitating co-creation with AYAs and enhancing stakeholder engagement and uptake.

## Melanie Barney

Sociology, Warren

Mentored by Kevin Lewis

### *Understanding ADHD Through a Sociological Lens: Gender, Identity, and Relationship Dynamics*

The lived experiences of individuals with ADHD offer perspective into how gendered expectations, socialization, identity formation, and relationship dynamics are shaped through the experience of being neurodivergent. Previous research shows that ADHD studies have

historically focused on boys and men, creating a gender imbalance. ADHD is typically studied through a psychological lens or clinical framework, focusing less on social context and lived experiences. ADHD research lacks sociological analysis of lived experiences and social relationships. Women's lived experiences are also underrepresented, which fails to address the gendered expectations surrounding ADHD. In this thesis, I ask the following question: How does

ADHD shape an individual's lived experiences of gender, identity, attachment styles, and relationships? I address this question by using a mixed-methods approach. To gather participants, I distributed an online survey in which participants were asked if they were willing

to participate in follow-up qualitative interviews. These findings will highlight how ADHD shapes identity and relationships, how gender influences different aspects of ADHD, and how lived experiences may differ from clinical or pharmacological research.

## Ayjay Ben Tovim

Global Health and Human Biology, ERC

Mentored by Shiri Gur-Cohen

### *Investigating the Role of a Pro-lymphangiogenic Cues in Tumor Progression and Metastasis*

The majority of cancer related deaths are caused by metastatic disease and tumor recurrence. Understanding the mechanisms that enable tumors to spread and evade

treatment is therefore a critical unmet need in cancer research. Squamous cell carcinomas (SCC) are aggressive tumors that frequently exhibit resistance to conventional chemotherapy, contributing to limited treatment options and poor clinical outcomes. Due to their treatment resistance, SCC provides a powerful model system for investigating mechanisms that drive tumor progression in incurable cancers.

Tumor progression and metastasis are strongly influenced by interactions between cancer cells and the surrounding tumor microenvironment, such as the vascular system. Our lab has recently identified the lymphatic vascular niche as a critical component in coordinating cellular plasticity in addition to its known function in tissue drainage and immunosurveillance. Despite mounting factors linking lymphatic vessels to tumor metastasis and recurrence, factors that regulate these interactions remain poorly characterized. Our goal is to investigate the role of pro-lymphangiogenic factors in regulating tumor growth, metastatic potential, and vascular remodeling within the tumor microenvironment.

Our work demonstrates that knockdown of pro-lymphangiogenic factors in tumor-initiating cells significantly reduces tumor growth and metastatic burden, suggesting that lymphatic remodeling mediates these effects. We further confirmed that knockdown of the pro-lymphangiogenic factor induced lymphatic dysfunction, suggesting that tumor stem cell-driven lymphatic remodeling drives tumorigenesis. Building on these findings, we are now investigating how altered expression of this factor reshapes lymphatic architecture and tumor-lymphatic interactions to drive progression and metastasis.

## Natasha Bercy

Molecular and Cell Biology, Seventh

Mentored by Galia Debelouchina

### *Exploring Amyloid-Beta Interactions in Disease Calcifications*

Age-related macular degeneration (AMD) is the leading cause of vision loss in aging populations, significantly impacting quality of life. The condition is characterized by small extracellular deposits that accumulate in the retina named drusen. Drusen are composed of a

lipid core, a mineral layer of calcium-based hydroxyapatite (HAP), and a protein-coated surface. Amyloid Beta (A- $\beta$ ) has been found in the protein layer of drusen and is also widely known to be

associated with Alzheimer's disease where it forms cytotoxic fibrils. However, its role in AMD and its interactions with the minerals in drusen during the mineralization process is largely unknown. Therefore, this project aims to explore how A- $\beta$  interacts with hydroxyapatite and

whether these interactions lead to A- $\beta$  aggregation. Here we show how A- $\beta$  aggregation kinetics are modulated in the presence of hydroxyapatite using ThT kinetic assays and cosedimentation

assays. In addition, transmission electron microscopy was used to characterize the deposits formed from kinetic assays. To enable these experiments, an optimized protocol was developed for the recombinant expression and purification of highly pure and monomeric A- $\beta$ . These experiments provide insights into the interactions between A- $\beta$  and calcification in diseases such as AMD.

Lorenzo Beronilla

Applied Math, Muir

Mentored by Matthias Morzfeld

*Data Assimilation, Neural Networks, Computational Methods*

Data assimilation (DA) for compressible flows with shocks is challenging because many classical DA methods generate spurious oscillations and nonphysical features near uncertain shocks. We focus here on the ensemble Kalman filter (EnKF). We show that the poor performance of the standard EnKF may be attributed to the bimodal forecast distribution that can arise in the vicinity of an uncertain shock location; this violates the assumptions underpinning the EnKF, which assume a forecast which is close to Gaussian. To address this issue we introduce the new neural EnKF. The basic idea is to systematically embed neural function approximations within ensemble DA by mapping the forecast ensemble of shocked flows to the parameter space (weights and biases) of a deep neural network (NN) and to subsequently perform DA in that space. The nonlinear mapping encodes sharp and smooth flow features in an ensemble of NN parameters. Neural EnKF updates are therefore well-behaved only if the NN parameters vary smoothly within the neural representation of the forecast ensemble. We show that such a smooth variation of network parameters can be enforced via physics-informed transfer learning, and demonstrate that in so-doing the neural EnKF avoids the spurious oscillations and nonphysical features that plague the standard EnKF. The applicability of

the neural EnKF is demonstrated through a series of systematic numerical experiments with an inviscid Burgers' equation, Sod's shock tube, and a two-dimensional blast wave.

## Meghan Brosnan

Cognitive Science, Eighth

Mentored by Douglas Nitz

### *Linking Global Map-Like and First Person Perspectives in Rodent Models*

Humans translate spatial information and navigational goals from external maps into action during navigation. The ability to transform between global map-based (allocentric) perspectives (GMPs) and first-person (egocentric) perspectives (FPPs) is essential for flexible navigation, yet the neural mechanisms underlying this process remain unclear. Evidence suggests that the retrosplenial cortex, subiculum, posterior parietal cortex, and hippocampus contribute to linking spatial location and orientation across object-centred reference frames via landmark-based representations. We recorded single-neuron electrophysiological activity in rodents performing a spatial navigation task that included an elevated ramp connecting two square platforms, with multiple reward cups and spatial landmarks. As animals ascend the ramp, they obtain a global map perspective of the destination platform and the signalled reward location. As they descend the ramp and enter the platform, animals transition from a GMP to an FPP, navigating toward the cued reward cup using the spatial landmarks and transformed information. Through this task, we aim to investigate how spatial representations are encoded and transformed across perspectives, thereby clarifying the neural basis of navigational decision-making.

## Nadia Burciu

Human Biology, Seventh

Mentored by Xin Jin

### *Mapping Structural Alterations in Cortical Neurons from ASD-Risk Genes using Perturb-CLEAR*

Healthy brain development relies on the assembly of precise neural circuits through the structural maturation of dendritic arbors and spines. We aim to uncover how dendritic structures mature to provide the structural framework for functional synaptic integration.

To map the developmental dynamics of dendritic morphology and spine geometry in vivo, we established a high-resolution cytoarchitectural phenotyping pipeline with sparse, brain-wide labeling of neurons, alongside targeted CRISPR perturbations, and tissue-clearing-assisted 3D cellular morphology analysis. This approach maps the developmental dynamics of dendrites and spine morphogenesis to reveal how genetic factors shape circuit assembly. We expect to identify ASD-linked structural alterations, such as reduced dendritic complexity and immature, filopodia-like spine phenotypes—characterized by thinner necks and smaller head volumes—indicating disrupted synaptic maturation. Ultimately, this pipeline provides a robust, quantitative framework to reveal how early brain circuits are physically assembled and refined. By comparing a healthy baseline against targeted genetic perturbations, this study directly maps the structural disruptions caused by neurodevelopmental mutations, providing the physical targets needed for future treatments.

## Santiago Cabrera Almanza

Bioengineering (Biotechnology, Warren

Mentored by Stephanie Cherqui

*Characterizing Two Novel Mouse Models of Cystinosis*

Due to proprietary information, this abstract has been redacted.

## Mac Carroll

Psychology, Sixth

Mentored by Leslie Carver

*Implicit Prediction in Autistic Adults*

Autism Spectrum Disorder (ASD) is a heterogeneous disorder characterized by social deficits, hypo/hypersensitivities, repetitive interests, and insistence on sameness. Current psychological research on ASD investigates cognitive differences that could explain the ASD symptom profile. The following study tested the Predictive Coding Hypothesis (PCH), a theory which claims an impairment in predicting outcomes from stimuli is the salient cognitive cause for ASD symptomology. Existing literature has found mixed conclusions on whether or not ASD participants even have a predictive impairment, and

this study aimed to explain these findings by partitioning predictive ability into implicit (unconscious) and explicit (conscious) prediction, and testing the compensatory hypothesis that ASD adults have impaired implicit prediction, but compensate for it with superior explicit prediction. Using the Weather Prediction Task (Gluck et al., 2002), we assessed neurotypical and ASD strategy use during probabilistic prediction. Data collection is ongoing. We hypothesized that ASD participants will use explicit strategies more than neurotypicals, who tend to start the task using explicit strategies but transition to using implicit strategies as the task progresses. These results would provide evidence that ASD adults have a preference for explicit strategies when solving probabilistic prediction tasks. An ASD preference for explicit prediction could provide alternate explanations for findings in the existing literature, reframing autism not as a general predictive coding impairment, but as a difference in cognitive processing style.

Rosa Cerritos Lara

Cognitive Science, Marshall

Mentored by Anne Beatty-Martínez

*Using Personal Network Surveys to Understand Heritage Speaker Variability and Processing*

It has been shown in bilingualism research that both languages are active at all times. As a result, bilinguals have to continuously monitor and regulate a two-language active system in order to speak in the target language. By utilizing an interpersonal survey tool, we can better assess how the different bilingual language experiences impact cognitive control and the language contexts that contribute to the shaping of cognitive processes. Especially in the cases of English-Spanish heritage speakers who grow up speaking Spanish at home and later, as English becomes dominant in their environment through social interactions such as school and community, become dominant speakers of English.

Additionally, we utilize a battery of tasks, including lexical production (Picture-Naming, Verbal Fluency) and cognitive control (AX-Continuous Performance Task), to assess the individual differences among bilingual populations. The data may suggest that certain linguistic environments and training contribute to the performance of bilinguals in both domain-general cognitive tasks and linguistic processing, such as measuring latencies of word production in both languages. These factors are not stable and dynamic, which

suggests that the bilingual experience is shaped by the environment and linguistic opportunities available to the bilingual speaker

## Joshua Cervantes

Neurobiology and Clinical Psychology, Muir

Mentored by Leslie Carver

### *EEG Signatures of Dynamic Emotional Face Processing in Autism Spectrum Conditions*

Facial emotion recognition is a critical component of social communication, yet individuals with Autism Spectrum Conditions (ASCs) often experience difficulty interpreting emotional facial cues. Previous research has relied largely on static facial images to study emotion recognition capabilities, which may not accurately represent the dynamic nature of real-life experiences. Additionally, studies often contain peripheral stimuli such as hair, glasses, and blemishes, which ASC individuals tend to focus on more than core facial expressions like eyes, mouth, and eyebrows (Pelphrey, 2002). With the integration of AI, we have created more controlled AI models sharing the same facial features, whilst controlling for these peripheral factors. Furthermore, we developed realistic models that have been controlled for the extent of smiling, blinking, and eye movements.

For this study, we propose the use of Electroencephalogram (EEG) and Event-Related Potentials (ERPs) to identify potential differences between Neurotypical and ASC populations while processing dynamic facial expression changes. We hypothesize that individuals with ASCs will experience reduced event-related potentials (ERPs) when viewing the morphing stimuli, which illustrates weaker neural responsiveness to emotional changes and will show less accuracy in identifying negative emotions (e.g sadness) compared to positive emotions (e.g happiness). The usage of EEG may provide a better understanding of neural mechanisms underlying social differences in Autistic individuals, and with the integration of morphing stimuli, we are able to explore these differences in a controlled social situation.

## Kit Jack Chan

Double major: Cognitive Science with a Specialization in Neuroscience; and Music, Revelle

Mentored by Gedeon Deák

## *Effects of Added Tonal Context and Increased Realism of Auditory Stimuli on Mode Perception*

The major-minor tonal system first emerged in the sixteenth century, and has since remained a core framework of Western music. Major and minor modes have come to be associated with happy/positive and sad/negative moods, respectively. They differ by a perceptually small alteration to a single pitch—the third scale degree. Although the affective association with this alteration has been considered fundamental, substantial research in recent decades has suggested that nonmusicians and even some musicians do not readily perceive the difference (Leaver and Halpern, 2004), even when presentation rate of tone series is significantly slowed (Mednicoff et al., 2018). Conversely, some have theorised that the poor mode discrimination results are not, in fact, due to poor perceptual musical abilities, but a lack of contextual musical information in the stimuli. Supporting this, Iveris et al. (2025) found that adding the second scale degree to the triadic tones (root, third and fifth) of artificial tone sequences significantly improved performance. In our study, we tested whether this improvement generalises to all ‘redundant’, non-triadic tones. In addition to the second scale degree, we also explored the addition of the fourth scale degree, which is the only other redundant scale degree that stays consistent in both major and minor scales. We investigated this addition both in isolation as well as in combination with the second scale degree to identify any potential interaction effects. Our findings will inform our understanding of human musical perception, and auditory processing of relative pitch relations.

Maya Chang

Mathematics, Seventh

Mentored by Aaron Pollack

## *Conjecture of Gross - Fourier Coefficients on $G_2$ and Cubic Twist L-Values Part II*

Benedict Gross has a conjecture relating the square roots of the central values of a certain L-function of a cuspidal eigenform  $f$  to the Fourier coefficients of the lift of  $f$  to the group  $G_2$ . In this talk, we describe our methods to compute the central values of the L-function of  $f$ , twisted by a Dirichlet character associated to a Galois cubic field. We will provide evidence for this conjecture of Gross via comparison with Fourier coefficients on  $G_2$  computed by Aaron Pollack.

## Emma Chen

Cognitive Science MLNC, Revelle

Mentored by Virginia de Sa

### *EEG Neural Correlates of Attention to Multifinger Vibrotactile Stimuli: A Pilot Study*

We are interested in measuring the effects of attention on vibrotactile steady-state somatosensory stimulation recorded via electroencephalography (EEG). Prior studies have revealed multi-site, within-hand vibrotactile stimulation to result in nonlinear interactions that produce reduced steady-state somatosensory stimulation evoked potentials (SSSEP) amplitudes alongside additional sub-frequencies, highlighting complex underlying interactions. Crucially, little to no research has been conducted on how attention modulates SSSEP signals across various levels of task difficulty. We present participants with a two-finger spatial discrimination task in which simultaneous stimulation is applied to the index and ring fingers of the participants' right hand. An event (100 ms brief pause) is randomly embedded in one of the two stimulation streams. Participants attend to zero or one of the stimulated fingers and either (1) identify at which finger an event occurred, or (2) perform simple addition (attention control mechanism). We expect attention to affect response accuracy, and anticipate finding identifiable neural correlates of attention to specific fingers regardless of physical discrimination difficulty. We also explore whether perceived successful (false positive) discrimination of event location versus true successful (true positive) responses yield differing SSSEPs and other neural correlates. Our findings will be valuable in constructing better methodologies for the development of noninvasive, sensorimotor brain-computer interfaces (BCIs).

## Faith Chen

Neurobiology, Marshall

Mentored by Jyoti Mishra

### *Meditative Neurofeedback to Treat Depression*

This study develops and tests the efficacy of a novel neurofeedback (NF) task to alleviate symptoms of depression, anxiety, and rumination. NF involves individuals volitionally modulating a physiological aspect of their brain. Specifically, this study utilizes a task paradigm built to train individuals to upregulate an electroencephalography (EEG) signal tied to depression, anxiety, and mindfulness. The NF target modulated was identified

from a prior cohort of 233 individuals and demonstrated strong associations with psychological symptomatology in the context of a mindful breath attention task. Modulation of this signal should, in turn, reduce symptoms of depression.

38/60 adults (21% males, age= 33.7 +/-13.8) with depression have enrolled in a three-arm NF study (20 in active, 4 in a yoked sham condition, and 14 no-contact controls (NCC)). Active participants complete 5 neurofeedback sessions in a month, at home breath exercises, and self reported mental health surveys for depression, anxiety, rumination, and mindfulness at pre and post-intervention. Sham group completes the same except their NF session feedback is based on an active participant's data. NCC completes mental health surveys at pre and post.

Improvements in PHQ9 (Depression; -5.75 +/-0.58; p=0.001), GAD7 (Anxiety; -3.65 +/-0.24; p=0.022), RRS(Rumination; -10.45 +/-0.32; p=0.008), MAAS (Mindfulness; 8.60 +/- 0.62, p=0.012), were seen at post-intervention in the active group, but not in sham or control (p>0.083). Thus, the intervention has shown potential as a treatment for depression.

## Raina Cheng

Neurobiology, ERC

Mentored by Nicole Coufal

### *Lysosomal Dysfunction in Down Syndrome Microglia and Implications for Neuroinflammation*

Down syndrome (DS), caused by triplication of Chr21, is the most common genetic cause of neurodevelopmental disability. Microglia, the brain's resident macrophages, exhibit the highest number of differentially expressed genes in DS, and their depletion rescues cognitive deficits in DS murine models. Given that microglia are phagocytic cells, and lysosomes are critical for material degradation, elucidating lysosomal function in DS microglia is an important step towards uncovering new pathways and therapeutic targets for DS.

Using iPSC-derived microglia from DS patients and controls, we aimed to query the lysosomal phenotype in DS microglia. Using immunofluorescence and confocal imaging, we found notable endolysosomal dysfunction in DS microglia. CD68, a lysosomal marker, showed a significant increase in both number and volume. Endosomal marker EEA1 revealed enlargement, suggesting changes spanning the endolysosomal pathway. DQ-BSA was used to examine the functional capacity of DS lysosomes and showed a

decrease in proteolytic activity in DS cells. Impaired lysosomal function may drive endolysosomal backups, ultimately leading to the greater lysosomal size and number found in DS microglia as their lysosomes fail to process cellular debris.

Lysosomal dysfunction has been shown to shift microglia into pro-inflammatory states, and indeed DS microglia display amoeboid morphology, a phenotype associated with microglial activation. Collectively, our findings suggest a strong lysosomal phenotype in DS microglia, which correlates with characteristic neuroinflammatory findings. Considering microglia are shown to contribute to cognitive outcomes in mouse models of DS, we hope that rescue of lysosomal functioning in these vital cells may pose a potential therapeutic target.

## Kelli Childs

Biochemistry, Revelle

Mentored by Alexis Komor

### *High-Throughput Base Editor Screen Validation in Human Fibroblasts and Epithelial Cells*

Base editors (BEs) are a next-generation CRISPR-Cas9-based genome editing method that uses deamination to convert a single nucleotide from a C•G to T•A base pair (cytosine BE, CBE) or an A•T to G•C base pair (adenine BE, ABE). Since the first BE's development in 2016, countless additional variants have followed, catering to different PAM requirements, editing windows, and organism specificity. These BEs are directed to their target site in the genome by a guide RNA (gRNA), which has a 20-base programmable spacer sequence that matches the target site. For any target edit, this spacer sequence must be optimized. Thus, there is a need for an efficient screening platform to identify gRNA:BE combinations that maximize editing efficiency and achieve the desired editing outcome in high throughput. To address this, my graduate student mentor has developed BESTIE: the Base Editor Screen To Interrogate Efficiency, which is a high-throughput system that allows researchers to screen hundreds to thousands of gRNA:BE combinations at once. To validate the BESTIE platform, top-performing gRNA:BE combinations identified from the screen were individually tested in relevant mammalian cell types. Combinations for the ERCC2 gene target were validated in human embryonic kidney cells (HEK293T). Successful validation in disease-relevant cell types demonstrates that BESTIE can rapidly identify optimal gRNA:BE combinations in high throughput, thereby saving researchers significant time and accelerating the development of base editing approaches for therapeutic correction of

pathogenic single-nucleotide variants. The screen also highlights cell-type-dependent chromatin accessibility barriers that can limit editing efficiency at certain loci.

## Gabriella Ching

Chemical Engineering, ERC

Mentored by Justin Opatkiewicz

*Student-Led Product Development of a Scalable Lip Gloss Formulation for the Collegiate Market*

Due to proprietary information, this abstract has been redacted.

## Yuran Choi

Biochemistry, Revelle

Mentored by Michael Bukart

*Solvatochromic probes capture inter-domain interactions in carrier protein-dependent biosynthesis*

Carrier protein (CP)-dependent biosynthesis pathways produce a broad range of important metabolites, including many clinically relevant natural products. These pathways rely on a carefully orchestrated series of enzymatic reactions mediated by a central carrier protein and multiple partner proteins. However, the protein-substrate and protein-protein interactions that enable these processes are often subtle, transient, and difficult to monitor in situ. Solvatochromic fluorophores offer a promising strategy to probe these interactions. These fluorescent molecules exhibit shifts in emission wavelength and intensity depending on their local chemical environment, allowing them to report changes in protein interactions. Such probes can be chemically synthesized, selectively attached to carrier proteins, and used to visualize CP-dependent pathways involving partner proteins such as fatty acid synthases (FAS), polyketide synthases (PKS), and nonribosomal peptide synthetases (NRPS). In this work, we demonstrate the application of solvatochromic probes to monitor inter-domain interactions within type I NRPS system. Using mutagenesis at the peptidyl carrier protein-epimerization (PCP-E) domain interface, interactions were detected with the solvatochromic 5-(4''-dimethylaminophenyl)-2-(4'-phenyl)oxazole (dapoxyl) pantetheinamide probe. These

findings highlight the utility of solvatochromic probes for detecting dynamic inter-domain protein interactions and suggest broader applications for studying carrier protein-mediated biosynthetic pathways.

Elaine Chuang

Cognitive Science spec. Neuroscience, ERC

Mentored by Gedeon Deak

*A Major Investigation into Musical Modal Discrimination Through a Minor Musical Feature: Harmonic Overtones*

How do listeners associate music with happy and sad moods? In Western music, these are often associated with major and minor keys, which differ mainly by a half-step pitch change at the 3rd scale degree. Despite its effects on musical mood, a recent study reports that most listeners do not reliably discriminate major vs. minor scrambled chord-tone sequences (Chubb et al. 2013). Why the disconnect? One possibility is lack of harmonic complexity: tone scrambles consisting of synthesized guitar tones rather than pure sine waves (as in Chubb et al. 2013) improve participants' performance (Iveris et al., in revision). To investigate if the higher resonant frequencies facilitate major/minor discrimination, we vary the number of harmonics by presenting 1 (pure sine tones), 4 (octave multiples only), or 8 (first 8 sequential harmonics). We asked listeners to discriminate “minor” tone scrambles from “major” tone scrambles in a same-different task, with condition order (1, 4, or 8 harmonics) counterbalanced across participants. We predict that most participants cannot reliably discriminate modes for pure sine tone sequences. If discrimination is facilitated by added harmonics, we expect both 4- and 8-harmonic sequences will improve performance. Alternatively, if a more complex harmonic context is necessary (i.e., harmonics that include additional pitch classes), then performance will improve only in the 8-harmonic condition. It is also possible that harmonics have additive facilitative effects, predicting  $1 < 4 < 8$ . The results will contribute to a complex emerging picture of mode sensitivity as a perceptual phenomenon and an influence on musical affect.

Rama Chunduri

Computer Science, Seventh

Mentored by Qipeng Liu

*Time Space Tradeoffs for Collision Finding and Element Distinctness*

The collision finding problem and the element distinctness problem are extensively studied in theoretical computer science and cryptography. Collision-finding algorithms identify distinct inputs that yield the same output under a hash function, and the element distinctness problem determines whether all elements in a given set are unique. In this project, we study both problems from theoretical and algorithmic perspectives. For collision finding, we analyze and compare several algorithms. For element distinctness, we focus on lower bounds such as those established by Borodin et al. [2] and Yao [8]. We extend it and propose a new model: where an algorithm can query multiple inputs at once (rather only two inputs). We show a optimal algorithm based on an extension of merge sorting, and a matching lower bound based on branching programs and techniques in Yao [8].

Ahri Chung

Molecular and Cell Biology, Sixth

Mentored by Scott Biering

*Inhibition of dengue virus NS1-induced endothelial barrier disruption and vascular leakage by glycan-targeting antiviral lectins*

Due to proprietary information, this abstract has been redacted.

Aisha Cinar

Cognitive Science with a Specialization in Neuroscience, Muir

Mentored by Deanna J Greene

*Relating Brain Network Topography and Functional Connectivity to Psychiatric Symptoms in Neurodevelopmental Disorders Using Precision Functional Mapping*

Depression and anxiety are two of the most prevalent neuropsychiatric conditions among adolescents and adults and are often comorbid with each other, as well as with other neurodevelopmental disorders such as Tourette syndrome. The salience network, a canonical fMRI resting state brain network related to reward processing and integration of autonomic feedback, has been found to double in size in adults with major depressive disorder. This finding was made possible with a dense-sampling fMRI approach in individuals called precision functional mapping (PFM). The current study aims to extend these findings to children. Using a child PFM dataset consisting of 1-5.5 hours of fMRI data per child from 21 children (8-16 y/o, Mean = 10 y/o, F = 11) and representing both typically developing children and children with neurodevelopmental disorder diagnoses, we will explore whether functional network topology and connectivity are related to measures of depression and anxiety. We quantify brain network size and functional connectivity strength within and between networks and investigate the predictive strength of network metrics with scores from the Children's Depression Inventory, Child Behavior Checklist, and the Multidimensional Anxiety Scale for Children. We hypothesize that relationships between network size will correspond with depression scores, as observed in adults. We will also explore whether a similar relationship extends to anxiety scores. By investigating brain network metrics related to depression and anxiety in a child PFM dataset, we hope that our findings may inform personalized treatment strategies and shed light on individual variability in these common comorbidities.

Samantha Clinton

Clinical Psychology, Sixth

Mentored by John Wixted

*The Diagnostic Utility of Eyewitness Confidence in the Accuracy of Composite Sketches*

This research examines whether eyewitness confidence can serve as a diagnostic indicator of composite sketch accuracy. Although facial composites play an important role in criminal investigations, decades of research demonstrate their inability to produce consistently accurate or reliable depictions of perpetrators. Drawing from the police lineup literature, the present study examines whether eyewitness confidence ratings, when collected immediately after sketch construction, are reliable predictors of sketch quality. By comparing each composite sketch against its corresponding target photo, independent raters will assess the accuracy of the sketches. From this, we can evaluate whether the eyewitness's initial confidence reflected their sketch's accuracy. We expect to find a positive relationship between eyewitness confidence and composite sketch

accuracy, such that higher confidence is associated with greater accuracy and lower confidence with poorer accuracy. If supported, these findings would suggest that initial eyewitness confidence, collected before any potential memory contamination occurs, can be a reliable measure of sketch quality. Therefore, incorporating confidence ratings into standard composite procedures could assist law enforcement in identifying and limiting the dissemination of poor composite sketches and ultimately reducing the risk of wrongful convictions.

## Arick Collander

Mathematics, Warren

Mentored by Eve Lee

### *How the Adiabatic Index Governs the Size and Evolution of Exoplanets*

Analytic models that track the size evolution of exoplanets often assume a single adiabatic index to describe the planetary interior structure. The assumed value of the adiabatic index  $\sim 1.4$  is appropriate for the present age of the planet ( $\sim$ multi billion years old) and then used to extrapolate to earlier ages (down to  $\sim$ million years old). According to thermodynamics, however, the adiabatic index of young planets is significantly different, approaching down to 1.2. In this project, we quantify the effect of varying the adiabatic index from 1.2–1.4 on the expected radius of the exoplanet over time. We find that, for larger adiabatic indices similar to the ones used in many current calculations, exoplanet size is considerably larger at ages  $\lesssim 1$ Gyr compared to smaller adiabatic indices. These larger sizes lend themselves to an overestimation of the mass loss rate, leading to a tangible impact on the interpretation of the observed exoplanet radius distribution and the “radius valley”, a topic of significant discussion in the field at present.

## Maria Cortes-Morton

Communication, Warren

Mentored by Andrew deWaard

*“Women Can't Drive”: A Feminist Analysis of how the Political Economy of F1, Sponsorship Politics, and Misogynistic Fan Culture Create Limited Opportunities for Women in Racing*

For the past 70 years, Formula 1, also known as F1, has been considered to be the “pinnacle of motorsport”. Throughout the history of F1, there have been over 600 male racers, yet only 5 female racers. In recent years, F1 has been evolving, and with Liberty Media’s acquisition of F1, there has been an increase in female fans. Since then, F1 has shifted its approach to audiences to better target women in addition to its existing strategy of marketing to men. However, despite all this new attention towards women in the field, female drivers are not benefiting at all from this shift. The sports culture maintains its boy focus and is not changing, and maintains its misogynistic core. The misogynistic culture is widespread and deep, and perpetuated by the drivers, the FIA, and the male fans. Using the method of Political Economy to analyze the underlying power structures in the political economy of F1 and how the systems design impact women in racing. Amidst the growing female audience of F1 (42% as of 2025), there has been an ongoing outcry for more women drivers in F1, and F1 itself claims there will be a woman in F1 within the next 10 years. However, I argue that the political economic structure of F1 will not allow for women in racing because of three key obstacles: inadequate financial support for women in racing, inadequate support for F1 Academy, and a lack of market breakthrough.

Leo Costanza

Biochemistry, Seventh

Mentored by Nathan Shaner

*Development of mLEO: A Bright, Monomeric, and Photostable Orange Fluorescent Protein*

Fluorescent proteins (FPs) are valuable tools for imaging and monitoring many dynamic cellular processes. Currently, existing orange FPs suffer several limitations such as low brightness, rapid photobleaching, and poor performance in fusion constructs, which reduces their reliability for cellular imaging and limits the usable color range for fluorescence microscopy. To address these issues, we engineered mLEO (monomeric Lasting Emission Orange), a bright, monomeric, and photostable orange fluorescent protein. mLEO was developed from the template of mOrange2 through iterative rounds of random and directed mutagenesis. Library variants from each mutagenesis step were expressed in *E. coli*, screened for brightness, purified, and characterized to quantify

absorbance and emission spectra, quantum yields, and photostability. Compared to mOrange2, The final mLEO construct has a modified N-terminus and additional internal amino acid substitutions that directly interact with the chromophore. Live-cell assays of mLEO demonstrate a ~2-fold improvement of median brightness compared to mOrange2 and improved photostability, while maintaining monomeric behavior. These improvements make mLEO well-suited for many cellular imaging applications, including multichannel microscopy and as a FRET acceptor in highly photostable ratiometric calcium sensors with compatible green FPs. mLEO expands the orange region of the fluorescent protein palette and enables more reliable biosensor development for long term in-vivo imaging.

## Thalia Crawford

General Biology, Eighth

Mentored by Christina Sigurdson

*Synapse loss and neuronal hyperactivity are accompanied by mGluR5 loss in a humanized mouse model for Alzheimer's disease*

The early stages of Alzheimer's disease (AD) are characterized by neuronal hyperactivity and synaptic loss, which suggest that dysregulated synaptic signaling occurs prior to widespread neuronal degeneration. Synaptic dysfunction and loss are strongly correlated with cognitive decline in AD, therefore it is essential to identify the signaling mechanisms driving these changes. To investigate synaptic signaling changes associated with AD, we analyzed 15-month old APPNL-G-F/NL-G-F knock-in mice (APP-KI), which express a humanized APP gene containing the Swedish, Iberian, and Arctic familial AD mutations. These mice showed amyloid-

## David Culver

Physics and Math, Revelle

Mentored by Matthias Morzfeld

*Using Sinusoidal Neural Networks to create Representations of Nearshore Ocean Waves from Irregularly Spaced LiDAR Data*

We use a class of neural networks known as sinusoidal representation networks or SIREN's to create accurate representations of LiDAR point clouds of nearshore ocean waves. We collected the data by flying a gas-electric drone equipped with a LiDAR sensor above extreme swell breaking off China Rock in Monterey. The LiDAR sensor simultaneously projects multiple LiDAR scans perpendicular to the crests of the incoming waves, resolving the sea surface. The SIRENs then use the LiDAR data to train on, optimizing themselves to become functions that output sea surface elevation as functions of space and time. We then tested the reliability of these networks by training multiple networks over the same data and examining the differences between the networks and the error from the LiDAR returns. Due to the functional construction of neural networks, the approximated sea surface is a continuous and fully differentiable function in space and time, allowing estimation of sea surface derivatives.

## Tonkhla Dankul

Molecular and Cell Biology, Marshall

Mentored by Galia Debelouchina

### *Characterizing the Interactions between HP1*

Heterochromatin protein 1 $\alpha$  (HP1 $\alpha$ ) is an essential component in the organization of chromatin into the more compact and transcriptionally silenced heterochromatin state. This is in part due to HP1 $\alpha$ 's ability to undergo liquid-liquid phase separation and form liquid like droplets that selectively manage which other proteins can enter and interact with chromatin inside the droplet. It has also been discovered that HP1 $\alpha$ 's propensity to phase separate is modulated through interactions with protein binding partners (PBPs). Shugoshin (Sgo1) is a protein thought to help maintain centromere stability during mitosis, and it is also a known PBP of HP1 $\alpha$ , however, the details behind its interaction with HP1 $\alpha$  and influence on phase separation have not been elucidated. Here, we use various experimental approaches to study the interactions between full length HP1 $\alpha$  and a segment of Sgo1. The effect of Sgo1 on HP1 $\alpha$ 's ability to phase separate has been directly observed through the use of fluorescence microscopy. Paired with binding assays, we determined the binding affinity between HP1 $\alpha$  and Sgo1 and the influence of binding motifs present on Sgo1. Finally, solution nuclear magnetic resonance (NMR) spectroscopy experiments were performed to capture the interactions between the two proteins. Through these experiments, we were able to develop a better understanding of the binding interactions between HP1 $\alpha$  and Sgo1.

## Will Davison

Sociology, Muir

Mentored by Kevin Lewis

### *The Democratization of College Knowledge: The Community College Method as the Great Equalizer*

In the community college system, students must rely on a broad range of sources of motivation and information in order to accomplish their goals. Understanding these sources and their impacts on student outcomes is vital for community colleges, which are often designed to serve as a second chance for students who were not accepted into, or could not afford, the four-year university of their choice. Previous research has focused on how student's expectations are not static throughout time, and are influenced by nonacademic factors such as socioeconomic status. The literature states that students from underrepresented groups struggle for motivation because they do not have role models at institutions of higher education and do not have the same access to college knowledge. However, we still do not know how broad the sources of motivation and information for community college students can be. In this thesis, I ask the following question: What are the most impactful sources of motivation and information for community college students and how do they impact their outcomes? This research surveyed and interviewed former community college students about their sources of information and motivation in community college, and the influence those sources had on their outcomes. These findings will expose that cultural capital is no longer confined to elite spaces. As college for all norms have exposed more Americans to higher education than ever before, college knowledge is held and distributed by countless sources, not only by people with college degrees.

## Ely Dawson

Oceanic and Atmospheric Science, Warren

Mentored by Daniel Rudnick

### *Observing Offshore Oxygen with the Spray Glider*

Repeated autonomous observations provide an opportunity to examine variability in ocean processes at temporal scales from weeks to years and spatial scales from one to hundreds of kilometers. My project uses observations from the Spray underwater gliders

operating as part of the California Underwater Glider Network (CUGN) to investigate variability in dissolved oxygen in the California Current System (CCS) off Northern California. This multiyear time series collected along repeated glider transects was analyzed to characterize the seasonal cycle of oxygen.

A well-known phenomenon is the appearance of hypoxic water nearshore during the spring upwelling season. Our data make clear this important annual feature, whose effects may be especially deleterious to benthic organisms. Our results also reveal a region of anomalously high oxygen offshore during spring, a feature that has not been previously described, to our knowledge. We hypothesize that this high is caused by a phytoplankton bloom and resulting photosynthesis forced by the increased supply of upwelled nutrient-rich water.

These results highlight the ability of sustained glider observations to resolve previously unrecognized features in the seasonal oxygen cycle of the CCS. The observed high oxygen suggests a coupling between upwelling-driven nutrient supply and offshore biological production that is not captured in the traditional view of coastal hypoxia alone. Continued analysis of glider observations will help determine whether this offshore oxygen maximum is consistently associated with phytoplankton blooms.

## Son Dinh

Cognitive Science | Neuroscience, Muir

Mentored by Kim Dore

### *Protein kinase C alpha is recruited to dendritic spines in Alzheimer's disease model mice neurons*

Alzheimer's disease (AD) affects 6.9 million individuals 65+ in the US, and is predicted to double by 2060. However, no effective treatment or early diagnosis are available. Genome-wide associated screens (GWAS) have identified a highly penetrant mutation in protein kinase C alpha (PKC $\alpha$ ) gene - M489V - in familial AD. This mutation increases PKC $\alpha$  enzymatic activity by 30%, and dysregulated PKC $\alpha$  has been implicated in AD. However, molecular mechanisms underlying PKC $\alpha$ 's role in AD are unclear. To better understand how overactive PKC $\alpha$  can lead to AD, we studied PKC $\alpha$  interactions with synaptic scaffolding proteins and PKC $\alpha$  trafficking to dendritic spines of neurons from the hippocampus, a brain region affected early in AD.

To investigate scaffolding proteins (PSD95 and IQGAP1) interactions in normal and AD-affected neurons, we used primary hippocampal neurons from WT and APP/PS1 mice.

Neurons were transfected with PSD95-GFP or IQGAP1-GFP and PKC $\alpha$ -WT-mCherry or PKC $\alpha$ -M489V-mCherry. PKC $\alpha$ -PSD95 and PKC $\alpha$ -IQGAP1 interactions in dendritic spines were measured using fluorescence lifetime imaging (FLIM-FRET), and the enrichment of PKC $\alpha$  in dendritic spines was quantified utilizing confocal imaging.

Our FLIM results indicated that A $\beta$  in APP/PS1 neurons increases the interaction between PKC $\alpha$ WT with PSD95 or IQGAP1 suggesting that A $\beta$  induces recruitment of PKC $\alpha$  to the postsynaptic density. Confocal imaging results also showed that A $\beta$  increased PKC $\alpha$ -WT and PKC $\alpha$ -M489V trafficking, and elevated PKC $\alpha$  activity increased trafficking of IQGAP1 and PSD95 to dendritic spines. These findings advance understanding of PKC $\alpha$ -scaffold dynamics in AD for future therapeutic design.

## Romalyn Escalada

Human Biology, Revelle

Mentored by Isabella Maita

### *Low Clarity, High Anxiety: Student's Emotional and Coping Responses to Classroom Uncertainty*

STEM students commonly experience difficulty with uncertainty on how to succeed in STEM courses with insufficient transparency. The Transparency in Learning and Teaching (TILT) framework emphasizes the purpose, task, and criteria of assignments to guide student learning. We hypothesize that unclear communication of any of the components may contribute to increased academic stress and uncertainty. This study observed students' feelings when they are unsure how to succeed in a course or assignment. The focus group contained 24 STEM students who were asked, "When you feel unsure about how to succeed in a course or assignment, how do you feel about it?". Focus group transcripts were inductively coded to identify themes in the data. The two primary themes that emerged were Feelings and Coping Mechanisms. Each theme has two subthemes: Negative/Positive Feelings and Reaching Out/Individual Actions. Negative emotions considerably outweigh positive emotions towards the uncertainty of succeeding in a course or assignment. STEM students are more likely to make independent behavioral changes than seek support from others. The findings suggest that uncertainty in STEM courses is strongly associated with emotional burden which influences students' strategies to cope. Finally, instructors have a critical role in mitigating students' stress by improving classroom transparency.

Nacho Espinoza

Psychology B.S. with specialization in Clinical Psychology, Muir

Mentored by Celeste Pilegard

*Training for Transfer: Using Worked Examples to Teach the Deep Structure of Science*

Supporting students' ability to apply knowledge learned in one context to appropriate novel contexts, known as knowledge transfer, is a central goal of education. This is crucial for science literacy, as students must apply scientific knowledge to evaluate scientific claims in the real world. However, decades of research show that learners struggle to transfer knowledge spontaneously. Transfer requires recognizing abstract structures and applying them to novel problems, which involves looking beyond surface features to detect underlying principles. Research shows that experts tend to organize knowledge around deep conceptual structures, whereas novices rely on surface features. Although this pattern is well documented for conceptual scientific knowledge, less is known about whether expertise is associated with recognizing deeper meta-scientific principles known as the Nature of Science (NoS).

The present study examines the relationship between science expertise and the ability to recognize NoS themes across diverse science domains, as well as the role of training in supporting this ability. Using a four-condition between-subjects design (novice-control, novice-training, expert-control, expert-training), participants read nine scientific statements reflecting three NoS themes and three domain topics and categorized them into groups. Participants in the training condition first completed a training lesson introducing the NoS themes. Categorization strategies will be analyzed using qualitative coding and computational modeling to assess whether participants group statements based on NoS themes (deep structure) or domain topics (surface features).

We hypothesize that experts will more often categorize statements by NoS themes and that training will support novices in adopting more expert-like categorization strategies.

Yolanda Yunluan Feng

Neurobiology, Marshall

Mentored by Claire Meaders

*How do we achieve agreement? Exploring the purpose of consensus meetings in a classroom observation study*

Structured classroom observation protocols are tools developed to systematically characterize a specific aspect of an instructor's teaching. As part of a larger research study, we observed college STEM courses using three protocols to generate data on teaching practices as a form of instructional feedback. Trained

observers coded class sessions by identifying and documenting behaviors defined by each protocol. Because each session was coded by two independent observers, we needed to establish consistency between those judgements. This is called inter-rater reliability (IRR). In this presentation, we describe the process of reaching IRR across our research team.

IRR was evaluated using percent agreement and Cohen's kappa. Percent agreement captures the proportion of coded units on which two independent coders agree, whereas Cohen's kappa accounts for agreement by chance. We discuss the thresholds used to establish acceptable agreement and the iterative process required to reach them. Central to this process were regular consensus meetings, which created opportunities for coders to share their reasoning and discuss challenging codes. We also describe best practices for documenting decisions from these meetings to maintain consistency in coding over time.

Establishing high interrater reliability ensures that our findings are reproducible and minimizes variability introduced by individual coders. This reduces bias in the interpretation of results and strengthens the credibility of our conclusions within our overarching research study. The approach we used to reach consensus highlights the process required to reach agreement in projects involving qualitative or observational analysis, and offers a model for similar research contexts.

Riya Fernando

Computer Engineering, Warren

Mentored by Tal Einav

*Using summer vaccination to boost antibody durability from influenza vaccination in the fall*

Although booster shots are commonly used to improve the resistance of patients to a pathogen, influenza vaccines are only administered once per year in the fall. In this study,

we assessed whether an influenza booster given in the summer works as well as a vaccine given in the fall, and if receiving both the summer and fall vaccination further enhances immunity. We used hemagglutination inhibition (HAI) titers to assess the antibody response for two cohorts given summer and/or fall vaccinations in 2024 and quantified their geometric mean fold change against multiple variants. Preliminary findings show that vaccination in the summer leads to increased antibody titers in the fall, and that a booster vaccination in the fall helps maintain those titers for longer than is seen from the standard fall vaccination alone. This work paves the way to understand the impact of booster immunizations for influenza and create long-lasting immunity.

## Carolyn Foo

Human Biology, Seventh

Mentored by William Pelham

*Mediators of the link between parental monitoring and youth adjustment: a review of the evidence*

Parental monitoring - how much parents track what their teenager is up to - is associated with improved youth adjustment. However, the mechanisms underlying this link remain unclear. By what mechanisms does parental monitoring affect youth adjustment? This systematic review aimed to review every published study that has tested a statistical mediator of this link.

We searched for eligible studies in archived databases, by inspecting reference lists in review chapters and authoritative texts, and by contacting authors who study this topic. We required that the study (a) enrolled youth  $\leq 18$  years old, (b) measured parental monitoring as parent action (vs., e.g., knowledge), and (c) linked monitoring to any form of youth adjustment.

13 studies have tested a statistical mediator of the link between monitoring and adjustment. All studies were non-experimental and none made a substantial effort to rule out potential confounders. There was at least one statistically significant test for 24 different mediator-outcome pairs, but 2 mediational pathways had been replicated in at least two independent samples. Effect sizes for single mediators were universally small, suggesting multiple mediators would be needed to explain the full effect.

Overall, the field does not have rigorous evidence on the mediators that may link parental monitoring to youth adjustment. There are few published tests for any given mediator and all tests have serious methodological limitations (e.g., use cross-sectional data). As a

result, many competing theories about the mechanisms relating parental monitoring to youth outcomes remain consistent with the available evidence.

## Curtis Furukawa

Bioengineering: Biotechnology, Sixth

Mentored by Irina Kufareva

*The C-terminal PDZ-binding motif of Cx40 is regulated by phosphorylation and required for the formation of functional intercellular channels.*

Due to proprietary information, this abstract has been redacted.

## Moumen Gabir

Neurobiology and Cognitive Science (Spec. Machine Learning and Neural Computation),  
Marshall

Mentored by Kay Tye

*Stress, Coping, and Sex: Why Studying Females Changes the Story*

Stress-related psychiatric disorders are characterized by substantial heterogeneity in behavioral expression and treatment response, which exposes important limitations in diagnostic and preclinical frameworks that collapse across distinct coping strategies. Using a chronic stress model, this work demonstrates that stress coping behavior is organized in a sex- and estrus-dependent manner, revealing biologically structured variability that is often obscured by male-biased study designs and reliance on summary behavioral measures. Together, these findings underscore the need for increased behavioral and biological granularity in preclinical research to improve translational insight into stress vulnerability, resilience, and differential treatment response.

Tamanna Gandhi

Human Biology, Marshall

Mentored by Cheryl Anderson

*Assessment of Healthy Dietary Patterns that Promote Cardiovascular Health in South Asian Immigrants*

**Background:** Cardiovascular disease is potentially modifiable by dietary practices. Although healthy dietary patterns are strongly associated with lower cardiovascular risk, most indices were developed in predominantly non-Asian populations, and it is unclear whether they are culturally appropriate or effective for South Asian populations.

**Objective:** To evaluate how healthy dietary patterns that promote cardiovascular health are assessed in South Asian immigrants.

**Methods:** We searched PubMed and reviewed additional peer-reviewed clinical and observational studies published through 2026. Search terms included combinations of the following keywords: dietary patterns, dietary assessment, cardiovascular disease risk, and South Asian population. We examined commonly used dietary indices, including the Healthy Eating Index (HEI), Alternative Healthy Eating Index (AHEI), Planetary Health Diet Index (PHDI), DASH-style diet, Mediterranean-style diet, and plant-based diets. This review draws primarily on findings from the Mediators of Atherosclerosis in South Asians Living in America (MASALA) Study, a large community-based cohort investigating cardiometabolic risk among U.S. South Asian adults.

**Results:** Data collection is ongoing and results are forthcoming.

**Innovation and public health implications:** Understanding whether current diet assessments accurately capture the dietary behaviors of the South Asian population is essential for informing effective cardiovascular disease prevention strategies. These findings can guide the development of culturally tailored dietary guidelines and public health policies in the United States to better address cardiovascular risk in the South Asian population.

## Alexis Garcia

Mathematics - Computer Science, Sixth

Mentored by Bradley Voytek

### *Visual Question Answering via Small Language Models with Neuroscience Priors*

Neuroscience literature is vast and expanding rapidly, generating both an extensive weakly structured corpus of neuroscience data, as well as a challenge for discovering the right answers to specific questions. NeuroVLM approaches this problem by providing a visual language framework trained on over 30,000 neuroscience publications, enabling a natural translation between brain activation maps and natural language. However, a challenge that remains is related to the inherent structure of peer-reviewed journals, which limits the reach of NeuroVLM into different tasks that can enable deeper user interactions. Building on NeuroVLM, we extend this framework to visual question answering, analyzing how small language models can be adapted to answer neuroscience questions with and without retrieved context powered by NeuroVLM's neurovectors.

We evaluated adaptation strategies using SmolLM2-1.7b-Instruct under four different conditions: zero-shot and fine-tuned with and without retrieved context. To initially quantify performance using scalable but coarse metrics, we focused on NLP text similarity metrics. We evaluated our LLMs' performance on 4000 examples from our PubMed neuroscience dataset using BLEU, ROUGE and BertSCORE F1. To further evaluate the LLMs' performance on a stricter but less scalable method, we conducted a reader study where neuroscience experts ranked preferred responses.

We conclude that fine-tuning allows for answers to become more similar to a ground truth, yet reader preference and the impact of retrieved context is not necessarily aligned with these metrics.

## Mariana Garcia

Cognitive and Behavioral Neuroscience, Muir

Mentored by Deanna Greene

### *Investigating Brain Cortical Thickness of the Somato-Cognitive Action Network in Children*

Recent work identified a previously unrecognized brain network in the primary motor cortex: the Somato-Cognitive Action Network (SCAN). Unlike classically defined motor regions that support fine movements of specific effectors (e.g., foot, hand, mouth), the SCAN is an interleaved, non-effector network thought to coordinate whole-body movement by integrating goals, body states, and physiological information. The SCAN exhibits a thinner cortex than adjacent somatomotor regions in adults.

Cortical thickness declines across childhood and adolescence before stabilizing in adulthood. It remains unclear whether the structural distinctiveness of SCAN observed in adults is already present in childhood or emerges through development.

The SCAN was discovered using precision functional mapping (PFM), an fMRI approach that leverages highly sampled, within-individual data to generate reliable, personalized maps of brain networks. Therefore, the present study used a unique child PFM dataset (N=11, 8-12 years old, 6M, 5F) to first isolate the SCAN, and then to examine cortical thickness in the SCAN and neighboring somatomotor regions. With 1-5.5 hours of resting-state fMRI data per child, we localized each child's individualized SCAN regions. Having identified these regions, we computed cortical thickness estimates from the SCAN and adjacent motor regions along the primary motor cortex. We found that the SCAN is significantly thinner than adjacent motor regions in children as previously shown in adults. This finding suggests that the SCAN's structural distinctiveness may represent a stable organizational feature of the motor cortex, providing insight into the developmental organization of brain circuitry involved in motor control.

## Ananya Giri

Ecology, Behavior and Evolution, Revelle

Mentored by Aniket De

*How to Kill a Tiger: British and Adivasi Ways of Seeing Wild Animals in Eastern India, c. 1860–1910*

This project brings together the fields of animal history and indigenous history in the study of colonial India to reveal new sets of political-economic relationships between the colonial state, adivasi communities, and animals in the forests of eastern and central India, particularly with reference to the Santals, the most numerous adivasi (indigenous) group in India. Drawing on colonial administrative accounts, hunting memoirs, and Santal literature, I explore divergent British colonial and Santal approaches to wild animals and hunting. I argue that colonial administrators devised a “hierarchy of value”

in classifying wild animals, one based largely on the damage they inflicted on the agrarian economy. Santal stories, by contrast, framed animals in terms of the dangers they posed to everyday life and survival. The hierarchical conception of animals served to inform colonial attitudes toward hunting, in which imperial shikar was elevated, while adivasi hunting was dismissed as primitive and wasteful. I show how the agrarian frontier in the Santal Parganas emerged as a theater of conflict between these competing ways of seeing. By treating animals as a historical and political-economic question of the agrarian-forest borderland, the project reveals distinct human relationships to the forest, shaped by power, subsistence, and survival.

## Jack Green

Astronomy & Astrophysics (B.S.), Muir

Mentored by Karin Sandstrom

### *Mapping the Emission from Aromatic and Aliphatic Hydrocarbons in a Low Metallicity Photodissociation Region in the Small Magellanic Cloud*

Polycyclic aromatic hydrocarbons (PAHs), small dust grains composed of bonded benzene rings of C and H, significantly contribute to the IR luminosity of star forming galaxies and help to establish the phases of the interstellar medium. Measuring the 3.3 $\mu\text{m}$  and 3.4 $\mu\text{m}$  emission features in photodissociation regions (PDRs), where chemical evolution occurs on small spatial scales, is essential for understanding the life cycle of PAHs. Until recently, The characteristics of PAHs in low-metallicity PDRs have not been observed due to previous limited spatial resolution in the IR, leaving crucial gaps in our understanding of PAH population characteristics. In this study, we use the James Webb Space Telescope NIRSpec IFU G395m grating to collect high spatial resolution spectroscopic data for the 3.3 $\mu\text{m}$  and 3.4 $\mu\text{m}$  features that were previously not achievable. We observe the N13 low-metallicity ( $Z = 0.2Z_{\text{sun}}$ ) PDR in the Small Magellanic Cloud (SMC) at sub-parsec resolution and present integrated intensity maps of the 3.3 $\mu\text{m}$  and 3.4 $\mu\text{m}$  feature strengths across the region by decomposing the spectra. We also present the ratio maps between the 3.4 $\mu\text{m}$  and 3.3 $\mu\text{m}$  features, along with comparisons to molecular and atomic hydrogen maps. Preliminary results indicate a systematically higher 3.4/3.3 ratio in the N13 PDR than in the Orion Bar. These comparisons allow us to map the aromatic-to-aliphatic hydrocarbon ratio across different phases of the ISM and disentangle the bottom-up versus top-down formation mechanisms of these small dust grains.

## Marlenne Gutierrez

Human Biology, Marshall

Mentored by Kim Dore

### *Linking Brain Protein Palmitoylation in Different Sub-Cellular Fractions to Performance in Memory Tests*

Although synaptic loss is increasingly recognized as a core feature of Alzheimer's disease (AD), the molecular mechanisms driving this process remain poorly understood. Proper synaptic function depends on the precise localization of thousands of proteins, a process in which palmitoylation, affecting 40-50% of synaptic proteins, is thought to be critical. For example, palmitoylation is essential for the function of PSD-95, a major postsynaptic protein. We found that palmitoylated PSD-95 was reduced in female AD model mice and that these mice had significant memory deficits, suggesting a link between memory and synaptic protein palmitoylation. The goal of this project is to determine if palmitoylation of synaptic proteins plays a critical role in brain resilience. To do so, we performed behavioral tests: Object Location Memory and Morris Water Maze to identify the best performers (resilient) and worst performers (susceptible) in four groups of mice: male and female wild-type and AD model mice. To increase the spread of behavioral outcomes for classification, we used an older cohort of mice (20-28 months old). Brain samples are homogenized and fractionated using high-speed centrifugation on a density gradient to obtain: mitochondria, synaptosomes, light membranes, and myelin. By optimizing our protocol, we obtained 100-200 µg of synaptosomal proteins per hemisphere. Protein palmitoylation is then quantified with Western Blotting. Resilient mice are expected to have increased palmitoylation in synaptosomes, which should be reduced in susceptible mice. Together, these experiments should provide new insight into resilience to aging and AD, and potentially lead to future therapeutic strategies.

## Caroline Hall-Sherr

Cognitive Science and Linguistics, Seventh

Mentored by Sarah Creel

### *Perception and Production of R/W Contrasts in Preschool Aged Children*

The production of /r/ sounds is difficult for many young children, resulting in variable realizations such as /w/ substitution (e.g. "wabbit" for rabbit). While /r/ and /w/ are

acoustically similar, they differ in formant placement. Typical adult /r/ productions are marked by f2 and f3 values that are very close to each other, whereas typical adult /w/ productions are characterized by a wider distance between the f2 and f3. These acoustic differences are an important cue for distinguishing the phonemes. The current work addresses how formant height impacts children's perception of their own /r/ and /w/ productions. Our data includes single word utterances with /r/ or /w/ onsets (N=72; tokens: 377) from 3–5 year old children. Children's perceptual accuracy was measured using a pointing task with 4 pictures and auditorily presented similar-sounding word pairs (hear "wing", see wing, ring, ship, and chip). While pointing accuracy was not significantly predicted by onset type, the acoustic cues predicting accurate pointing differed for /r/ and /w/. Generalized logistic mixed effects modeling revealed that f3 height and f2/f3 distance predicted pointing accuracy for /r/ onset words. Attempted productions of /r/ with lower f3 values, and consequently smaller f2/f3 distance, were more likely to be correctly interpreted as /r/ by children listening to their own speech. Formant heights did not predict perceptual accuracy for /w/. This work provides insight into the acoustic cues children use to interpret their own utterances, and the differences between adult and child interpretations of formant cues.

Leo Harris

Ecology, Behavior, and Evolution, Marshall

Mentored by Maria Vernet

*Explorations of Plastics and Prey in Gut Contents of Northern Fulmars (*Fulmarus glacialis*)*

Due to proprietary information, this abstract has been redacted.

Olivia Hawrysh

Mechanical Engineering, Sixth

Mentored by Maziar Ghazinejad

*Transfer Learning for Automated Vision-Based Metrology in Additively Manufactured Steels*

Machine vision-based methods have emerged as a rapid means of identifying and classifying features from large datasets or images with complex patterns. When applied to scanning electron microscopy (SEM) data of metals, Machine learning (ML) models can accurately extract information about defects and other microstructural features present in the images. While such models benefit from the high fidelity of SEM images, acquiring SEM datasets of adequate size for training and testing can be costly and time-consuming. Optical microscopy (OM) models have been considered a more accessible and affordable alternative to SEM, achieving comparable defect characterization performance, though at the trade-off of decreased image resolution.

In this study, we leverage transfer learning techniques to investigate whether a machine vision model trained exclusively on OM images can be extended to identify defects in SEM images of direct metal laser sintering (DMLS)-printed 316L stainless steel samples. This approach enables automated, high-throughput microstructural analysis of SEM images, but subverts the training data demands of a SEM-based model. OM is advantageous because it enables rapid image acquisition, reduces computational demands, and integrates seamlessly with automated feature detection workflows.

The goal is to enable robust metrology of AM samples, as the microstructural defects inherently introduced by AM processes can significantly degrade mechanical performance of 3D-printed parts. Automated metrology for defect classification can improve the understanding of performance in dynamic, real-life loading scenarios. It offers valuable insights into predicting the mechanical behavior of AM steels and paves the way for future advancements in manufacturing quality control.

## Crystal Hernandez

Psychology- Specialization in Clinical Psychology, Muir

Mentored by Cindy Chang

*Clinician and Veteran Perspectives on The Role of Trauma in Providing Mental Health Care and Suicide Prevention to LGBTQ+ Veterans at Risk of Suicide*

Lesbian, gay, bisexual, transgender, and queer (LGBTQ+) Veterans have a greater prevalence of experiencing traumatic events, including identity-based traumas, Criterion A traumas, and minority stressors. These disparities often coincide with elevated risk of suicide, however, little research has examined lived experiences of this population regarding mental healthcare and suicide prevention. This study investigated clinician and Veteran perspectives of incorporating trauma into mental healthcare through in-depth

interviews with 10 LGBTQ+ Veterans who have experienced suicidal thoughts and behaviors (STBs) and 9 clinicians who work with this population at the Department of Veterans Affairs. Patterns were identified via reflexive thematic analysis of transcribed interviews. Preliminary themes included: 1) trauma as a contributor to interpersonal risk factors for suicide (e.g., thwarted belongingness and perceived burdensomeness); 2) the importance of expanding Criterion A definitions of traumatic events; 3) the unique role of military-specific experiences and policies as stressors (e.g., Don't Ask, Don't Tell); and 4) the need for suicide prevention efforts to consider minority stress and unique challenges that affect LGBTQ+ Veterans. Both clinicians and Veterans identified trauma as a significant driver of STBs, noting that interventions are insufficient when trauma remains unaddressed. Findings highlight that healthcare systems must prioritize trauma-informed care and address traumatic stress symptoms to provide comprehensive and effective suicide prevention for LGBTQ+ Veterans.

J Hernandez

Cognitive Psychology B.S., Warren

Mentored by Celeste Pilegard

*Education and Eye Tracking: Examining the Interaction of Expertise and Spatial Contiguity and Impact on Meaningful Learning via Multimedia Models*

Novices' meaningful learning from multimedia can be enhanced through the spatial contiguity effect, in which text and diagrams are integrated rather than separated. This enhanced learning is associated with increased eye movements between text and pictures called integrative saccades (Johnson & Mayer, 2012). The current study investigates how the expertise reversal effect (Kalyuga, 2021), in which experts show reduced benefits from spatial contiguity, is reflected in these eye movements. Novices (psychology students) and experts (upper-division mechanical engineering majors) viewed lessons about mechanical devices. The study manipulated model type (integrated vs. separated) within subjects and expertise between subjects. Learning was measured via retention and transfer questions, and integrative saccades were recorded with an eye tracker. Consistent with previous research, we predict that novices will benefit more from integrated models, and that experts will score higher than novices overall and show no difference between models. There are 2 predictions for patterns in eye movements: if experts integrate information mentally, we expect to see fewer integrative saccades than novices for both model types. However, if experts integrate information visually even without

instructional scaffolding, we expect more integrative saccades than novices in the separated condition.

## Ian Hicke

Ecology Behavior and Evolution and Education Studies, ERC

Mentored by Patrick Rohner

### *Comparison of Insect Assemblages in Native and Non-Native Plant Communities*

Local ecosystems have faced human disruption for centuries which has significantly impacted biodiversity. Anthropogenic stressors include pollution, habitat fragmentation, urbanization, and species introductions resulting in biodiversity decline or altering ecological interactions. Eucalyptus trees are non-native species introduced to San Diego in the early 1900s from Australia, but their ecological impacts remain poorly understood, especially for insects. To examine the ecological effects of eucalyptus trees, insect communities were sampled using pitfall traps and pan traps from two native sites, chaparral biomes from the UC San Diego Ecological Reserves, and two non-native sites, areas on UCSD campus with a high abundance of eucalyptus trees. Across habitat types and seasons, richness, diversity, evenness and abundance were measured revealing ecological differences between environments. Identification of insect families revealed distinct insect assemblages across habitat types. These results give new insights into the impact of eucalyptus trees on insect biodiversity and demonstrate how the introduction of novel plant communities can influence ecological communities.

## Mimi Hoang

Molecular and Cell Biology, Revelle

Mentored by Eduardo Fricovsky

### *Inhibition of Lactate Dehydrogenase by Traditional Chinese Medicines (TCM)*

Cancerous cells rely heavily on anaerobic metabolism to spread. As a result, novel therapies have emerged focused on inhibiting key enzymes such as Lactate Dehydrogenase and limiting energy supply. By identifying possible anti-cancer properties of Traditional Chinese Medicine, the aim of this study is to identify natural products that create novel therapies in cancer treatment through the inhibition of Lactate

Dehydrogenase – preventing the conversion of pyruvate to lactate and fueling cancerous cell spread.

To determine the rate of inhibition, spectrophotometric enzymatic assays were used to measure typical rates of Lactate Dehydrogenase inhibition compared to that of the presence of Traditional Chinese medicinal herbs concentrated into tea. Through enzyme inhibition kinetics analysis, natural products such as Jiaogulan (*Gynostemma pentaphyllum*), Rehmannia (*Rehmannia glutinosa*), and Goldthread (*Coptis chinensis*) showed significant inhibitory effects.

## Iris Hochwalt

History, Revelle

Mentored by Aniket De

### *Modern Wife, Modern Marriage: The Construction of the Ideal Woman in the Satires of Parashuram*

Women's lives and achievements are often measured against an imaginary standard: that of the ideal woman. In South Asia, women often appear in the imperial record in relation to their conformity to British imperial and South Asian ideals, but the imperial record does not allow for a recovery of the South Asian ideal woman on her own. Literary sources offer the potential to recover the South Asian ideal woman of the Western-educated middle classes, particularly for women of the Bengali bhadralok, known as the bhadramahila. The 20th century satirist Parashuram's short stories were analyzed to recover the Bengali bhadralok's ideal woman through examining the ideal woman and the deficient or "bad" woman. Through analyzing how men in the satires are made good or bad by the women in their lives, the importance of the ideal woman becomes apparent. The deficient woman is bad because she makes men effeminate through dominating them, which makes salient the colonial stereotype of effeminate Bengalis that had been used to deny Bengali men political agency. In contrast, the ideal embraces desirable elements of both Bengali society and Western society; the ideal marriage rejects dowry, as the woman's skills make her of equal worth. Neither tradition nor Western modernity will make a bhadramahila "good." The history of how this modern ideal woman and marriage were constructed suggests how one South Asian social class attempted to construct their own modernity through literature in place of conforming to imperial norms or reviving conservative tradition.

## Michael Hoffman

Mathematics, Muir

Mentored by Aaron Pollack

### *Conjecture of Gross - Fourier Coefficients on $G_2$ and Cubic Twist L-Values Part I*

Benedict Gross has a conjecture relating the square roots of the central values of a certain L-function of a cuspidal eigenform  $f$  to the Fourier coefficients of the lift of  $f$  to the group  $G_2$ . In this talk, we describe our methods to compute the central values of the L-function of  $f$ , twisted by a Dirichlet character associated to a Galois cubic field. We will provide evidence for this conjecture of Gross via comparison with Fourier coefficients on  $G_2$  computed by Aaron Pollack.

## Meilani Hollenbeck

History, ERC

Mentored by Verónica Martínez-Matsuda

### *“Bridge or Wedge”: Asian Americans and the Affirmative Action Debate in Higher Education*

Asian American students have significantly shaped the debate over the consideration of race in university admissions decisions. The media has played a major role in positioning Asian Americans at the center of this discussion by influencing the public’s perception of them. My research explores how Asian American University of California (UC) students’ distinct positions in the affirmative action debate impacted all minority students’ access to higher education and the notion of “diversity” at universities nationwide. By analyzing newspaper articles published in the 1970s to early 2000s, I juxtapose news reporters’, UC representatives’, and government officials’ framing of Asian American UC students to these students’ statements and activism. Additionally, through a total of fifteen interviews with current Asian American UC students, this thesis explores contemporary views on the consideration of race and use of comprehensive review in the UC admissions process. Ultimately, my research dispels common misconceptions about Asian Americans and race-conscious admissions policies by disrupting the black-and-white paradigm that is routinely used to examine this topic. Although Asian American UC students’ beliefs have transformed over time, their individual experiences illustrate how they continue to hold a prominent position in the affirmative action debate. If the UC system remains committed

to improving minority students' access to higher education to ensure societal progress and create more equitable opportunities for everyone—especially at a time when the federal government is eliminating the the promotion of diversity, equity, and inclusion (DEI) on college campuses—it is vital to consider Asian Americans' position in these efforts historically.

## Makenna Holst

Neurobiology, Muir

Mentored by Nathan Shaner

### *Developing an improved red fluorescent calcium sensor for cellular imaging*

Genetically encoded fluorescent calcium sensors allow for noninvasive imaging of cellular signaling in neurons. Green-emitting indicators like the GCaMP series have undergone many generations of optimization, but it remains challenging to optimize red-emitting indicators to equivalent performance in terms of brightness and photostability. We sought to generate an improved red fluorescent calcium sensor scaffold by evolving the peptide linker connecting the C and N terminus of a circularly permuted (cp) variant of the red fluorescent protein mChilada. We initially screened libraries of linker variants in a cp-mChilada scaffold with a truncated N terminus, identifying a promising linker sequence that appeared to improve the folding and/or maturation rate of the fluorescent protein. Directed evolution of this variant revealed additional point mutations that further improved this cp-mChilada variant. However, when this cp-mChilada clone was incorporated into various calcium sensor constructs, the resulting proteins failed to fold properly and had dim or absent fluorescence, though some displayed small calcium-dependent fluorescence changes. These results suggest that while the evolved linker mutations may improve properties of the fluorescent mChilada locally, they are insufficient to support proper folding and function within a complete calcium sensor construct. Based on these findings, current work has shifted toward a new cp-mChilada design that retains the original longer N terminus of mChilada while incorporating the beneficial mutations discovered during previous directed evolution processes. We aim to preserve favorable sequence changes while restoring proper folding and functionality, and ultimately develop an improved red fluorescent calcium sensor with increased brightness and reliability for biological imaging.

Cuixia Hong

Psychology B.S., ERC

Mentored by Adena Schachner

*Do Children's Beliefs About Digital Devices as Informational Sources Influence Their Learning Outcomes?*

Due to proprietary information, this abstract has been redacted.

Shiven (Steven) Hu

Applied Mathematics, Muir

Mentored by JiaWang Nie

*A Hybrid Explicit-Implicit Gradient Descent Ascent Framework for Nonconvex-Nonconcave Min-Max Optimization*

Min-max optimization has become a cornerstone of modern machine learning, formalizing the competitive dynamics found in real-world applications such as generative adversarial networks (GANs), adversarial robustness, and multi-agent reinforcement learning. However, standard explicit gradient methods (GDA) frequently fail to converge in general nonconvex-nonconcave landscapes, while implicit methods offer stability but are computationally prohibitive to apply globally. We propose a Hybrid Explicit-Implicit GDA framework that combines the global exploration efficiency of explicit methods with the local stability of implicit updates. This paper also presents a rigorous convergence analysis for finding saddle points in a class of functions without global convex-concave condition by using our Hybrid strategy.

## Anny Huang

Double Major in Human Biology and Psychology, Sixth

Mentored by Xi Fang

*The role of Mitochondrial Stress Response in Cardiomyopathy.*

Due to proprietary information, this abstract has been redacted.

## Emma Huang

Electrical Engineering, Marshall

Mentored by Michael Yip

*Reeling It In: Flexible Needle Pick Up via Thread Manipulation for Autonomous Suturing*

Suture-needle pickup is necessary for autonomous suturing, as a needle can be unexpectedly dropped or strategically released to adjust the grasping configuration.

Current methods for autonomous needle pickup typically guide a robot to move straight toward the needle and grasp it, limited to conditions where the needle is observable and directly approachable.

In addition, grasping the needle lying on tissue can lead to the robot pinching nearby tissue or the needle jumping around due to its slippery surface, posing potential safety issues.

This work proposes an autonomous framework that uses a suture thread as an assistive tool for indirect needle pickup, avoiding unnecessary tool-tissue contact and enabling pickup even when the needle is occluded or inaccessible.

The framework spans the entire workflow, including thread and tissue reconstruction, safe grasp-point selection, stable thread lifting, and bimanual thread-following until securing needle grasping.

The robot policies account for visual uncertainty to maximize robustness in real-world environments.

We evaluate the proposed framework on a da Vinci Research Kit under various real-world conditions.

The results demonstrate robust performance even with a challenging thread configuration or a non-approachable needle, closing the gap in applying autonomous robot policies to unstructured suturing environments.

## Kokoro Igawa

History & Sociology, Marshall

Mentored by Aniket De

### *When Two Roads Diverged: The Roots of Tagore and Noguchi's Pan-Asian Disagreement*

Rabindranath Tagore and Noguchi Yonejiro were both Asian intellectuals who propounded their pan-Asian ideals in the early 20th century and once considered themselves close friends. However, by 1938, it seems as though their perspectives could not have been more irreconcilable—one, a staunch nationalist parroting the views of an imperial state, and the other, an internationalist proponent of humanism and spiritual unity beyond the politically constructed borders of a nation.

Through a critical analysis of Tagore's thought, this study asks: How did Tagore's pan-Asian vision change in the interwar years? Could the roots of the two poets' disagreement be identified in 1916, or were Japan's increasingly expansionist policies responsible for their divergence on the question of pan-Asianism as a viable path to peace? This study examines the letters exchanged between Tagore and Noguchi alongside the former's writings on and experiences in Japan during his first 1916 trip and his subsequent travels. It also analyzes Noguchi's largely unexplored book, *Tateyo Indo*, which was written in Japanese and illustrates his interpretation of pan-Asianism.

This study concludes that Tagore's pan-Asian ideal slowly transformed as historical context developed, and his vision for Asian universalism diverged so dramatically from those like Noguchi as he traveled, met with Japanese and colonized intellectuals, and was faced with the realities of Japanese imperialism. However, the differences between him and Noguchi were identifiable from the beginning of their relationship, and these events did not create the rift but certainly widened it beyond remedy.

## Julian Jackson

Astronomy and Astrophysics, Sixth

Mentored by Adam Burgasser

### *Crazy Cool Quasars: An Infrared Spectra Survey of Quasars*

Quasars are compact regions of bright emissions powered by supermassive black holes (106 - 1010 Solar Masses) that are rapidly consuming gas and dust. They have long been observed at optical wavelengths through surveys such as the Sloan Digital Sky Survey (SDSS), with thousands of spectra published. However, there are a far more limited number of quasar spectra covering near-infrared (NIR) wavelengths due to the lack of efficient NIR spectral surveys. NIR observations of quasars is important, as these sources can be very faint and heavily redshifted, making them brighter at longer wavelengths. This project aims to expand the number of NIR quasar spectra by reducing and analyzing data from the IRTF/Spex archive, a collection of over 20 years of NIR spectral observations that include previously unpublished quasar observations. I will present the process by which these observations were identified and reduced using the newly-developed pypextool package. I will then describe spectral analysis of these data, in particular measurement of redshifts and emission line strengths using the composite spectral template of Glikman et al. (2006). These new spectra will help improve our understanding of the geometry, emission processes, and evolution of quasars over cosmic time.

## Lily Ji

Microbiology, Revelle

Mentored by Scott Biering

### *Calprotectin inhibits dengue virus nonstructural protein 1/matrix metalloproteinase 9-triggered vascular leak*

Due to proprietary information, this abstract has been redacted.

Sam Johnson

Clinical Psychology, Sixth

Mentored by Melinda Owens

*Effects of Scientist Identity in Student Responses to Scientist Spotlight Assignments*

Research has shown that many minoritized students in STEM feel disconnected from their aspirations due to lack of representation in the classroom, among other obstacles. The Scientist Spotlight initiative brings diversity to classrooms by requiring students to learn about scientists from underrepresented backgrounds by reading a biography with a description of their research and writing a short response. This study investigates how different scientist's stories result in varying themes from student reflections based on the scientist's unique identity and the characteristics of the biography. Scientist biographies and student responses were qualitatively coded with a focus on codes including themes about diversity, self-efficacy, and humanizing scientists. The codes and themes present in each biography are being compared to those present in the corresponding student reflections. Such analysis can surface which codes and themes students drew directly from the biographies and which ones the students came up with themselves upon reflection.

Although this research is still ongoing, preliminary findings show that specific codes present in the biographies seem to correlate with the codes that students mention in their reflections. In particular, "rare" codes (ones outside of the top five codes for each scientist) appear to increase in prevalence only when present in the biographies, indicating that students build on distinctive elements of the scientists' narratives. Overall, this research shows that incorporating underrepresented scientist biographies can lead to both story-specific and generalized conclusions about the diversity of the science field that may ultimately influence students' perspective about belonging and capability within STEM.

Soobin Jones

Cognitive and Behavioral Neuroscience, Muir

Mentored by Lisa Eyler

*Cognitive Subgroups in Bipolar Disorder and Their Distinct Sleep Profiles*

Bipolar disorder (BD) is a psychiatric mood disorder characterized by severe fluctuations in affect, sleep quality, and behavior over the course of cyclic episodes. Patients with BD experience elevated rates of disability, difficulties with functioning, and significantly increased rates of suicide. A notable feature of the disorder is impaired cognition, which is closely linked to worsened life outcomes. Previous research identified subgroups of varying levels of cognitive functioning in people with BD, resulting in globally impaired (GI), selectively impaired (SI), and cognitively intact (CI) groups. Parsing features of BD correlated with worsened cognition is crucial for understanding the heterogeneous life outcomes associated with the disorder. Specifically, sleep disruptions have been previously identified as a potential predictor of worsened cognition in both people with and without BD. This study asks how actigraphy-based sleep-related characteristics, e.g., sleep duration, sleep latency, and sleep efficiency, differ between these cognitive subgroups. Different domains of BD patients' and healthy controls' (HC) cognition were assessed using the MATRICS Consensus Cognitive Battery; sleep data were collected using Actisleep-BT actigraphy watches. By dividing BD patients into subgroups based on cognitive performance, sleep characteristics can be compared between subgroups and the HC sample. We hypothesize that the more severely impaired groups will display more abnormal sleep profiles, with those in the GI group displaying the greatest deviation from the HC sleep characteristics. Investigating the association between sleep and cognition will expand our understanding of significant intervention targets to reduce the disease burden of BD and promote effective recovery.

Lauren Kaiser

Microbiology, Revelle

Mentored by April Lukowski

### *Uncovering Enzymatic Degradation of Toxic Polybrominated Compounds*

Guamanian marine sponge, *Lamellodysidea herbacea*, harbors vast amounts of these natural PBDEs, as well as a symbiotic bacterium, AHP, that encodes a putative Rieske oxygenase (RO-Ahp) of interest. TcsA is the only homolog to RO-Ahp that has been studied to date, with TcsA having the ability to degrade polychlorinated diphenyl ethers into their monocyclic constituents. Critically, RO-Ahp is found within a biodegradative gene cluster encoding enzymes typically associated with the oxidative breakdown of organohalogen pollutants. I hypothesize that RO-Ahp is a critical enzyme for AHP to both break down and also fully metabolize these natural PBDEs. In order to investigate RO-Ahp's function, I will first utilize heterologous expression to obtain soluble enzyme,

then explore the enzyme's function through in vitro biochemical assays. In addition, microbiological cell assays using culturable marine bacteria that encode highly similar biodegradative gene clusters will be performed to determine whether RO-Ahp enables degradation in vivo. Currently, I have obtained one of the two subunits of RO-Ahp; I expect to solubilize the second subunit and utilize both for preliminary activity analysis promptly. If the anticipated results are obtained, there is potential to utilize RO-Ahp in bioremediation of marine environments. Furthermore, downstream structural analysis of RO-Ahp provides an opportunity to integrate the utilization of these Rieskie oxygenases as biocatalysts in the manufacturing of useful chemical products.

## Amit Kannan

Physics, Revelle

Mentored by Yi-Zhuang You

### *Autoregressive Transformer Decoders for Quantum Error Correction*

We introduce an autoregressive Transformer decoder for quantum error correction that approximates maximum likelihood decoding via learned conditional inference. The model is trained in a supervised manner on syndrome-error pairs  $(x, z)$  sampled from a known noise model. Training combines teacher forcing with a squared log-ratio regularizer  $(\log p_{\theta}(z|x) - \log p_{\theta}(z))^2$  that penalizes deviation from the prior without full KL-divergence computation. The learned distribution  $p_{\theta}(z|x)$  enables Monte Carlo estimation of logical operator likelihoods for any observed syndrome. We introduce efficient inference strategies: greedy decoding ( $O(n^2)$  per syndrome), ensemble decoding, and syndrome-consistent best-candidate decoding. Numerical experiments on stabilizer codes under independent bit-flip noise demonstrate accuracy competitive with or superior to belief propagation. The framework generalizes to arbitrary code topologies and sampleable error models, with GPU acceleration enabling parallel decoding of multiple syndromes.

## Mridu Karanam

Molecular and Cell Biology, Marshall

Mentored by Lars Bode

*Nutrient Composition of Human Milk for the Premature Infant: Macronutrient Analysis of Pre and Post Enteral Feed*

In a neonatal intensive care unit (NICU) setting, continuous enteral tube feeding of human milk can result in nutrient loss, particularly fat, due to separation of milk fat globules and adherence to tubing surfaces (Paulsson et. al., 2021). These losses reduce delivery of essential fatty acids and other bioactive components critical for infant development (Zozaya et al., 2018). Through this research, we aimed to characterize the impacts of enteral tube feeding on fat, lactose, protein and human milk oligosaccharides (HMOs). Twenty-five paired clinical samples were collected from the NICU at Jacobs Medical Center in La Jolla. Pre-feeding (prepped) and post-feeding (scavenged) samples were analyzed. Fat was measured by creatocrit, lactose by Megazyme Lactose Assay, protein by Bicinchoninic Acid Assay, and HMOs by High-Performance Liquid Chromatography with fluorescent detection. Mean fat content was higher in scavenged (4.88 g/dL) compared to prepped sample (3.70 g/dL), indicating that scavenged samples are not representative of the milk that was fed to the baby and that fat is lost during an enteral feed. There were no significant losses of HMOs, range of HMO recovery was between 86-106%. Mean lactose remained the same (5.89 g/dL vs. 5.94 g/dL), as well as mean protein (1.98 g/dL vs. 1.93 g/dL). Losses were most pronounced in triacylglycerol and diacylglycerol lipid classes. Future directions should include optimizing milk preparation and feeding protocols to minimize fat loss and support better health outcomes for NICU infants.

Minh-Nha Kawamura

Neurobiology and Global Health, Seventh

Mentored by Sherry Hayes

*The Evolution of the Gender Gap in Olympic Swimming Performance*

Throughout the first half of the 20th century, female athletic performance in the Olympics improved at a rate significantly faster than men. Researchers questioned how the gender gap in athletic

performance would evolve and how much it would narrow in the subsequent years. We investigated the evolution of the Olympic gender gap specifically in butterfly swimming performance. Data from the 100 and 200 meter butterfly was collected for the Olympic games from 1956 to 2024 for gold, silver, and bronze medalists. The ratio of female time performance to male time performance was calculated for each entry. Paired t-tests and

Kendall tau-b tests were performed. There was an average 10.44% and 12.07% gender gap in performance for the 200 meter and 100 meter butterfly respectively. Additionally this gap did not narrow or widen from 1956 to 2024. The findings support the hypothesis that the gender gap has stabilized between 10-12% for Olympic butterfly races up to 2024. This gap is most likely a result of the physical differences between men and women which is more marked in the shorter 100 meter race.

## Izze Keith-Mahler

Literature/Writing, ERC

Mentored by Ariana Ruíz

*Breaking Writing Norms: Experimental Writing Practices in Bio-Prose and Poetry*

Get to Know Me: An Experimental Scroll is a poetry anthology that explores the theme of self through both content and form. In revising the collection, I reordered and stitched together poems written between 2019 and 2025 into a scroll-like structure that can be read digitally or physically rolled out, echoing older textual forms. While the work is published as a book, the project's artist statement reflects on the scroll form and how it shapes the experience of the poems.

The anthology developed from a poetry project completed during Spring Quarter 2025. Although publication for emerging authors is often difficult and fairly inaccessible, I wanted to bring my deliverable from the TRELS scholarship to life. Through a 21-day poetry program with BookLeaf Publishing, I submitted one poem per day from the collection and ultimately published the book in November 2025.

## Demir Khawaja

International Business, Sixth

Mentored by Munseob Lee

*Service as Strategy: Conscription, Human Capital, and Civic Development in South Korea and Israel*

Service as Strategy: Conscription, Human Capital, and Civic Development in South Korea and Israel

What if mandatory military service could actually help a country's economy and bring its people closer together? This paper explores that question by examining the national service systems of South Korea and Israel, two countries that have maintained military conscription while achieving remarkable economic growth and social cohesion.

Most debates about the draft focus on what young people lose: time, wages, and freedom. But this paper asks a different question: what can they gain? By analyzing decades of GDP data, youth unemployment rates, and surveys on civic trust, I show that when national service is designed well, it can build valuable skills, reduce youth unemployment, and strengthen the social fabric of a nation. South Korea's system helped create disciplined, career-ready workers during its economic rise. Israel's elite military technology units became pipelines for the startup culture that now drives nearly a fifth of its entire economy.

Meanwhile, the United States faces declining trust in government, rising inequality, and a generation of young people feeling disconnected from national life. Drawing on the lessons of Korea and Israel, this paper proposes a flexible American national service program, with military, technical, and community service options, that could help rebuild civic identity and expand opportunity for young Americans across all backgrounds.

The takeaway is simple: service works when it's designed to.

Noah Kim

Human Biology, Eighth

Mentored by Karl J. Wahlin

*Optimized Safe Harbor Site Integration for Sustained Gene Expression in Pluripotent Stem Cell Derived Models*

Pluripotent stem cells (PSCs) are an advantageous way to investigate human neurodevelopment and disease. The introduction of fluorescent reporters and functional transgenes via gene editing, lentiviral transduction, and transposase-mediated integration has greatly increased their utility. However, a major limitation in long-term models is transgene silencing, which reduces the efficacy of integrated DNA. Integrating DNA at defined genomic safe harbor sites (SHS) enables stable, reproducible integration of functional gene cassettes. SHS are genomic locations that, in principle, can accept genetic cargo and remain open to maintaining gene expression without disrupting nearby gene elements. Undifferentiated, pluripotent stem cells exhibit relatively stable transgene expression; however, upon exiting pluripotency and undergoing differentiation, transgene

expression is often silenced. Transgene silencing affects CRISPR screening, cell labeling in lineage-traced models, and the overexpression of functional proteins. The source of silencing is complex and influenced by genomic location, regulatory properties of the inserted genomic material, and the epigenetic landscape of the cell. This project explores SHS location, constitutive promoters, intronic sequences, and polyadenylation sites to optimize transgene plasmid design. We are also validating elements that have been shown to reduce silencing, including the inclusion of the open chromatin element from the HNRPA2B1-CBX3 (A2-UCOE) gene, the Woodchuck Posttranscriptional Regulatory Element (WPRE3), and the chicken  $\beta$ -globin locus hypersensitive site 4 (cHS4) insulator sequences. Gene expression will be evaluated in undifferentiated PSCs, general induced neurons, induced retinal ganglion cell neurons, and retinal organoids. Overall, this project serves to enhance understanding of available SHS and provide standardized ways to reduce transgene silencing.

## Sharon Kim

Education Science, Muir

Mentored by Amy Bintliff

### *The Long Road to AP: How EL Designation Shapes Academic Trajectories*

This research aims to address the specific challenges EL students face in pursuing advanced-level coursework and curriculum in California secondary schools. It will specifically examine how placement in EL tracks over multiple years shapes students' academic trajectories and access to AP-level coursework, arguing that the EL designation may function as a structural gatekeeping mechanism that negatively affects the opportunities available to these students. It will also investigate EL participation differences across AP subjects to better understand whether language support systems inadvertently contribute to stratified academic pathways. Understanding this relationship is essential for designing more equitable instructional models that support language development while preserving access to rigorous academic opportunities.

## Takuya Kitamura

Psychology BS. With Specialization in Cognitive Psychology, Marshall

Mentored by John Wixted

*The Independent Source Rule on Trial: Lineups Rewrite the Witness's Memory of the Perpetrator*

Despite the recent scientific consensus that a witness's memory of a suspect should be tested only once, the criminal justice system continues to assume that the original memory can remain independent, free from contamination, and be reliably tested in court after the initial test. This so-called "independent source doctrine" has consistently been applied in real-world cases, preventing the legal system from focusing on the first test. While previous research has demonstrated the risk of repeated testing, none has provided direct evidence against the assumption of an independent memory source. The present study adapts and integrates the continuous-report task from visual memory research with the traditional eyewitness paradigm to investigate how memory changes following exposure to a lineup. Participants will be asked to view a target face, complete a lineup test, and find the target from a continuous face wheel. It is hypothesized that subjects' memory reports from the face wheel selection task will be systematically biased toward the fillers seen in the lineup test had they made a filler identification, and away from the fillers had they made a correct identification. Findings from this study will reveal the scientific basis underlying the independent source doctrine, if any.

Daria Kouzminova

Cognitive Science, ERC

Mentored by Lieselot Carrette

*Visualizing Individual Variability in the Brain as Microstructural Differences Across Rat Strains*

Advancements in neuroscience have significantly improved our understanding of brain function and disorders, like substance use disorders. However, the complexity of the brain and the heterogeneity of these disorders necessitate controlled, comprehensive approaches across diverse populations to characterize individual variability. Longitudinal multi-parametric MRI can be used to assess brain features in genetically diverse rat models before and after substance use. We hypothesize that both pre-existing and substance-induced differences can be identified as MRI biomarkers.

As proof of concept, we imaged 5 rat strains (ACI, BN, F344, M520, and MR; N=8 males/group) at baseline using a 7T Bruker MRI system and compared anatomical (T2-weighted), microstructural (diffusion tensor imaging), and functional (resting-state BOLD-fMRI) measures. Here we present strain differences in fractional anisotropy (FA)

and mean diffusivity (MD), metrics reflecting white matter integrity and tissue microstructure. Voxel-wise one-way ANOVA with cluster-based correction (minimum cluster size = 7 voxels, voxel wise  $p=0.01$ , cluster threshold  $p=0.01$ ) identified 74 FA clusters and 81 MD clusters following skull stripping and alignment to the Waxholm rat brain atlas.

Broad-sense heritability ( $H^2$ ) averaged around 0.5, indicating that genetic factors account for approximately half of the observed micro structural brain variation. Strain-specific patterns emerged, with the BN strain showing the greatest divergence, consistent with its known genetic and behavioral differences. Next, molecular mechanisms underlying microstructural differences can be validated. Ultimately, this work aims to enable the identification of biomarkers of vulnerability and resilience, paving the way for improved prevention and personalized treatment strategies for substance use disorders.

## Arya Krishna

Microbiology, ERC

Mentored by Sergey Kryazhimskiy

### *Fitness effects of spontaneous mutations in budding yeast vary across strains and environments*

One of the central suppositions of evolutionary theory is that most mutations decrease fitness of organisms, and only very few mutations increase it. However, recent studies have suggested that instead, most mutations may be deleterious only in relatively well adapted organisms, but become beneficial in poorly adapted organisms. To test this pattern for spontaneous mutations, we conducted a mutation accumulation experiment in yeast *Saccharomyces cerevisiae* in which several strains with varying background fitness were propagated for 61 generations with minimal action of natural selection, allowing each strain to accumulate approximately three to nine new mutations. We then measured how the growth rates of these strains changed during this experiment. We found that in a permissive, nutritionally rich environment, the accumulation of spontaneous mutations led strains that initially grew quickly to lose fitness on average, whereas strains that initially grew slowly gained fitness on average. In contrast, in another more stressful environment, all strains gained or lost fitness by the same amount irrespective of their initial fitness. Overall, these results suggest that the statistical distribution of the effects of random mutations is far more complex and variable than previously thought.

## Kira Lavine

Anthropology Archaeology Concentration, ERC

Mentored by Zachary Dunseth

### *Camelid Coprolites: Reconstructing Virú Pastoralism through Phytolith Analyses of Chicama Valley Archaeobotanical Taxa*

Originating from the Viru Valley of northern Peru, Virú state (ca. 200 B.C.E. - 700 C.E.) was the earliest state to expand and establish colonies in the Moche and Chicama Valleys (Millaire et al. 2016). Iconic to Andean cultures, camelids such as llamas feature prominently in archaeological faunal assemblages across the region (Szpak et al 2020, 2014; Hultquist et al 2024). In 2023, Proyecto de Investigación Arqueológica de Puerto Malabrigo (PIAPM) excavated household structures at the Virú colony in Puerto Malabrigo, Chicama. As a coastal settlement, the colony had access to various local resources; floodplain crops (e.g., *Capsicum* sp., *Zea* mays, *Phaseolus* sp.), wild desert-dune taxa (e.g., Solanaceae, *Prosopis* spp.), and wetland plants (e.g., Cyperaceae, Poaceae). Opaline microfossils of plant cells, phytoliths, are proxies for diet through microbotanical analysis of camelid coprolites (Piperno, 2006). Analysis of these coprolites offer insight into Virú agriculture and husbandry practices (Gross 2010, Billman 2021). Additionally, phytolith reference collections for Andean taxa are improved through extraction and documentation of phytoliths from macrobotanical samples excavated by PIAPM. In this paper, we consider how phytolith insights from camelid coprolites can reveal foddering practices at Virú-Malabrigo (ca. 50 B.C.E. to 223 C.E.) and consider Virú-herder influence on coastal camelid diets. This project aims to contribute to the reconstruction of Virú camelid pastoralism through phytolith analysis with a goal of unraveling resource exploitation and the dynamic human-animal relationship while contributing to a reconstruction of the paleoenvironment in the archaeological record.

## Ashley Lee

Cognitive & Behavioral Neuroscience, Marshall

Mentored by Seana Coulson

### *Is Memory Encoding Shaped by Different Perceptual Associations?*

Subsequent memory effects (SMEs), describe the difference in neural activity during the encoding of items later remembered versus those that are forgotten. Prior studies have examined how perceptual associations of the stimuli facilitate word recognition memory, yet less is known about whether these relationships are reflected in neural responses during encoding. We are conducting a recognition memory study (ongoing, currently  $n = 18$ ) using electroencephalography (EEG) to investigate the neural encoding of sentences ( $n = 164$ ) as a function of their sensorimotor profiles as well as their subsequent memory performance. Sentences are presented in a rapid serial visual presentation (RSVP) format followed by a recognition memory task in which half of the studied sentences ( $n = 82$ ) are presented alongside foils ( $n = 82$ ). We quantify sensorimotor associations across 11 dimensions (6 sensory; 5 motor) using contextualized sensorimotor ratings collected from human raters and will use a regression-based ERP approach to test how these features relate to encoding-related neural activity and the later memory performance. We hypothesize that sentences with stronger sensorimotor associations are likely to be more correctly endorsed and less likely to be confused with the foils. We also predict that the sensorimotor strength will explain the encoding related to event-related potential differences, especially during the time window associated with semantic processing (200-500ms). Such effects would suggest that stronger sensory associations mediate the processes that predict subsequent memory.

Michelle Lee

Cognitive Science, Seventh

Mentored by Deanna Greene

*Characterizing Tic Expression During fMRI Scanning in Pediatric Tourette Syndrome*

Tourette syndrome (TS) is a neurodevelopmental disorder characterized by involuntary, repetitive movements and vocalizations in the form of motor and vocal tics. To study the neural mechanisms underlying tics, tics can be observed directly during fMRI scanning, allowing for the assessment of real-time brain activity. However, collecting high-quality fMRI data in pediatric and clinical populations can be challenging. Moreover, tics can vary substantially across different environmental contexts as well as between and within individuals. Therefore, characterizing tic expression during fMRI scanning, including the frequency, tic type, and contextual influence, can provide important insight into the feasibility and reliability of fMRI studies in pediatric TS. The current study aims to provide a detailed behavioral tic characterization during fMRI scans in pediatric TS. Tic expression will be examined in two densely-sampled participants: (1) 10-year-old girl

with comorbid attention deficit hyperactivity disorder (ADHD) and autism spectrum disorder (ASD), and (2) 15-year-old girl with comorbid generalized anxiety disorder. Video and audio recordings were collected during fMRI scans as well as outside the scanner. We will code the precise timing and type (e.g., eye blink, sniff) of tics across eight fMRI scan runs (97 minutes of video data) and ten out-of-scanner sessions (35 minutes of video data) per participant. We will quantify the number of tics per minute and types of tics, and compare these metrics for in-scanner vs. out-of-scanner videos. We hypothesize that tic frequency will be higher outside the scanner vs. inside the scanner and that tic expression will be individually unique.

Nicolas Leedy

Cognitive Science w/ Specialization in Machine Learning and Neural Computation, Sixth

Mentored by Andrea Chiba

*Model comparison via nested cross-validation: influence of hippocampal replay in decision making modeled with Classic and Meta Reinforcement Learning models*

Good decisions rely on evaluation of options compared to past experience. We compare the value of available actions by simulating their outcomes. Memory replay, the sequential reactivation of place cells in the hippocampus, is a possible neural correlate for such a memory simulation process that can be measured in animals at wakeful rest. Because replay often precedes behavioral choices, it is hypothesized to guide subsequent choices. However, recent studies have shown conflicting relationships between replay and subsequent choice posing a challenge to the concept of replay encoding the choice directly. Here, we evaluate an alternative hypothesis for the role of replay in memory-guided behavior where replay mediates a value-update mechanism: when an action is replayed, rewards of recent experiences are recalled to update the estimated value of the replayed action. We investigate the effect of replay on choice in an 8-armed bandit task using reinforcement learning models (RL) and small recurrent neural networks (RNN). We use nested cross validation (NCV) to perform model comparison between fitted RL models and RNNs. To train RNNs, we use early stopping to avoid overfitting. However early stopping requires a validation set separate from the test set. Furthermore, we find the hyperparameters with best average validation loss across innerfolds, and select the model closest to that average because it should generalize best to unseen data. NCV helps us select the model with best generalization accuracy and elucidate the functional significance of replay in decision making.

## Marc Levy

NanoEngineering, Revelle

Mentored by Olivia A. Graeve

### *Thermal conductivity of water-based titania nanofluids: Experimental results and modeling framework*

As heat dissipation demands grow in data centers, power plants, and other large-scale energy consuming systems, increasingly efficient heat exchange fluids are increasingly important for optimizing heat dissipation processes with respect to performance and cost. Ceramic-based nanofluids combine the longevity of water with significantly enhanced thermal conductivity, surpassing alternatives such as microfluids that deliver negligible performance uplift at excessive

pumping costs. This study focuses on a water-based titania nanofluid. Its thermal conductivity was measured against increasing concentration using the steady-state parallel plate method, while the solution stability was quantified by zeta potential measurements. The powder was characterized using X-ray diffraction and transmission electron microscopy. The results demonstrate a linear increase in the thermal conductivity with solid loading up to 1.1% concentration without losing stability. This significantly outperforms comparable microfluid formulations at a lower practical loading.

## Wynn Li

Applied Mathematics, Marshall

Mentored by Kathleen Fisch

### *A Streamlit-Based Laboratory Information Management System (LIMS) for Whole-Genome Sequencing Logging*

Due to proprietary information, this abstract has been redacted.

## Laura Liang

Neurobiology, ERC

Mentored by Karl J. Wahlin

*Construction of a Temporal microRNA Atlas of Human Retinal Development Using Transcriptional Reporter-Guided 3D Organoid Models*

MicroRNAs (miRNAs) are increasingly recognized as critical regulators of gene expression during neural and retinal development, yet their temporal dynamics and interactions with key transcription factors remain incompletely understood. Using hPSC-derived retinal organoids, my thesis investigates how miRNA expression changes across stages of retinal differentiation and how these patterns correlate with transcription factors that drive cell fate specification. During organoid development from day 90 to day 200, we expect miRNA expression changes to correspond with the transcription factor Cone-Rod Homeobox (CRX) and Arrestin-3 (ARR3), which regulate photoreceptors and cone phototransduction. Because miRNAs negatively regulate mRNA through transcript degradation or translational repression, integrating small and large RNA sequencing should reveal inverse relationships between miRNA abundance and cone-associated gene expression. Together, identifying differentially expressed miRNAs will provide insight into post-transcriptional regulatory mechanisms that shape retinal cell lineage specification and contribute to a developing genetic atlas of the eye, informing future strategies for studying and treating retinal degenerative diseases.

Bryan Liao

Molecular and Cell Biology, Marshall

Mentored by Miguel Lopez Ramirez

*Effects of Anti-CD25 Antibody mPC61 on Regulatory T Cell Differentiation*

Treg (T-regulatory) cells are a special subset of immune cells that suppress excessive or misdirected immune responses, preventing autoimmune diseases. Tregs arise through the differentiation of naive CD4<sup>+</sup> T cells. CD25 is a protein expressed on the surface of CD4<sup>+</sup> T cells, and the binding of the anti-CD25 antibody mPC61 to this receptor can initiate a novel IL-2 signaling pathway in Tregs. Previous studies in the Ginsberg Lab have shown that the mPC61 anti-CD25 antibody enhances the suppressive function of Treg cells through this novel signaling pathway. Building on this work, our project aims to investigate the effects of mPC61 on Treg differentiation in vitro. Specifically, we hypothesize that mPC61 increases Treg differentiation.

Naive CD4<sup>+</sup> cells were isolated from C57BL/6 Foxp3GFP mouse spleens and cultured under standard conditions for Treg differentiation, with mPC61 or an isotype control.

After 5 days of incubation, the cells were analyzed by flow cytometry to assess the percentage of Tregs, defined by Foxp3 GFP expression, for both groups and compared via a paired t-test. The mPC61-treated group showed a significant increase in the proportion of Tregs compared to the control group, indicating that CD25 signaling induced by mPC61 promotes greater differentiation of naive CD4+ T cells into Tregs. These findings highlight the potential of mPC61 as a therapy for autoimmune diseases involving Treg dysregulation.

Jiaying Liu

Undeclared (Intended to Anthropology), Sixth

Mentored by Saiba Varma

*"\$1 = 2 Meals?" NGOs and the Governance of Food Insecurity*

This paper examines how neoliberal welfare cuts have shifted basic food assistance from the government to nonprofits. In this context, neoliberalism refers to the shrinking of direct state responsibility and the growing reliance on NGOs to address social need through fiscal efficiency, metrics, and market-oriented logics. Instead of simply viewing this as the state "stepping back," this research focuses on how NGOs translate structural economic insecurity into measurable and manageable problems.

This research draws on participant observation, semi-structured interviews, and text analysis at a regional food rescue organization.

Through this fieldwork, I explore how staff members define 'helping well' via eligibility rules, standardized processes, and donor-facing success stories. I argue that nonprofit food assistance does not merely bridge the gaps left by a shrinking welfare state. Instead, it serves as a key mechanism that normalizes these cuts and grants them moral legitimacy. To compete for funding, organizations must reduce complex poverty into quantifiable metrics, such as 'pounds rescued' and 'individuals served.' This fundamentally transforms assistance into a logistical task centered on calorie delivery. Meanwhile, while the organization actively avoids "savior" narratives and highlights client "dignity," this dignity does not exist outside bureaucratic control. Instead, it is institutionally produced through standardized scripts of care and strictly limited "client-choice" spaces. Ultimately, what neoliberalism outsources is not just the distribution of food, but the responsibility of social reproduction. NGOs redistribute more than just material goods. They redefine political accountability, moral judgment, and the very criteria of whose needs are recognized as deserving.

## Vivian Liu

Physics, Marshall

Mentored by Adam Burgasser

### *Near-Infrared Spectral Classifications of Previously Unclassified Nearby Low Mass Stars and Brown Dwarfs*

We present near-infrared (NIR) spectral classifications of a sample of previously unclassified low-mass stars and brown dwarfs ( $M < 0.1 M_{\odot}$ ) located within 20 parsecs of the Sun, a volume known as the Solar Neighborhood. While brown dwarfs and low mass stars comprise most of the stellar population in this region, their intrinsic faintness means that many sources have limited follow-up and are poorly characterized. Using 20 years of archival data from IRTF/SpeX spectrograph, we compiled a sample of sources with missing or ambiguous spectral classifications in the SIMBAD astronomical database, then reduced the data using the pypextool package. We determined spectral types by comparison to established template spectra with SpeX Prism Library Analysis Toolkit (SPLAT). The findings of this study improves the completeness of the Solar Neighborhood, which provides an empirically robust basis for extrapolating to the stellar and substellar population of the broader Milky Way galaxy.

## Christian Lopez-Castro

Sociology: Law & Society and Social Psychology, Seventh

Mentored by Kevin Michael Lewis

### *Backstage Behind Backstage: How College Students Reconstruct Privacy on Instagram*

How college students manage their audiences on Instagram is a sociologically rich question because it reveals how the tension between public visibility and private expression in a digital environment collapses distinct social contexts into a single audience. Research has examined why users create secondary "Finsta" or spam accounts (Dewar et al., 2019; Kang & Wei, 2022), how these accounts differ from main accounts in content and tone (Huang & Vitak, 2022), and how self-presentation on secondary accounts changes over time as users encounter new forms of audience pressure (Tao & Ellison, 2023). However, we still do not know how users decide who is granted or denied access to these spaces, how the everyday boundary maintenance practices that sustain them work, or how spam accounts relate to Instagram's Close Friends feature, a platform-

built tool that serves an overlapping but structurally distinct purpose. Therefore, I ask: how and why do college students construct, maintain, and negotiate the boundaries of their private audiences on Instagram, and what do the strategies they adopt (spam accounts, Close Friends, both, or neither) reveal about how they understand privacy, intimacy, and identity? I address this question through semi-structured interviews combined with digital ethnography, allowing participants to narrate the meaning of their posts, followers, and boundaries in real time. These findings contribute to sociological understandings of audience management and context collapse by demonstrating that there is no final backstage on social media; each private space users construct develops its own pressures of performance, forcing a cycle of boundary reconstruction that reshapes how intimacy and identity are practiced online.

## Marylin Loritsch

Astronomy & Astrophysics, Muir

Mentored by Adam Burgasser

### *Identifying and Characterizing Low-Temperature Stars and Brown Dwarfs in Deep JWST Spectroscopic Surveys*

M-, L-, and T-type dwarfs are the lowest-mass, coolest, and most abundant stars and brown dwarfs in the Milky Way. Given their low temperatures, these objects are dim and emit primarily at infrared wavelengths, making them difficult to detect beyond a roughly one hundred light-year region around the Sun known as the Solar Neighborhood. Deep spectroscopic surveys conducted with the James Webb Space Telescope (JWST) can now detect low-mass dwarfs thousands of light-years from the Sun in the “foreground” of high redshift galaxy observations. I present a sample of 52 new distant low-mass dwarfs identified by low-resolution JWST/NIRSpec Prism spectra obtained from various surveys compiled in the DAWN JWST Archive. I report spectral classifications based on comparison to near-infrared spectral standards, and present atmosphere model fits that determine the sources’ physical properties and distances. The latter confirm membership in the Milky Way’s thin disk, thick disk, and halo populations. This sample joins a growing list of distant low-mass dwarfs that can be used to study the formation history and evolution of the Milky Way.

This research was supported by the Summer Program for Undergraduate Research in Science (SPURS), with sponsorship from Kenneth Abeloe. It was also supported by the STARTastro program, funded by the Heising Simons Foundation and the National Science Foundation.

Grace Lu

Molecular and Cell Biology & Global Health, Seventh

Mentored by Vi Nguyen

*Cheap Clothes, High Cost: A Survey-Based Framework for Examining Public Perceptions on the Environmental Health Effects of Fast Fashion*

Fast fashion has reshaped global clothing consumption by rapidly producing inexpensive, trend-driven clothing. However, this convenience comes at great environmental and human costs, contributing to microplastic pollution, excessive water use, textile waste accumulation, and exposure to hazardous chemicals such as PFAS and carcinogenic dyes.

To assess public knowledge of fast fashion's health and environmental impact, a mixed-methods anonymous, electronic survey was distributed over two months to San Diego residents via social media and in-person tabling events. Although open to all ages, post-collection demographic analysis revealed that 87.3% of respondents were high school or college students; analyses were therefore limited to this group (n = 226) to ensure statistical validity.

Approximately 1 in 13 respondents reported experiencing illness or injury from new clothing. While 96.5% correctly identified the skin as vulnerable to chemical exposure, only 31.4% correctly identified multiple body systems as potentially affected, and far fewer recognized risks to internal organs such as the kidneys and bladder. Additionally, only 56.6% reported receiving education on sustainable fashion, and of those, 81.9% cited social media as their primary source.

Limited recognition of internal health risks suggests persistent misconceptions regarding the broader health impacts of fast fashion. Illness related to clothing exposure may therefore be underrecognized. The high percentage of respondents learning about sustainability through social media suggests this may be a useful tool for targeted health education. Future studies should expand demographic representation to better inform clinicians, advocates, and policymakers supporting environmental health standards.

Nicole Macias

Media Industries and Communication, ERC

Mentored by Andrew deWaard

*Can You Be Sexier and More Likable: The Affective Feedback Loop of Neoliberal Feminism and Conservative Backlash in the Popular Music of Hayley Williams, Olivia Rodrigo, and Taylor Swift*

*Lean In: Women, Work, and the Will to Lead* by Sheryl Sandberg was released in 2013, a self-help book that encourages women to “lean in” and navigate structural inequalities to gain capitalistic success. The following year, Sophia Amoruso released her memoir *#GIRLBOSS*, detailing her career journey and redefining success for women. Both books set the cultural context for the “girl boss movement” in popular culture, which celebrated ambitious women for their self-made success in capitalist spaces. This movement caused a notable shift in feminism in 2014, the year of feminist wins in the entertainment world. Unfortunately, the movement not only failed to incorporate institutional critique, but created a cultural shift within popular culture where celebrities absorbed the core values of neoliberal feminism to elevate their brand image, resulting in exacerbated commodification.

The phenomenon of neoliberal feminist celebrities is especially visible in contemporary pop music. Popular artists, like Taylor Swift™ and Olivia Rodrigo™ are influential in shaping public understanding of female empowerment. Through digital ethnography, multimodal critical discourse analysis, narrative analysis, and ideological criticism, I examine how neoliberal feminism circulates across their brand identity. Hayley Williams™ serves as a comparative case study, revealing what happens when celebrities reject commodification. Drawing on feminist theory from Sarah Banet-Weiser and Sara Ahmed, I analyze music, live performance, interviews, and audience engagement to expose the mutually constructive reinforcing relationship, which I call an affective feedback loop, that sustains the commodification of neoliberal feminism while simultaneously perpetuating conservative cultural logic in contemporary popular culture.

## Fabrizio Malatesta

Bioinformatics, Revelle

Mentored by Sanchez-Roige

*The Genetic Architecture of Wisdom: A Genome-Wide Association Study*

Due to proprietary information, this abstract has been redacted.

## Amanda Marquez

Sociology: Law and Society, Marshall

Mentored by Michel Estefan

*Divorce Stories: The Role of Parental Divorce on College Life*

College often frames students as independent adults whose family lives exist outside the boundaries of school. Yet family instability, particularly parental divorce, can shape students' emotional well-being, academic engagement, and social participation. While sociological research has documented the effects of parental divorce on children and adolescents, it has paid less attention to how divorce shapes the experiences of college students, and even less attention to in-process divorces. This study asks two central questions: how does parental divorce continue to shape students' day-to-day college experiences, and to what extent does the timing of divorce, ongoing versus resolved, shape those experiences differently? Drawing on individual perspectives from students and divorce literature, this research treats divorce not as an isolated issue, but as a family transition with consequences that persist and vary across time and context. The interviews explore academic focus and life outside school, such as relationships, hobbies, and family responsibilities. My study highlights how family instability intersects with the demands of higher education during a critical period of students' lives. The findings explore how parental divorce shapes inequalities in students' academic, social, and emotional experiences that may go unrecognized in higher education. My goal is to contribute to broader conversations about student well-being and structural support in universities to promote greater opportunities for students' health and future success.

Jayden Marquez

Human Biology, Sixth

Mentored by Jeremy Landeo-Gutierrez

*Participant Background Characteristics on Pediatric Obstructive Sleep Apnea Clinical Trials*

Adequate representation of the U.S. population in clinical trials is essential for generalizable findings and equitable care. Demographic reporting and representation in pediatric obstructive sleep apnea (OSA) trials have not been systematically evaluated. We hypothesized that pediatric OSA trials do not reflect the racial and ethnic diversity of the U.S. pediatric population.

Cross-sectional study of U.S.-based clinical trials registered on ClinicalTrials.gov enrolling participants <18 years old between October 2007 and October 2025. Only completed studies with available results were included. Representation was assessed using the Enrollment–Census Difference (ECD), defined as the percentage-point difference between trial enrollment proportions and the 2019 U.S. Census pediatric population for each racial/ethnic group. One-sample Wilcoxon signed-rank tests evaluated whether median ECD values differed from zero.

23 studies met inclusion criteria; 65.2% (n=15) reported race and 56.5% (n=13) reported ethnicity. Median enrollment proportions were 64.0% White, 21.1% Black/African American, 6.7% Hispanic, 1.6% Asian, and 0% American Indian/Alaska Native. ECD analysis showed significant overrepresentation of White participants (+32.06%,  $p<0.01$ ), underrepresentation of Asian participants (−3.33%,  $p<0.01$ ), and American Indian/Alaska Native participants (−1.00%,  $p<0.01$ ). Hispanic participants trended toward underrepresentation (−18.08%,  $p=0.31$ ), while Black participants trended toward overrepresentation (+7.70%,  $p=0.05$ ); neither difference reached statistical significance.

These findings highlight disparities in representation in pediatric OSA clinical trials and the need for improved recruitment strategies and policies to promote equitable participation.

## Justin Mascari

Physics w/ Specialization in Astrophysics, ERC

Mentored by Karin Sandstrom

### *Mapping CO-dark H<sub>2</sub> in Local Group Galaxies*

The interstellar medium (ISM), which is mainly composed of gas and dust, plays a crucial role in galactic structure and evolution. A very abundant molecule within the ISM is molecular hydrogen (H<sub>2</sub>). Understanding the H<sub>2</sub> abundance is important as it is the main constituent of the molecular clouds where new stars form. H<sub>2</sub> is a notoriously difficult molecule to detect, so other molecules, such as Carbon Monoxide (CO), are used to trace the gas. CO is a common molecule used for CO tracing, but evidence suggests that a considerable amount of H<sub>2</sub> lies outside of CO bright regions, creating what is known as “CO-dark” H<sub>2</sub>. This study focuses on mapping the “CO-dark” H<sub>2</sub> abundance within galaxies in the Local Group. Using a galaxy’s dust and HI surface, we can derive a total H<sub>2</sub> surface density by scaling dust by a dust-to-gas ratio (DGR) and subtracting off the HI. This gives an idea of how much H<sub>2</sub> is not being traced by CO. Since the CO abundance is believed to be tied to a galaxy's metallicity, we also explore how metallicity potentially has an impact on the “CO-dark”. Finally, we discuss prospects for another tracer molecule, hydroxyl (OH) in M33, and how this molecule might help trace out more of the “CO-dark” H<sub>2</sub>. These results will help us better understand molecular clouds in the ISM and more tightly constrain our models of star formation.

## Makena Massey

Human Biology, Revelle

Mentored by Kathleen Fisch

### *Fibronectin Mutations in Preeclamptic Pregnancies and Their Effect on Cell Adhesion*

Preeclampsia (PE) is a serious pregnancy complication impacting approximately 8% of pregnancies worldwide and is characterized by high blood pressure and damage to organs. PE contributes to over 50,000 maternal deaths and more than 500,000 fetal deaths each year. Sequencing of mesenchymal stem cells (MSCs) from both healthy and PE pregnancies highlighted certain genetic mutations that were specific to PE samples. Several of these mutations were identified in genes associated with the extracellular matrix, such as Fibronectin 1 (FN1), which contributes to cell adhesion and migration. It

binds integrin receptors on the cell surface and links cells to the extracellular matrix, thereby regulating cell movement and signaling. To address whether mutations in FN1 alter cell attachment, we performed a fibronectin adhesion assay to evaluate extracellular matrix–dependent cell adhesion. We expect that cells with FN1 mutations will have reduced adherence to fibronectin compared to cells from healthy pregnancies. The improper adhesion may affect how cells interact with their surroundings, potentially affecting trophoblast function and leading to abnormal placental development in patients diagnosed with PE.

## Darya Massih

Sociology, Marshall

Mentored by Christena Turner

### *Connected Yet Alone*

This project examines how social factors shape smartphone usage patterns among Generation Z and how these patterns influence the quality of in-person interaction. Smartphones have become necessary for navigation, communication, work, and entertainment, making our worlds accessible in the palms of our hands. While this reliance is not inherently negative, the constant accessibility of smartphones raises a paradox: devices designed to connect us can also leave us feeling isolated. Face-to-face conversations may be avoided, eye contact can feel invasive, and spontaneous interaction with strangers can seem uncomfortable. This research explores why a tool built for connection leaves us with social disconnection.

Focusing on Generation Z, the first generation to grow up with access to smartphones from a young age, this study considers how young people are living within a culture of constant digital connectivity. Rather than showing Gen Z as lacking discipline or social skills in their phone use, this research shifts the narrative to consider how they may also be products of a social environment shaped by technological norms.

Drawing on sociological perspectives from theorists such as Durkheim, Weber, Turkle, and others, this study situates smartphone use within discussions of community, weak ties, and the reproduction of public social life. Using qualitative methods, observations will take place on Library Walk at the University of California San Diego, documenting public smartphone usage among students. These observations will be paired with interviews to better understand how Generation Z interprets their own phone use and norms that have normalized connectivity but isolation.

## Kayla Mitchiner

Neurobiology, Sixth

Mentored by William Pelham

### *Digital Location Tracking and Adolescence*

We will co-present a series of studies examining parents' use of smartphone-based digital location tracking (DLT) applications (e.g., Life360, Find My) to monitor adolescents. Drawing on multiple projects, including a large nationwide longitudinal survey (n ~ 3,000) and a recent pilot study (n ~ 40) integrating objective smartphone usage data, this research investigates the prevalence, patterns, and relational implications of contemporary DLT practices. Preliminary findings suggest that DLT has become normative in US families, with 76% of parents reporting use and a substantial proportion checking location information frequently. Importantly, monitoring frequency demonstrates a non-linear association with adolescent and family outcomes, such that both very low and very high levels of checking may be linked to higher family conflict compared to moderate use. Early evidence also indicates discrepancies between parents' self-reported monitoring and objectively recorded app usage, showing the importance of multimethod measurement in understanding digital parenting behaviors. Building on these findings, our ongoing longitudinal study further examines when, why, and how parents use DLT and evaluates its prospective effects on adolescent behavioral and psychosocial adjustment across multiple timepoints. By integrating survey data, qualitative interviews, and objective usage metrics, this series of research aims to advance the understanding of parental monitoring in the digital age and its implications for adolescent development.

## Aiden Momtaz

Bioengineering: Bioinformatics, ERC

Mentored by Shankar Subramaniam

*Comparison of the development of neural organoids derived from ESCs vs. iPSCs with scRNA-seq analysis*

A key consideration in brain organoid research is the choice between induced pluripotent stem cells (iPSCs) and embryonic stem cells (ESCs), which represent distinct pluripotent states with unique biological properties that may influence early neurodevelopmental trajectories, transcriptomic programs, and fidelity to in vivo maturation. To provide a reference for selecting the most appropriate cell source, we compared organoids generated from H9 ESCs and 409B2 iPSCs using similar protocols. Single-cell RNA sequencing data were compiled from several public studies. Force-directed graphs and trajectory inference were used to produce pseudotemporal labels, enabling targeted longitudinal differential gene expression and transcription factor (TF) enrichment analyses. A scANVI model was trained on fetal brain data to annotate cell type compositions and quantify physiological relevance. While both organoid types recapitulated major neurodevelopmental stages, we identified diverging pathways in radial glia differentiation. Specifically, SATB2 and SP1 exhibited a more pronounced decrease in activity in iPSC-derived organoids, whereas ESC-derived organoids more closely resembled fetal data. Our findings highlight the importance of stem cell source, with differential SATB2 and SP1 activity suggesting distinct neuroepithelial differentiation, and ESC-derived organoids possibly offering greater fidelity for modeling neuron progenitor development.

Arantza Montoya

Biology, Revelle

Mentored by Laura E. Crotty Alexander

*Immuno Profiling of Nasal Mucosa in Nicotine E-cigarette users*

Intro: E-cigarette use, or vaping, has proliferated at a fast rate amongst young adults in the past decade. Investigating the potential adverse effects that vaping can have on a prompt immune response to foreign antigens is a priority given commonplace vaping behaviors. Therefore, this pilot study was conducted to identify and quantify immunological responses in nicotine vapers to assess differences in immune cell recruitment in the nasal mucosa.

Methods: 22 subjects aged 18-35 were recruited and nasal epithelial cells were harvested. RNA extraction for transcriptomic profiling was performed on the samples. Eight subjects aged 18-30 were recruited for a pilot study where their naso-pharynx adenoid tissue and mid-turbinates were swabbed. Swabs are transported to La Jolla Institute of Immunology where flow cytometry was performed to look at immune cell populations.

## Results:

Monocyte frequencies were observed to be significantly higher in vapers compared to the healthy controls in both the Mid-Turbinate ( $p < 0.0009$ ) and Naso-Pharynx regions ( $p < 0.02$ ). Transcriptomic analysis showed an increase in the expression of 11 innate immune and macrophage-associated genes, in e-cigarette users relative to non-smoking, non-vaping controls.

Conclusion: Compared to controls, vapers' Mid-Turbinate and Naso-Pharynx regions exhibited higher immune cell concentrations, pointing to a correlation between vaping and dysregulated immune responses in the nasal mucosa. This leads to vapers being more susceptible to infections and viruses. Further assessment of immune cell response in nasal epithelial tissue to pathogen exposure is needed to investigate the pathways and consequence of vaping on immune proliferation efficacy and functionality.

## Arlene Grace Nagtalon

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

Mentored by Erika Cyphert

### *From Classrooms to Communities: Evaluating Bioengineering Experiments for K-12 STEM Engagement in San Diego Schools*

Efforts to strengthen science education increasingly emphasize experiential learning that connects classroom concepts to real-world applications. This project examines how hands-on bioengineering activities can support meaningful STEM engagement among K–12 students in San Diego. Through a community-oriented educational framework, this study evaluates a series of classroom bioengineering experiments designed to introduce students to foundational biological and engineering principles while fostering curiosity, scientific confidence, and collaborative problem-solving.

Data were collected through classroom observations, student feedback, and reflective assessments from educators and facilitators who implemented these activities in local schools. The experiments focused on accessible, low-cost demonstrations of bioengineering concepts, such as biomaterials, drug delivery methods, and human health, allowing students to actively participate in the scientific process through hypothesis generation, experimentation, and discussion. Particular attention was given to how these activities resonated with students from historically underrepresented backgrounds in STEM.

Preliminary findings suggest that interactive bioengineering experiments can significantly increase student interest in science and improve perceptions of STEM as both approachable and relevant to community well-being. Students reported greater enthusiasm for scientific inquiry when experiments were framed through real-world health and environmental challenges. Educators also highlighted the value of interdisciplinary activities that integrate biology, engineering, and social context.

By assessing the impact of these educational interventions, this project contributes to broader conversations about equitable STEM education and the role of community-engaged science outreach. The findings underscore the potential for bioengineering education initiatives to bridge classroom learning with community-centered scientific engagement, helping cultivate the next generation of scientists, engineers, and informed citizens.

Deen Nair

Neurobiology, ERC

Mentored by Kim Dore

*Behavioral experiments in old mice to characterize resilience to aging and Alzheimer's disease*

Aging is a major risk factor for Alzheimer's disease (AD), yet some individuals remain cognitively resilient despite advanced age and significant neuropathology. Understanding the biological basis of this resilience may reveal mechanisms that protect synapses and preserve memory. Synaptic dysfunction and loss are early hallmarks of AD and are closely linked to disruptions in synaptic scaffolding proteins, receptor signaling, and lipid-dependent post-translational modifications that regulate synaptic stability and plasticity. However, more research is needed to understand molecular and cellular mechanisms of synaptic vulnerability and how they relate to memory performance.

This project aims to characterize cognitive resilience in aged male and female wild-type and AD model mice (20-28 months). We used behavioral assays to assess exploratory behavior, memory, and learning. No group differences were observed in the Open Field (OF) test, which measures locomotion and anxiety-related behaviors that may influence cognition. As expected, AD model mice showed significant deficits in the Object Location Memory (OLM) test, which evaluates short-term spatial memory, with worse outcomes in female AD model mice. Similar results were observed in the Morris Water Maze (MWM), which measures spatial learning and memory retention. We are

identifying mice that performed best in OLM and MWM tests as likely resilient to aging and AD, while those unable to remember task locations are considered more susceptible.

By integrating behavioral findings with molecular characterization of brains from resilient and susceptible mice, this work should define functional signatures of resilience and identify protective mechanisms to help prevent cognitive decline in AD.

## Nandhana Nair

Molecular and Cell Biology & Probability and Statistics, Sixth

Mentored by Elisabet Bjanes

*Molecular iodine acts as a non-staining, broad-spectrum antiseptic, providing a new, high-performance solution to fight resistant hospital pathogens*

Povidone-iodine is a widely used broad-spectrum antiseptic in clinical settings for the prevention of bacterial, viral, and fungal infections. However, iodine-based products are infamous for the deep gold stain which can also cause skin irritation after repeated topical application. Here we test the disinfectant, staining, and cytotoxic properties of reformulated molecular iodine (I2) relative to povidone-iodine in collaboration with I2Pure. Microbial inhibition and killing were evaluated against common hospital-acquired pathogens, including *S. aureus*, *E. faecium*, *K. pneumoniae*, *P. aeruginosa*, and *Candida* using minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) assays. Cytotoxicity was assessed against mammalian keratinocytes. To validate the non-staining properties of the molecular iodine, hospital textiles and fabrics were doused in iodine, then washed with hospital grade detergent. The long-term antimicrobial persistence was tested by swabbing molecular iodine on surfaces and textiles and quantifying bacteria and fungal survival. Results showed that the molecular iodine was highly efficacious against most pathogens, resulting in greater than a 4 log<sub>10</sub> reduction in colony forming units (CFUs) or 99.99% killing. The median minimum inhibitory concentration was 6.25%. Relative to povidone-iodine, molecular iodine had similar levels of cytotoxicity and washed out of textiles readily. Collectively, molecular iodine was equally efficacious compared to povidone iodine without its characteristic intense staining properties. For high volume clinical settings in which staining is undesirable and expensive, molecular iodine could prove a suitable alternative to povidone-iodine.

Samantha Nasser

Molecular and Cell Biology, ERC

Mentored by Shiri Gur-Cohen

*Lymphatic-mediated mechanical cues direct stem cell fate decisions during tissue regeneration*

Due to proprietary information, this abstract has been redacted.

Thomas Nghiem

Computer Engineering, Eighth

Mentored by Yuanyuan Shi

*Experimental Testbed for Building Airflow Control*

This research presents the design and implementation of an indoor environmental testbed developed to study ventilation control and sensor-driven airflow management in a room environment. The system consists of a 4 ft × 4 ft × 4 ft scaled room model that integrates mechanical ventilation hardware and programmable control logic to simulate key aspects of real-world HVAC operation. The testbed incorporates a motor-actuated air vent with adjustable louvers along with controllable fans, allowing precise modulation of airflow into the room.

Embedded sensors monitor environmental variables such as CO<sub>2</sub> concentration and temperature, providing real-time data from the test environment. The control system processes this sensor data and wirelessly transmits control instructions to the microcontroller-based ventilation hardware. This architecture allows the physical testbed to execute externally computed control strategies while maintaining real-time interaction with the environment.

The primary objective of the testbed is to serve as a physical platform for validating theoretical airflow and environmental control models. By combining mechanical design, sensor feedback, and hardware-based control, the project demonstrates a minimal cost and flexible foundation for prototyping smart HVAC concepts. This work provides a practical environment for studying responsive ventilation strategies and contributes to ongoing efforts to develop intelligent building technologies that can improve comfort and energy efficiency in indoor spaces.

## Joseph Nguyen

Electrical Engineering, Warren

Mentored by Abdoulaye Ndao

*Heterogeneous Modulus Transparent Substrate for Zero Poisson's Ratio Stretchable Displays*

Due to proprietary information, this abstract has been redacted.

## Nam Anh Nguyen

Cell and Molecular Biology, Warren

Mentored by Julian Schroeder

*Modulation of Stomatal Response using CRISPR-based Guard Cell-Specific Knockout technique*

Due to proprietary information, this abstract has been redacted.

## Chista Niknam

Human Biology, Sixth

Mentored by Miranda Koloski

*Brain Network Disruptions May Underlie Heightened Anxiety-Like Avoidance Following Controlled Cortical Impact*

Individuals with traumatic brain injury (TBI) are twice as likely to develop an anxiety disorder compared to their non-TBI counterparts. The structural and functional changes underlying risk for neuropsychiatric disorders remains unknown. Here, we assess the effects of a bi-frontal TBI on anxiety-like behavior in rodents and examine the associated neural network activity during light/dark box exploration. Our study, consisting of 21 male rats (n=9 control, n=12 TBI), utilizes a bilateral controlled cortical impact (CCI) centered over the prefrontal cortex as a preclinical model of TBI.

Three weeks after injury, subjects are given exploratory freedom in a light/dark box while brain activity (local field potentials) from 32 regions is recorded. We predict that TBI will impact neural activity and behavior (zone occupancy, zone switches, distance traveled). Specifically, we predict that the TBI group will have a higher rate of dark (or “safe”) zone occupancy and show altered cortical-network activity.

Our results show that TBI animals spend more time in the dark zone compared to controls ( $p < .001$ ), without differences in total trial time, ( $p = .237$ ) total switches ( $p = .227$ ) or distance traveled ( $p = .554$ ). This behavioral change was accompanied by a baseline hypoactive state in cortico-striatal circuits ( $p < .001$ ). In cortico-striatal-amygdala electrodes, TBI animals had less low-frequency power in the dark zones compared to control animals ( $p < .001$ ). Our results suggest that frontal TBI impairs network dynamics involved in approach-avoidance behavior that may contribute to heightened anxiety following brain injury.

## Borngreat Omoma-Edosa

Data Science, Warren

Mentored by Bradley Voytek

### *NeuroVLM: Translating neuroimage images to text*

Neuroimaging research has produced tens-of-thousands of articles that pair natural language and activation coordinate tables. Recent advances in vision-language models (VLMs) have provided methods to model text and images simultaneously. In this work, we present NeuroVLM, a model architecture for learning from 30,000 human neuroimage-text pairs. The architecture supports text to neuroimage and neuroimage to text contrastive and generative objectives. This presentation focuses on the neuroimage to text capabilities. The contrastive model ranks similarity between neuroimages and text. The generative models is capable of generating text interpretations of neuroimages, labeling networks, finding publications most related to a neuroimage query.

## Aydin Pappas

History, Warren

Mentored by Verónica Martínez-Matsuda

### *Indentured Servitude in the 21st Century: An Examination of America's J-1 Visa Program*

This research focuses on the history of the J-1 Exchange Visitor Visa and its transformation into a cheap labor program in the United States. After conducting a historical analysis of the program's Cold War origins, the thesis evaluates each of the work-contingent programs housed within the visa; namely, the Summer Work Travel, Internee/Trainee, and Au Pair programs. As each of these programs are administered almost exclusively by the private sector, the J-1 Visa is emblematic of America's adoption of neoliberal politics at the end of the 20th century. The program is a cautionary tale of this neoliberal paradigm, as the racialized and gendered violence embedded within the program continues to devalue the labor of those from the Global South today. By analyzing notable moments of controversy as the program emerged and developed, and firsthand accounts of participants traveling to the U.S. on a J-1 Visa, the thesis reveals how the growing influence of the private sector has had disastrous consequences for the programs' participants. With the current administration's recent crackdown on unauthorized immigration, an analysis of the J-1 Visa program offers an insightful perspective, revealing the ulterior motives at play.

## Spencer Parks

Neurobiology, ERC

Mentored by Shelley Halpain

### *Characterizing actinification: structural insights into cytoskeletal remodeling and stability induced by glutamate excitotoxicity*

Due to proprietary information, this abstract has been redacted.

## Pooja Parthasarathy

Biology w/ specialization in Bioinformatics, ERC

Mentored by Pradipta Ghosh

*A two-hit mechanism locks alveolar progenitors in a pro-fibrotic transitional state*

Due to proprietary information, this abstract has been redacted.

## Arunima Prakash

Ecology, Behavior & Evolution, Revelle

Mentored by Patrick Rohner

*Diet and Temperature Affect Brood Ball Construction in the Dung Beetle *Onthophagus taurus**

Brood balls are underground nests typically constructed by a female dung beetle. They are the only source of nutrition for a single developing larvae. Therefore, the maternal investment in their construction can have a huge impact on the offspring's fitness, and it is well understood that female body weight is directly correlated with offspring (adult) body weight. What is not known is whether females consistently make the same size and shape of brood ball, or if environmental factors can affect brood ball construction. We tested how ambient temperature and diet (dung type) affected brood ball shape and size by giving female dung beetles either horse dung or cow dung, putting each beetle into a 19- or 27-degree Celsius incubator to make brood balls for 1 week, and then putting them in the alternate temperature treatment for a second week. We found that cow dung brood balls tend to be bigger and more numerous than horse dung brood balls, and horse dung brood balls tend to be heavier and wider at 19 degrees than at 27 degrees. There also appeared to be more variation between females than within females in size and shape, so brood ball construction seems to be tied to individual beetles.

## Antonio Puron Guerrero

Molecular & Cell Biology, Revelle

Mentored by April Lukowski

### *Structural drivers of substrate specificity in aromatic single-component Flavin-Dependent Halogenases.*

Halogenated compounds are often intermediates in the production of novel biosynthetic materials, as well as important precursors for drug development in medicinal chemistry. Single-component Flavin-Dependent Halogenases (FDHs) are uniquely powerful self-sufficient enzymes that bypass the need for a separate flavin reductase to catalyze site-specific halogenation chemistry. These enzymes are rare and almost exclusively found in marine bacteria, but their functions in natural product biosynthesis are not fully defined. There exist different kinds of FDHs that are specific to different substrates; AetF is a well studied enzyme that catalyzes the regioselective mono- and di-bromination of the aromatic ring on the amino acid L-tryptophan. Crystal structures of AetF have permitted the identification of certain specific amino acid residues within its active site that are hypothesized to contribute to the electrostatic stabilization of the substrate tryptophan backbone. Moorea-AetF (referred to as bin59) is another single-component FDH closely related to AetF, recently discovered from sedimentary cyanobacteria in the South Pacific. Both enzymes share very high structural similarity, except for one important distinction: bin59 uses indoles as the substrate for bromination rather than L-tryptophan. Structural determination of bin59 revealed key differences in the identity of some amino acids in the active site— specifically, non-polar residues in bin59, in place of the polar and electrically charged side chains in AetF known to interact with L-tryptophan. This led to the following research question: what are the main structural drivers of substrate-specificity in aromatic single-component flavin-dependent halogenases?

## Jonathan Qiu

Bioengineering, Sixth

Mentored by Heidi Cook-Andersen

### *Changes in splice site utilization with inhibition of nonsense-mediated decay in an embryonic stem cell model*

Nonsense-mediated decay (NMD) is a critical RNA pathway, and its inhibition in embryonic stem cells (ESCs) leads to significant changes in alternative splicing and transcript quality. Analyzing these massive transcriptomic changes requires robust computational pipelines, but researchers need to balance biological sensitivity with computational constraints.

In this study, we investigate changes in splice site utilization and efficiency following NMD inhibition in an ESC model. We used three bioinformatics tools: SpliSer, Leafcutter, and majiq, to detect differential splice-site usage across samples. Using these three tools for detecting large-scale splicing inhibition, we evaluated each tool's biological output and computational efficiency. Specifically, we analyzed the consistency of splice-site detection across the three algorithms, highlighting overlapping predictions and discrepancies in their output, as well as determining which kind of analysis they are suitable for. Simultaneously, we will record HPC performance metrics, including peak memory usage, execution runtime, and the scalability of job arrays when using these tools to process large datasets and compare their performance.

Our results demonstrate how algorithmic differences affect the biological interpretation of splicing events in ESCs and computational overhead. Ultimately, this research provides a comparative framework to guide tool selection, accelerating the biological analysis of RNA splicing and cell fate transitions while minimizing computational bottlenecks.

## C.J. Rees

Biochemistry, ERC

Mentored by Elizabeth Villa

### *Purification and Mechanistic Characterization of Dual-Activity RNase H in a Nucleus-Forming Jumbo Phage*

Jumbo bacteriophages of the chimallivirus family replicate their genomes within a proteinaceous phage nucleus that segregates viral DNA replication and transcription from host translation. Although this compartment protects viral DNA, it imposes constraints on genome amplification. Using the *Escherichia coli*-infecting chimallivirus Goslar, we identify RNase H as a core component of a non-canonical three-subunit DNA polymerase complex (DNAP-N, DNAP-C, and RNase H) essential for replication and nuclear maturation. To dissect its mechanism, we purified RNase H and polymerase subunits to

perform in vitro biochemical assays, enabling direct analysis of RNA–DNA hybrid processing, polymerase coupling, and replication activity.

## Kyle Rich

Biochemistry and Microbiology, Muir

Mentored by Michael Burkart

### *Solvatochromic probes capture inter-domain interactions in carrier protein-dependent biosynthesis*

Carrier protein (CP)-dependent biosynthesis pathways produce a broad range of important metabolites, including many clinically relevant natural products. These pathways rely on a carefully orchestrated series of enzymatic reactions mediated by a central carrier protein and multiple partner proteins. However, the protein-substrate and protein-protein interactions that enable these processes are often subtle, transient, and difficult to monitor in situ. Solvatochromic fluorophores offer a promising strategy to probe these interactions. These fluorescent molecules exhibit shifts in emission wavelength and intensity depending on their local chemical environment, allowing them to report changes in protein interactions. Such probes can be chemically synthesized, selectively attached to carrier proteins, and used to visualize CP-dependent pathways involving partner proteins such as fatty acid synthases (FAS), polyketide synthases (PKS), and nonribosomal peptide synthetases (NRPS). In this work, we demonstrate the application of solvatochromic probes to monitor inter-domain interactions within type I NRPS system. Using mutagenesis at the peptidyl carrier protein-epimerization (PCP-E) domain interface, interactions were detected with the solvatochromic 5-(4''-dimethylaminophenyl)-2-(4'-phenyl)oxazole (dapoxyl) pantetheinamide probe. These findings highlight the utility of solvatochromic probes for detecting dynamic inter-domain protein interactions and suggest broader applications for studying carrier protein-mediated biosynthetic pathways.

## Seema Rida

Cognitive Science Spec. Machine Learning and Neural Computation, Muir

Mentored by Andrea Chiba

### *Designing Wearable Biosensor Pipelines Around Individual Variability*

Children's development and their individual strengths play a large role in learning, however, very little research is able to examine their brain and body dynamics as they navigate a typical day in the classroom, often missing the ongoing "quiet signals" that could inform us of internal states and preparation for learning. To explore this, we have a laboratory classroom with a small number of children. Here, we are able to examine physiological states with enough precision to detect subtle rapid fluctuations that reflect the individual behavioral and physiological dynamics of each child. Wearable biosensors offer a promising path toward measurement in these settings. The validity of the signals significantly depend on the preprocessing quality, however current standard pipelines were not designed with our holistic approach in mind.

In this study, we examine where and how existing preprocessing frameworks break down when applied to children in naturalistic classroom settings, and what a more thoughtful alternative might be. A central challenge is distinguishing true physiological signal from artifact generated by the very behaviors we care about: fidgeting, play, and physical engagement. We investigate how artifacts manifest across multiple signal modalities and develop approaches that preserve real physiological information. We do this through IMU-based artifact detection, signal quality assessment pipelines, and wavelength-level comparisons to characterize how sensor performance varies across individuals, all validated against concurrent video recordings as behavioral ground truth. Together, these constitute a multimodal preprocessing framework that treats individual variability as a design constraint rather than noise to be discarded.

Kaia Robinson

Molecular and Cell Biology, ERC

Mentored by Irina Kufareva

*AI-powered discovery, annotation, and deorphanization of G protein-coupled receptors in the parasitic flatworm Schistosoma mansoni*

Schistosomiasis is a neglected tropical disease affecting over 200 million people worldwide and is currently treated with a single drug, praziquantel. The emergence of hybrid parasite species and persistent concerns about drug resistance stresses the need for new therapeutic targets to sustain effective disease control. G protein-coupled receptors (GPCRs) are central regulators of cell signaling and represent the most widely druggable protein family in biology. However, GPCRs in the schistosomiasis pathogen, the parasitic

flatworm *Schistosoma mansoni*, remain poorly annotated and largely unexplored as therapeutic targets.

Here, we present an AI-powered pipeline for proteome-wide discovery, annotation, and deorphanization of *S. mansoni* GPCRs. By integrating BLAST searches with signal peptide prediction and removal, AlphaFold confidence-based excision of disordered regions, and structure prediction, we identified and modeled 132 unique *S. mansoni* GPCRs. Cross-comparisons with sequence-based GPCR prediction methods demonstrated improved accuracy of our pipeline. Structure-guided homology mapping enabled putative classification by receptor class and agonist type, revealing conserved aminergic and other ligand-specific receptors alongside receptors lacking clear canonical homologs.

Building on this global annotation, we performed targeted deorphanization of aminergic GPCRs, focusing on the invertebrate-specific octopamine signaling pathway. Computational receptor–ligand modeling and AlphaFold- and ICM-based scoring successfully recapitulated published experimental pairings and supported a focused RNAi screen, leading to the identification of a candidate octopamine receptor implicated in parasite neuromuscular signaling.

By linking global receptor classification to targeted deorphanization, this framework provides a foundation for dissecting poorly characterized genomes and guiding structure-informed antiparasitic drug discovery.

## Ruhini Saha

Pharmacological chemistry, Warren

Mentored by Professor Debnath

*Bioactivity of a Marine Natural Product-Derived Compound against the “Brain-eating Amoeba” Naegleria fowleri*

1Center for Discovery and Innovation in Parasitic Diseases, Skaggs School of Pharmacy and Pharmaceutical Sciences, UC San Diego

2Center for Marine Biotechnology and Biomedicine, Scripps Institution of Oceanography, UC San Diego

*Naegleria fowleri* is a thermophilic free-living protozoan typically found in freshwater lakes, hot springs, and rivers. *Naegleria* enters through the nasal passage and invades the brain tissue. This infection leads to primary amoebic meningoencephalitis (PAM) with symptoms such as hallucinations, nausea, vomiting, fever, and death. Mortality for this infection is suspected to be 98% within 5 days of the first sign of symptoms, which reflects the importance of finding novel therapeutics for this infection. Despite the contribution of natural products to pharmacotherapy, research on identifying new natural product-based anti-*N. fowleri* agents is limited. This is more so for marine natural products which are important sources of biologically active agents. Our goal was to identify amoebicidal activity of compounds isolated from marine natural products. In our recent research, we tested the activity of a metabolite isolated from a unique marine bacterium. This pure compound with an unusual molecular formula exhibited nanomolar potency on a reference strain of *N. fowleri* and provided a selectivity index of more than 100 when tested on a mammalian cell line. In addition, the compound is active on multiple strains of *N. fowleri* belonging to different genotypes. Based on these results, our study has the potential to develop an alternative antimicrobial that is suitable for future clinical advancement for the treatment of PAM.

Saurabi Sakthivel

Biochemistry, ERC

Mentored by Kevin Kuehn

*A Multi-Dimensional Analysis of Engagement and Patterns of Missing Data in a Personalized Digital Intervention for Suicidal Thoughts and Behaviors*

In 2023, over 49,000 suicide deaths and 12.8 million cases of suicidal ideation were reported in the United States (5). Researchers increasingly use ecological momentary assessment (EMA) to measure emotional, behavioral, and cognitive states in real time within participants' natural environments (4). Recent research using EMA has suggested that risk factors for suicidal thoughts and behaviors (STBs) differ both within and between people (1). Digital suicide-prevention interventions that combine EMA with personalized coaching targeting proximal, person-specific correlates of STBs offers a unique opportunity for real-time support, but its effectiveness depends on sustained user engagement (3). Nonresponse to EMA prompts may introduce bias, if missing data reflects underlying psychological states rather than logistical factors. Prior research implies that missing data in EMA studies may be driven by structural factors rather than

suicidal ideation (2). However, the extent to which emotional states influence subsequent nonresponse in suicide-focused interventions remains unclear.

This study examines patterns and predictors of EMA missingness in a 6-week hybrid intervention with high-frequency EMA (5 prompts/day) and personalized coaching. Specifically, we examine whether 1. baseline psychological characteristics predict overall EMA completion, 2. missingness varies by time of day and study day, 3. momentary emotional states predict later EMA nonresponse, and 4. missed prompts precede elevated distress.

By distinguishing structural from emotional contributors to missing data, this paper examines whether EMA nonresponse reflects meaningful behavioral withdrawal or random unresponsiveness. We hypothesize that participants with higher baseline levels of suicidal ideation have higher rates of missing EMA responses.

## Shayna Salerno

Human Biology, Seventh

Mentored by Jeremy Landeo-Gutierrez

### *Participant Background Characteristics on Pediatric Obstructive Sleep Apnea Clinical Trials*

Adequate representation of the U.S. population in clinical trials is essential for generalizable findings and equitable care. Demographic reporting and representation in pediatric obstructive sleep apnea (OSA) trials have not been systematically evaluated. We hypothesized that pediatric OSA trials do not reflect the racial and ethnic diversity of the U.S. pediatric population.

Cross-sectional study of U.S.-based clinical trials registered on ClinicalTrials.gov enrolling participants <18 years old between October 2007 and October 2025. Only completed studies with available results were included. Representation was assessed using the Enrollment–Census Difference (ECD), defined as the percentage-point difference between trial enrollment proportions and the 2019 U.S. Census pediatric population for each racial/ethnic group. One-sample Wilcoxon signed-rank tests evaluated whether median ECD values differed from zero.

23 studies met inclusion criteria; 65.2% (n=15) reported race and 56.5% (n=13) reported ethnicity. Median enrollment proportions were 64.0% White, 21.1% Black/African American, 6.7% Hispanic, 1.6% Asian, and 0% American Indian/Alaska Native. ECD

analysis showed significant overrepresentation of White participants (+32.06%,  $p < 0.01$ ), underrepresentation of Asian participants (−3.33%,  $p < 0.01$ ), and American Indian/Alaska Native participants (−1.00%,  $p < 0.01$ ). Hispanic participants trended toward underrepresentation (−18.08%,  $p = 0.31$ ), while Black participants trended toward overrepresentation (+7.70%,  $p = 0.05$ ); neither difference reached statistical significance.

These findings highlight disparities in representation in pediatric OSA clinical trials and the need for improved recruitment strategies and policies to promote equitable participation.

Davi Salles Leite

Bioengineering: Biotechnology, Warren

Mentored by Alexis Komor

### *Enhancing Base Editing Efficiency Through Nuclease-Mediated DNA Processing*

Around 96% of human genetic variation is attributable to single-nucleotide variants. Base editors (BE), a precision genome editing technology, can mediate the targeted conversion of base pairs to precisely install genetic variants, and have the potential to revolutionize precision medicine and disease modelling. However, certain genomic sites appear inherently resistant to editing, even when potent deaminases are employed. Editing at these loci may plateau because cellular repair pathways do not efficiently convert the deamination intermediate into the desired mutation, instead reverting the lesion or restoring the unedited sequence. Overcoming these limitations will require manipulating editor-independent factors, which in turn depend on a deeper understanding of the molecular mechanisms underlying editing outcomes. We hypothesized that localized recruitment of DNA processing enzymes could promote repair pathways that favor the incorporation of edited bases, and explored nuclease-enhanced base editors (NucBEs) as a strategy to increase base-editing efficiency beyond local thresholds. Using RNA aptamer-mediated recruitment, we systematically evaluated the ability of nucleases, particularly hDNA2, to modulate DNA processing during base editing. Early designs yielded site- and editor-dependent increases in editing efficiency, but subsequent iterations revealed limited generalizability across targets and editor variants. These results highlight key constraints in coupling DNA repair factors to base editors, including sensitivity to expression levels and recruitment modalities. Collectively, this work provides design principles and cautionary lessons for engineering modular genome editing tools, highlighting the challenges of translating mechanistic hypotheses into robust, broadly applicable editing platforms.

Noemi Salmeron

Cognitive Science and Linguistics, ERC

Mentored by Seana Coulson

*Activation of Sensorimotor Features during Language Comprehension*

Language comprehension unfolds incrementally, with the brain continuously generating predictions about upcoming words from the given context. In EEG studies, violations of these predictions modulate the N400 component. However, whether the N400 amplitude is sensitive to the kind of violation or only to the degree of violation is a contested issue. Here, we re-analyze data from a prior study that examined semantic violations in sentences (n=136); they presented four kinds of continuations to 34 different contexts (e.g., Amber...zoo...see the bright pink [ ]): (1) expected (e.g., “flamingos”) (2) perceptuomotor-related unfit (e.g., “makeup”) (3) event-related unfit (e.g., “elephants”), and irrelevant (e.g., “secretary”). Notably, the 136 continuations also varied on various sensorimotor information axes, such as vision, motion, and taste. In the present reanalyses we ask whether these sensorimotor associations can differentially explain the neural responses to the violation conditions. Using eight predictors from the Lancaster Sensorimotor Norms we fit regressions on ERPs starting 200 to 700 ms from the target word onset for every channel and timepoint. In the perceptuomotor-related unfit condition, words with higher interoceptive ratings elicited more negative ERPs approximately 350-450ms and 550-650ms and those with higher visual ratings elicited greater negativities from 550-650ms; negativities associated with these predictors were observed on the centroparietal channels. No effects emerged for the event-related unfit or unrelated violations. Findings suggest that violations that are perceptually-related scale with perception-related strength, and that the N400 is sensitive to the kind prediction violation.

Arushi Sangal

Human Biology and Public Health (Concentration in Medicine Sciences), Warren

Mentored by Elisabet Bjanes

*Molecular iodine acts as a non-staining, broad-spectrum antiseptic, providing a new, high-performance solution to fight resistant hospital pathogens*

Povidone-iodine is a widely used broad-spectrum antiseptic in clinical settings for the prevention of bacterial, viral, and fungal infections. However, iodine-based products are infamous for the deep gold stain which can also cause skin irritation after repeated topical application. Here we test the disinfectant, staining, and cytotoxic properties of reformulated molecular iodine (I2) relative to povidone-iodine in collaboration with I2Pure. Microbial inhibition and killing were evaluated against common hospital-acquired pathogens, including *S. aureus*, *E. faecium*, *K. pneumoniae*, *P. aeruginosa*, and *Candida* using minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) assays. Cytotoxicity was assessed against mammalian keratinocytes. To validate the non-staining properties of the molecular iodine, hospital textiles and fabrics were doused in iodine, then washed with hospital grade detergent. The long-term antimicrobial persistence was tested by swabbing molecular iodine on surfaces and textiles and quantifying bacteria and fungal survival. Results showed that the molecular iodine was highly efficacious against most pathogens, resulting in greater than a 4 log<sub>10</sub> reduction in colony forming units (CFUs) or 99.99% killing. The median minimum inhibitory concentration was 6.25%. Relative to povidone-iodine, molecular iodine had similar levels of cytotoxicity and washed out of textiles readily. Collectively, molecular iodine was equally efficacious compared to povidone iodine without its characteristic intense staining properties. For high volume clinical settings in which staining is undesirable and expensive, molecular iodine could prove a suitable alternative to povidone-iodine.

Anika Satya

Psychology BS, Marshall

Mentored by Douglas Nitz

*Linking Global Map-Like and First Person Perspectives in Rodent Models*

Humans translate spatial information and navigational goals from external maps into action during navigation. The ability to transform between global map-based (allocentric) perspectives (GMPs) and first-person (egocentric) perspectives (FPPs) is essential for flexible navigation, yet the neural mechanisms underlying this process remain unclear. Evidence suggests that the retrosplenial cortex, subiculum, posterior parietal cortex, and hippocampus contribute to linking spatial location and orientation across object-centred reference frames via landmark-based representations. We recorded single-neuron electrophysiological activity in rodents performing a spatial navigation task that included an elevated ramp connecting two square platforms, with multiple reward cups and spatial

landmarks. As animals ascend the ramp, they obtain a global map perspective of the destination platform and the signalled reward location. As they descend the ramp and enter the platform, animals transition from a GMP to an FPP, navigating toward the cued reward cup using the spatial landmarks and transformed information. Through this task, we aim to investigate how spatial representations are encoded and transformed across perspectives, thereby clarifying the neural basis of navigational decision-making.

## Natalie Schafer

Clinical Psychology, Sixth

Mentored by Leslie Carver

### *EEG Signatures of Dynamic Emotional Face Processing in Autism Spectrum Disorder.*

Facial emotion recognition is a critical component of social communication, yet individuals with Autism Spectrum Conditions (ASCs) often experience difficulty interpreting emotional facial cues. Previous research has relied largely on static facial images to study emotion recognition capabilities, which may not accurately represent the dynamic nature of real-life experiences. Additionally, studies often contain peripheral stimuli such as hair, glasses, and blemishes, which ASC individuals tend to focus on more than core facial expressions like eyes, mouth, and eyebrows (Pelphrey, 2002). With the integration of AI, we have created more controlled AI models sharing the same facial features, whilst controlling for these peripheral factors. Furthermore, we developed realistic models that have been controlled for the extent of smiling, blinking, and eye movements.

For this study, we propose the use of Electroencephalogram (EEG) and Event-Related Potentials (ERPs) to identify potential differences between Neurotypical and ASC populations while processing dynamic facial expression changes. We hypothesize that individuals with ASCs will experience reduced event-related potentials (ERPs) when viewing the morphing stimuli, which illustrates weaker neural responsiveness to emotional changes and will show less accuracy in identifying negative emotions (e.g., sadness) compared to positive emotions (e.g., happiness). The usage of EEG may provide a better understanding of neural mechanisms underlying social differences in Autistic individuals, and with the integration of morphing stimuli, we are able to explore these differences in a controlled social situation.

## Marissa Sheehy

Biochemistry, Marshall

Mentored by Erika Cyphert

*Testing Antimicrobial Metabolites Against BV-Associated Bacteria*

Due to proprietary information, this abstract has been redacted.

## Yeshi-Wangmu Sherpa

Neurobiology, ERC

Mentored by Shelley Halpain

*Role of CAP in INF2-mediated actin reorganization in neurons exposed to glutamate excitotoxicity*

Due to proprietary information, this abstract has been redacted.

## Samantha Sokolowski

Neurobiology, Revelle

Mentored by Christina Sigurdson

*The Role of mGluR5 in Prion Disease Pathology*

Synapse loss and neuronal hyperactivity occur early in Alzheimer's and human prion disease (PrD), yet the mechanisms driving these neuronal phenotypes are poorly understood. Alterations in glutamatergic receptors may underlie the synaptic vulnerability and hyperactivity observed in early PrD. The metabotropic glutamate receptor 5 (mGluR5) is a G-coupled protein receptor found on the post synapse of excitatory neurons and is a vital receptor in learning and memory. It has been shown that mGluR5 is significantly decreased during preclinical stages of prion disease in prion-affected mice and in the frontal cortex of postmortem PrD patients. Here we prion-infect mGluR5 f/f - synapsin1 - Cre mice and find that depleting neuronal mGluR5 accelerates prion disease progression. Immunohistochemistry of terminal prion-infected mice with neuronal

mGluR5 depletion leads to an increase in area covered by PrP aggregates in the cortex, and a trend towards an increase in PrP aggregates in the hippocampus. There was no difference in microglial or astrocytic activation. Western blot analysis revealed an increase in VAMP2 (presynaptic protein), suggesting that mGluR5 depletion increases neuronal hyperactivity. Histological and western blot analysis on prion-infected mGluR5 f/f - synapsin1 - Cre mice revealed that mGluR5 plays a neuroprotective role, and that the loss of neuronal mGluR5 may be a contributor to neuronal hyperactivity, which accelerates disease progression.

## Roshan Sood

Computer Science, Sixth

Mentored by Onat Gungor

### *EAGER: Edge-Aligned LLM Defense for Robust Cybersecurity Question Answering*

Large Language Models (LLMs) are highly effective for cybersecurity question answering (QA) but are difficult to deploy on edge devices due to their size. Quantization reduces memory and compute requirements but often degrades accuracy and increases vulnerability to adversarial attacks. We present EAGER, an edge-aligned defense framework that integrates parameter-efficient quantization with domain-specific preference alignment to jointly optimize efficiency, robustness, and accuracy. Unlike prior methods that address these aspects separately, EAGER leverages Quantized Low-Rank Adaptation (QLoRA) for low-cost fine-tuning and Direct Preference Optimization (DPO) on a self-constructed cybersecurity preference dataset, eliminating the need for human labels. Experiments show that EAGER reduces adversarial attack success rates by up to 7.3x and improves QA accuracy by up to 55% over state-of-the-art defenses, while achieving the lowest response latency on a Jetson Orin, demonstrating its practical edge deployment.

## Vivek Sudarshan

Public Health: Medicine Sciences, Muir

Mentored by Laura E. Crotty Alexander

### *Immuno Profiling of Nasal Mucosa in Nicotine E-cigarette Users*

Intro: E-cigarette use, or vaping, has proliferated at a fast rate amongst young adults in the past decade. Investigating the potential adverse effects that vaping can have on a prompt immune response to foreign antigens is a priority given commonplace vaping behaviors. Therefore, this pilot study was conducted to identify and quantify immunological responses in nicotine vapers to assess differences in immune cell recruitment in the nasal mucosa.

Methods: 22 subjects aged 18-35 were recruited and nasal epithelial cells were harvested. RNA extraction for transcriptomic profiling was performed on the samples. Eight subjects aged 18-30 were recruited for a pilot study where their naso-pharynx adenoid tissue and mid-turbinates were swabbed. Swabs are transported to La Jolla Institute of Immunology where flow cytometry was performed to look at immune cell populations.

Results:

Monocyte frequencies were observed to be significantly higher in vapers compared to the healthy controls in both the Mid-Turbinate ( $p < 0.0009$ ) and Naso-Pharynx regions ( $p < 0.02$ ). Transcriptomic analysis showed an increase in the expression of 11 innate immune and macrophage-associated genes, in e-cigarette users relative to non-smoking, non-vaping controls.

Conclusion: Compared to controls, vapers' Mid-Turbinate and Naso-Pharynx regions exhibited higher immune cell concentrations, pointing to a correlation between vaping and dysregulated immune responses in the nasal mucosa. This leads to vapers being more susceptible to infections and viruses. Further assessment of immune cell response in nasal epithelial tissue to pathogen exposure is needed to investigate the pathways and consequence of vaping on immune proliferation efficacy and functionality.

Saba Taheri

General Biology, Seventh

Mentored by Fadel Zeidan

*Randomized Controlled Study Investigating a High Cannabidiol (CBD) Botanical Extract for Complex Regional Pain Syndrome*

Due to proprietary information, this abstract has been redacted.

Sara Tan

Human Biology, Revelle

Mentored by Isabella Maita

*The Big 5: Focus group interviews with STEM students identify 5 common academic stressors*

Stress among students is common, particularly in college, and is frequently brought on by social difficulties, financial worries, academic pressure, etc. Reduced academic performance and mental health problems are associated with high levels of stress. Nevertheless, there are a number of research gaps, such as a dearth of studies on varied student groups and successful interventions. The research question we are looking into is: Does transparency in teaching and learning in the classroom (TILT) reduce academic stress in higher education students? The main interview question we are analyzing is: When you think about school work, what are some things that caused you the most stress? We asked a total of 24 students, split into 5-6 students per focus group, what they found most stressful about their coursework. Focus group transcripts were inductively coded, and thematic analysis was performed to identify common stressors. Code occurrence was used to quantify the frequency with which each type of stress was mentioned. Focus group findings indicate that stress can hinder students' abilities. Preliminary findings indicate 5 types of stressors: managing time and coursework, grading, uncertainty about expectations, understanding concepts, and course activities. Further analysis will include quantifying data to identify the most common stressors. By providing explicit explanations of tasks, grading standards, and course objectives, instructors can clarify expectations, better support students in managing their workload, and identify any stressful aspects of their course to improve the learning environment and lessen course confusion.

Michelle Tang

Human Biology, Marshall

Mentored by Miguel Lopez-Ramirez

*Effects of Anti-CD25 Antibody mPC61 on Regulatory T Cell Differentiation*

Treg (T-regulatory) cells are a special subset of immune cells that suppress excessive or misdirected immune responses, preventing autoimmune diseases. Tregs arise through the

differentiation of naive CD4<sup>+</sup> T cells. CD25 is a protein expressed on the surface of CD4<sup>+</sup> T cells, and the binding of the anti-CD25 antibody mPC61 to this receptor can initiate a novel IL-2 signaling pathway in Tregs. Previous studies in the Ginsberg Lab have shown that the mPC61 anti-CD25 antibody enhances the suppressive function of Treg cells through this novel signaling pathway. Building on this work, our project aims to investigate the effects of mPC61 on Treg differentiation in vitro. Specifically, we hypothesize that mPC61 increases Treg differentiation.

Naive CD4<sup>+</sup> cells were isolated from C57BL/6 Foxp3GFP mouse spleens and cultured under standard conditions for Treg differentiation, with mPC61 or an isotype control. After 5 days of incubation, the cells were analyzed by flow cytometry to assess the percentage of Tregs, defined by Foxp3 GFP expression, for both groups and compared via a paired t-test. The mPC61-treated group showed a significant increase in the proportion of Tregs compared to the control group, indicating that CD25 signaling induced by mPC61 promotes greater differentiation of naive CD4<sup>+</sup> T cells into Tregs. These findings highlight the potential of mPC61 as a therapy for autoimmune diseases involving Treg dysregulation.

Dylan Thomas

Physics, Revelle

Mentored by Tenio Popmintchev

*Attosecond-Femtosecond Sensing of Strongly Correlated Electrons in Atomic, Molecular Systems, and Nanomaterials for Quantum and Neuromorphic Computing*

This research investigates attosecond–femtosecond optical methods for probing electron correlation in atomic, molecular, and emerging condensed-matter systems, with an emphasis on strong-field and ultrafast spectroscopic techniques relevant to future quantum and neuromorphic technologies. The work begins with atomic helium, where electron correlations are examined through soft X-ray high harmonic generation, highlighting how correlated multielectron dynamics can be encoded in high harmonic spectra.

To support the detection of correlated processes, this research also analyzes a novel aberration-free, high-efficiency spectrometer–monochromator designed for attosecond spectroscopy. Zemax simulations are used to evaluate its imaging quality, spectral performance, and suitability for resolving correlation-sensitive ultrafast signals.

A further component of this work studies interferometry and ptychography of laser beams carrying orbital angular momentum, together with their propagation in different waveguide structures. These theoretical and experimental investigations establish tools for structured-light control and diagnostics in advanced photonic platforms.

Finally, phase-sensitive characterization methods for high harmonic beams are explored through ptychographic coherent diffractive imaging, demonstrating how ptychography can recover spatial and phase information essential for precise materials metrology and for the analysis of phase transitions. This research also outlines future directions for applying these ultrafast methods to strongly correlated nanomaterials, including VO<sub>2</sub> and high-temperature superconductors, where electronic correlations play a central role in emergent functionality for next-generation information-processing devices.

## Tristan Tjussardi

Electrical Engineering, Warren

Mentored by Abdoulaye Ndao

*Heterogeneous Modulus Transparent Substrate for Zero Poisson's Ratio Stretchable Displays*

Due to proprietary information, this abstract has been redacted.

## Sofia Tkachenko

Applied Mathematics, Muir

Mentored by Robert J. Webber

*Shattered Gradients: Exploring Neural Network Behavior under an Infinite-Depth Limit*

It can be difficult to explain how neural networks make predictions while otherwise accurately modeling an underlying function. Deep neural networks in particular often have noisy gradients, meaning that small changes to the input can lead to drastically different gradient outputs. Our work explores the limiting behavior of gradients in randomly initialized neural networks. Prior literature has coined the "shattered gradients problem," which claims that gradients in standard feedforward networks begin to resemble "white noise" under a fixed-width, infinite-depth limit. We explore the basis of

this claim, as well as propose several "shattered gradient" hypotheses in an attempt to understand when and how infinite-depth neural network gradients may converge to a "white noise" limit.

## Kenton Tsang

Molecular and Cell Biology, Revelle

Mentored by Elizabeth Villa

### *Identifying Hitchhiking Ribosomes for Cryo-ET Analysis of Translational Regulation*

Translational dysregulation is a key characteristic in Alzheimer's Disease and Related Dementias (ADRD). In healthy neurons, spatiotemporal regulation of translation is necessary to maintain cellular homeostasis. To satisfy local translational demands, neuronal cells deliver ribosomes and phase-separated RNA granules to distal regions by hitchhiking on motile lysosomes using the molecular tether annexin 11. During hitchhiking, ribosomes have been shown to adopt a stalled translation state, which is thought to conserve energy and mediate rapid reactivation at synapses. Importantly, the mechanisms by which ribosomes stall, transport, and reactivate are poorly understood. Furthermore, annexin 11 has also been shown to form ordered filaments with TDP-43, another RNA binding protein involved in translational regulation, in ADRD, suggesting that they may play a critical role in understanding ADRD pathology.

At the Villa Lab, we aim to utilize cryo electron tomography (cryo-ET) to investigate the structural basis of translation regulation. To accomplish this, we will use iPSC neurons to determine how ribosomal states change at different stages of ribosomal trafficking. However, identifying targets for cryo-ET remains challenging. While approaches such as correlative light and electron microscopy (CLEM) enable us to detect regions of interest, confocal microscopy data demonstrates that it is difficult to distinguish between stationary and hitchhiking particles. As a result, we have created and optimized a workflow that filters picks based on particle size and nearest ribosome-lysosome puncta distances, which enriches for hitchhiking particles that are better candidates for future structural studies.

## Aaliyah Vaden

Neurobiology, Revelle

Mentored by Amy Non

### *HIV Disparities between BIPOC and White American Communities of People living with HIV*

Human Immunodeficiency Virus, better known as HIV, is a sexually transmitted disease that, without treatment, is 100% fatal. Since the 1980s, research on HIV has allowed scientists to develop Antiretroviral Therapy (ART) drugs to combat the illness and reclassify it now as a chronic illness, with treatment. These scientific breakthroughs in treatment have removed the death sentence HIV once imposed, for those who can access it. Disparities in care are driven by differences in socioeconomic status or geographical location, which can influence access (or lack thereof) to proper, equitable health care and affordable medications. These have led to downstream disparities in infection, transmission, and death amongst primarily BIPOC communities, specifically the Black and Hispanic communities. By analyzing data around HIV transmission and infection, treatments related to pharmacogenetics, i.e., the different genetic variations and their correlation with drug metabolism, as well as these studies' underrepresentation of BIPOC patients, I recognize an ongoing disparity in research that calls for scientists and HIV researchers to include BIPOC patients into their studies. Inclusion of these communities' genetic variants will allow for greater progress towards a cure for HIV and its related illnesses (especially HAND - HIV-Associated Neurocognitive Disorder and HIVAN - HIV-Associated Nephropathy).

## Izabella Vasquez

Neurobiology, ERC

Mentored by Amy Bintliff

### *Biology Education and Engagement in East Africa*

This research project focuses on providing hands-on biology education kits for children in Kenya and Uganda, with the goal of increasing interest in the biological sciences. East Africa has a high percentage of students lacking basic educational skills, many of whom are also underperforming in biology. I conducted a curricular review of the Uganda Ministry of Education and Sports science curriculum and identified the following

findings: 1) Biology material was based on the memorization of material; 2) there was a lack of hands-on learning, which left little room for conceptual understanding or imagination; 3) the curriculum did not include resources for teachers to implement the lessons. Implementing hands-on activities for students to visualize biology concepts, practice making connections, and interact with their classmates would allow students to use their curiosity and learn in ways that are engaging. I built three biology kits, including lessons and materials, used by our international partners, Africa Education and Leadership Initiative, and Teule Kenya. Last summer, I taught and implemented the pilot curriculum in Kenya with children in primary grades 1-7. I also received feedback from students. Results from participant responses and modifications to the curriculum will be discussed.

## Devan Velji

Mathematics & Economics, Sixth

Mentored by Aram Grigoryan

### *Aftermarket Class Swap System: An Extension Of The TTC Algorithm To University Course Enrollment*

This paper introduces a method allowing students to enter into an aftermarket class swap system where they have the opportunity to ‘trade’ their class timings to improve their schedule. The class swap system uses the top trading cycles algorithm (Shapley and Scarf 1974) and applies additional modifications to make it relevant to this use case. In this paper we examine possible use cases, desirable economic properties of this application, as well as implementation methods. The gains of the proposed course allocation algorithms are evaluated using the UCSD course schedule waitlist data.

## Aditya Verma

Biology with a Specialization in Bioinformatics, Marshall

Mentored by Shiri Gur-Cohen

### *Lymphatic Signaling Promotes Tumor Plasticity in Squamous Cell Carcinoma*

The aggressiveness of cancer cells can be attributed in part to their ability to adopt distinct identities, including a more invasive and mesenchymal phenotype, a behavior known as plasticity. Growing evidence suggests the tumor microenvironment, including the vasculature and immune milieu, plays a key role in shaping cancer cell plasticity and metastatic potential. Recent work from our lab demonstrated that lymphatic vessels interact with epithelial stem cells to maintain tissue homeostasis. Despite evidence linking lymphatic vessels to heightened risks of tumor metastasis, the mechanisms by which lymphatic vessels shape the plastic potential of cancer-initiating cells remain unknown. In this study, we investigated how lymphatic function affects tumor plasticity in cutaneous squamous cell carcinoma (SCC), a common and invasive skin cancer. Using a genetically engineered mouse model of SCC using Sox9-CreER; KRAS; p53fl/fl; YFPfl/fl mice, tumors were analyzed comparing endogenous lymphatic conditions to intratumor lymphatic dysfunction using VEGFR3-Fc, a chimeric antibody that blocks lymphatic vessel growth and signaling. To build a comprehensive transcriptomic profile of cancer cells with and without lymphatic integration and examine how gene expression changes when lymphatics are dysfunctional, tumor cells were sorted and profiled using scRNA sequencing. The analysis revealed that lymphatic regressed tumors had reduced expression of epithelial-to-mesenchymal transition (EMT)-associated genes and shifted toward an epithelial cell state characterized by increased EpCAM expression. Together, these findings suggest that lymphatic signaling promotes tumor cell plasticity and EMT in SCC, whereas lymphatic regression constrains these programs and maintains tumor cells in a more epithelial state.

Caroline Wang

Sociocultural Anthropology, Revelle

Mentored by Saiba Varma

### *'Brainrot' and Dark Humor: The Hidden Power of Gen Z Laughter and Collective Identity Making*

'Brainrot' is a relatively new concept in the fields of anthropology, cognitive science and psychology. 'Brainrot' is generally defined as low-effort social media content that causes a plethora of negative consequences like shorter attention spans and increased anxiety. Based on ethnographic interviews with 7 'Generation Z' (Gen Z) participants—

undergraduate students at UC San Diego—this paper shows how ‘brainrot’ is a genre of dark humor used by ‘Gen Z’ to express a sense of collective political identity. Though brainrot has been primarily viewed as harmful to the youth’s cognitive and social development, I argue that ‘brainrot’ humor shares qualities of surrealism that historically and aesthetically link it to dark humor which can have an emancipatory political potential.

Julia Wang

Cognitive Behavioral Neuroscience, Eighth

Mentored by Steven Barrera

*Cerebello-cortical Functional Connectivity in Pediatric Tourette Syndrome and Typically Developing Children*

Tourette Syndrome (TS) is a neuropsychiatric disorder characterized by sudden, repetitive motor and vocal tics that emerge in childhood and fluctuate across development. Although research on the brain mechanisms underlying TS has provided valuable insight, our understanding remains limited. The cerebellum may be important in TS as it plays a key role in motor functioning, sensorimotor integration, and executive control. These functions are known to be altered in individuals with TS, but little is known about how the cerebellum may contribute to these alterations. One way to study function in the brain is functional connectivity (FC), which measures temporal correlations of functional magnetic resonance imaging (fMRI) activity between spatially distinct brain regions. Examining cerebellar FC allows researchers to assess how activity in the cerebellum correlates with functional networks in the cerebral cortex, which can reveal its involvement in TS. Using previously collected resting-state fMRI data from 90 children with TS (aged 10-14; 31F, 59M) and 90 matched typically-developing controls, cerebellar-cortical network FC is computed by correlating the time series of each voxel in the cerebellum with the mean time series of canonical large-scale cortical functional networks. Resulting FC maps between children with TS and their matched typically-developing controls are statistically compared to identify group differences in cerebello-cortical network connectivity. We hypothesize that children with TS will demonstrate differences in cerebellar FC compared to matched, typically-developing controls. This new understanding of neurobiology shared across TS children may contribute to the development of novel targets for interventions and improved treatment outcomes.

## Sam Wang

Applied Mathematics, Warren

Mentored by Griffin Hosseinzadeh

### *Early Observations and Progenitor Constraints of the Type II Supernova SN 2024pxg*

We present high-cadence optical, ultraviolet (UV), and near-infrared data of the nearby ( $D \approx 11.2$  Mpc) Type II supernova (SN 2024pxg). Recent advancements in early observations have revealed that many Type II SNe show signs of interaction with circumstellar material (CSM), demanding the need to map the diversity of CSM configurations in red supergiants (RSGs). SN 2024pxg, first detected within 19 hours of explosion, shows signatures of CSM interaction but without the pronounced narrow emission lines commonly associated with dense CSM environments. We find that the most likely progenitor was an RSG with mass in the range  $15 M_{\odot} \leq M_{\text{progenitor}} \leq 19 M_{\odot}$ , and a synthesized nickel mass of  $M_{\text{Ni}} = 0.088 M_{\odot}$ , encompassed by low-density CSM. Our analysis highlights the need to consider a revised paradigm for Type II supernovae

## Selina Wang

Cognitive Science, Joint Math/Economics, Muir

Mentored by John Serences

### *Expectation Effects in RNNs: Evidence for Criterion Shifts Over Sensitivity Changes*

In perceptual decision-making, repeated experience with specific sensory features can lead people to form probabilistic expectations about how likely these features and objects that contain these features occur. Signal detection theory (SDT) provides two possible explanations for expectation-related behavior changes: they may either arise from changes in sensitivity to the stimulus, or a shift in decision criterion. Under the first account, changes in sensitivity may implicate a bottom-up change in perceptual processing and under the second account, changes in criterion may reflect a top-down processing strategy. In this study, we analyzed 80 recurrent neural networks (RNNs) trained in either statistically biased environments or statistically uniform environments. We then tested the models on an unbiased reproduction task, with either a pre-stimulus or post-stimulus cue for the correct response mapping. Expectation effect was quantified by

computing stimulus sensitivity ( $d'$ ) and response bias (criterion  $c$ ) for each model. Relative to unbiased-trained models, biased-trained models exhibited a response bias favoring the expected stimulus for both cues. Inconsistent with previous findings from human behavioral data that suggested post cues have larger criterion effect, we found a roughly symmetric impact of cue timing. Further, we do not find a significant difference between cue timing in their impact on modulated stimulus sensitivity ( $d'$ ), aligning with previous findings that expectations do not alter sensory signal itself. Overall, these findings support that statistical regularities in training primarily modulate criterion shifts, consistent with the top-down account. Moreover, our models do not show varied criterion effects across cue timings.

Sara Wickenhiser

Mechanical Engineering, Seventh

Mentored by Michael Yip

*ARCSnake V2: Mechanical Adaptations For An Amphibious Multi-Domain Screw-Propelled Snake-Like Robot*

Robotic exploration in extreme environments, such as caves, oceans, and extraplanetary surfaces, poses significant challenges, specifically locomotion across diverse terrains. Conventional wheeled or legged robots often struggle in such contexts due to variability in traction. This paper presents ARCSnake V2, an adaptation of ARCSnake V1 with additional amphibious capabilities for aquatic environments. ARCSnake V2 combines the high mobility of hyper-redundant snake robots with the terrain versatility of Archimedean screw propulsion. Key contributions include a water-sealed mechanical design with serially linked screw and joint actuation, and an integrated buoyancy control system. Extensive experiments validate its underwater capabilities for diving and surfacing, as well as force-regulated actuation. These capabilities position ARCSnake V2 as a versatile platform for exploration, search-and-rescue, and environmental monitoring in multi-domain settings.

Sebastian Willis Sugiyama

Electrical Engineering, Seventh

Mentored by Parinaz Naghizadeh

### *Benchmarking Influence for Centrality Measures*

The study of spreading processes is a central topic in network science, with applications in optimizing the spread of information. Although the influence maximization problem is NP-hard, heuristic seed selection strategies can still achieve strong performance. In this work, we benchmark the performance of several centrality based strategies for influence maximization. We compare their effectiveness across different network structures and spreading processes to identify which centrality measures perform best in each context.

## Talisa Wines

Cognitive and Behavioral Neuroscience, Muir

Mentored by Anne Beatty-Martínez

### *Using Personal Network Surveys to Understand Heritage Speaker Variability and Processing*

It has been shown in bilingualism research that both languages are active at all times. As a result, bilinguals have to continuously monitor and regulate a two-language active system in order to speak in the target language. By utilizing an interpersonal survey tool, we can better assess how the different bilingual language experiences impact cognitive control and the language contexts that contribute to the shaping of cognitive processes. Especially in the cases of English-Spanish heritage speakers who grow up speaking Spanish at home and later, as English becomes dominant in their environment through social interactions such as school and community, become dominant speakers of English.

Additionally, we utilize a battery of tasks, including lexical production (Picture-Naming, Verbal Fluency) and cognitive control (AX-Continuous Performance Task), to assess the individual differences among bilingual populations. The data may suggest that certain linguistic environments and training contribute to the performance of bilinguals in both domain-general cognitive tasks and linguistic processing, such as measuring latencies of word production in both languages. These factors are not stable and dynamic, which suggests that the bilingual experience is shaped by the environment and linguistic opportunities available to the bilingual speaker.

## Allison Woo

Biochemistry, Marshall

Mentored by Lalit Deshmukh

### *Ubiquitination of HIV-1 p6 Enhances ALIX Recruitment via Avidity-Driven Interactions*

Human immunodeficiency virus type 1 (HIV-1) hijacks the host Endosomal Sorting Complex Required for Transport (ESCRT) machinery to facilitate viral budding and membrane scission. This recruitment is primarily mediated by the interaction between the p6 domain of the viral Gag polyprotein and the host adaptor protein ALIX. While Gag ubiquitination is known to occur during budding, its precise biophysical impact on ALIX recruitment has remained unclear. In this study, we utilized fluorescence anisotropy to quantify the binding dynamics between ALIX and a recombinant Ubiquitin-p6 fusion protein. Our results demonstrate that the presence of ubiquitin increases the binding affinity for ALIX by approximately 3-fold compared to p6 alone. This enhancement is driven by an avidity effect, suggesting that ubiquitin provides a secondary docking site that stabilizes the ALIX–Gag complex. These findings highlight how post-translational modifications can cooperatively regulate host-pathogen interfaces, providing a biochemical basis for how ubiquitination may accelerate HIV-1 release.

## Ellen Wu

Molecular and Cell Biology, Global Health, Revelle

Mentored by George Sen

### *Epigenetic Rescue of Foxp3 Stability Through HDAC Inhibition in Hnrnpu-Deficient Regulatory T Cells*

Regulatory T cells (Tregs) maintain immune tolerance through stable expression of the transcription factor Foxp3. Disruption of Foxp3 expression destabilizes Tregs and promotes autoimmune inflammation. Prior work in the Sen Lab demonstrated that deletion of heterogeneous nuclear ribonucleoprotein U (Hnrnpu) in Tregs causes chromatin closure at the Foxp3 conserved non-coding sequence 2 (CNS2) enhancer, leading to reduced Foxp3 expression, loss of Treg identity, and autoimmune disease.

This project investigates whether histone deacetylase (HDAC) inhibition can restore Foxp3 expression and stabilize Tregs in Hnrnpu-deficient mice. Because HDACs remove

acetyl groups from histones and promote chromatin compaction, pharmacologic inhibition may increase histone acetylation and reopen chromatin at regulatory loci controlling Foxp3 transcription. Hnrnpu-deficient and control mice were treated in vivo with the HDAC inhibitor Trichostatin A (TSA), and immune cell populations were analyzed using flow cytometry.

Initial pilot experiments established a safe dosing regimen for TSA treatment and confirmed the feasibility of the experimental workflow. In a subsequent higher-dose trial, TSA-treated knockout mice exhibited partial restoration of Foxp3+ Treg populations compared with vehicle-treated knockouts. TSA-treated knockouts showed a tissue-specific rescue of Foxp3+ Tregs in lymph nodes, with frequencies approaching wild-type levels, while splenic Tregs remained unrescued. Treated mice also displayed reduced lymphadenopathy and splenomegaly relative to untreated knockouts, suggesting an improvement in autoimmune pathology. These findings suggest that HDAC inhibition partially rescues Foxp3 expression and Treg stability, supporting a role for histone acetylation in maintaining Treg identity.

## Ellen Wu

Molecular and Cell Biology, Global Health, Revelle

Mentored by Vi Nguyen

### *Advancing Climate and Health Advocacy Through Multi-Institutional Collaboration: The American Academy of Pediatrics District VIII Climate Health Symposium*

Climate change increasingly threatens child health through rising temperatures, worsening air quality, wildfire smoke exposure, and climate-related disasters. Children face heightened physiological vulnerability to environmental stressors, and these risks disproportionately affect low-income and marginalized communities. Despite growing recognition of climate-related health impacts, structured opportunities for trainees to engage in climate and environmental health advocacy remain limited within medical and public health education.

To address this gap, a collaborative team of students, physicians, and public health advocates developed and implemented the first American Academy of Pediatrics (AAP) District VIII Climate Health Symposium, *From Extreme Heat to Fire: Disparate Effects Through the Arc of Human Health*. The virtual symposium was designed as a regional initiative to strengthen cross-institutional collaboration and expand trainee engagement in climate-health advocacy. Programming included keynote lectures, interdisciplinary

expert panels, student research presentations, and regional breakout sessions focused on environmental health education, policy engagement, and community advocacy.

Participation metrics from the inaugural symposium demonstrate substantial regional engagement, with more than 150 registrants representing institutions across AAP District VIII. Early feedback indicates high participant satisfaction and increased preparedness to engage in climate-health advocacy. Qualitative responses highlight the value of interdisciplinary collaboration and trainee-led programming in advancing climate and health education.

Building on the success of the inaugural symposium, planning is currently underway for the 2026 District VIII Climate Health Symposium, with improved programming designed to further evaluate and strengthen this regional collaboration model. This initiative illustrates how trainee-supported programming can function as an implementation framework for integrating climate and environmental health into medical and public health training while fostering systems-level collaboration across institutions.

## Violet Wu

Mathematics-Economics, Marshall

Mentored by Lilly Irani

### *Investigating Global Think Tank Influence*

The Atlas Network is a collection of think tanks founded in 1981 with the purpose of planting new think tanks globally and strengthening them through funding, leadership training, and networking opportunities. Started by Antony Fisher, who was influenced by Austrian economist Frederick Hayek and gained his fortune from mining and battery farming, it serves to promote classically libertarian ideas and influence public policy. Think tanks, organizations providing research and briefs on policy issues, are the tool with which he chose to influence the political landscape, and have so far had great impact on climate change denial, tobacco, petroleum, and pharmaceutical regulation, and social conservatism. They've also historically been linked to Donald Trump and Javier Milei's presidential administrations, as well as Brexit. As of 2025, the Atlas Network has grown to over 500 partnered think tanks in over 100 countries, with the highest influence in the United States, Europe & Central Asia, and Latin America. Their primary strategy includes training and funding leaders to proliferate think tanks, circulating falsely objective and privately funded research like policy briefs and templates, political mobilization, organizing convenings, and direct outreach campaigns to policymakers. In

2025 dollars, the network received over \$321,000,000 in donations from groups like Koch Industries, ExxonMobil, Eli Lilly, and the John Templeton Foundation and distributed \$131,000,000 in the form of grants to think tanks around the globe. This report details their history, methodology, finances, and policy impact using public record data and leaked communications.

## Rong Xing

Math- Computer Science, Warren

Mentored by Melinda Owens

### *Exploring Natural Language Processing for Deductive Thematic Analysis of Scientist Spotlight Assignments*

Manual qualitative coding of written student assignments allows human coders to make nuanced judgements about students' ideas. However, it requires a lot of time; from reading the responses to ensuring on agreement among coders, the process can take months to complete. Work in the machine learning (ML) field have demonstrated the potential of techniques like bag-of-words and Doc2Vec for classification of word documents in general, such as sentiment analysis for movie reviews, classifying whether an email is spam, and author identification. But very few ML research papers use these techniques on education-related datasets. For example, one paper used Doc2Vec and Naive Bayes to classify "cognitive presence" in student learning. In this project, we apply the bag-of-words and Doc2Vec techniques to classify student ideas present in Scientist Spotlight assignments and compare the results to each other. Scientist Spotlights are student homework assignments that ask students to read about and reflect on the personal and academic lives of counter-stereotypical scientists, and previous research using manual coding has found that students report ideas related to diversity, self-efficacy in science, and humanizing scientists. To do this, we are building and evaluating an automatized coding process for word documents with multi-labels. The word documents are students' responses to the prompt, "What do these [Scientist Spotlight] readings tell you about scientists?" and if applicable, "What did you find most interesting?". The labels are derived from the previous manual coding guide. Ultimately, we hope this project will create an efficient and replicable approach in characterizing student responses to Scientist Spotlight assignments and can be advantageous for large-scale studies that focus on similar documents and coding schemes in education.

## Alexander Xiong

Chemical engineering, Sixth

Mentored by Ping Liu

### *Enhancing Reversibility in Aqueous Iron Batteries through Electrolyte Environment Modification*

Due to proprietary information, this abstract has been redacted.

## Lasya Yadlapati

Data Science, Muir

Mentored by Andrea Chiba

### *Designing Wearable Biosensor Pipelines Around Individual Variability*

Children's development and their individual strengths play a large role in learning, however, very little research is able to examine their brain and body dynamics as they navigate a typical day in the classroom, often missing the ongoing "quiet signals" that could inform us of internal states and preparation for learning. To explore this, we have a laboratory classroom with a small number of children. Here, we are able to examine physiological states with enough precision to detect subtle rapid fluctuations that reflect the individual behavioral and physiological dynamics of each child. Wearable biosensors offer a promising path toward measurement in these settings. The validity of the signals significantly depend on the preprocessing quality, however current standard pipelines were not designed with our holistic approach in mind.

In this study, we examine where and how existing preprocessing frameworks break down when applied to children in naturalistic classroom settings, and what a more thoughtful alternative might be. A central challenge is distinguishing true physiological signal from artifact generated by the very behaviors we care about: fidgeting, play, and physical engagement. We investigate how artifacts manifest across multiple signal modalities and develop approaches that preserve real physiological information. We do this through IMU-based artifact detection, signal quality assessment pipelines, and wavelength-level comparisons to characterize how sensor performance varies across individuals, all validated against concurrent video recordings as behavioral ground truth. Together, these

constitute a multimodal preprocessing framework that treats individual variability as a design constraint rather than noise to be discarded.

Desiree Yang

Cognitive Behavioral Neuroscience, Sixth

Mentored by Kay Tye

*Prefrontal Encoding of Social Rank-Dependent Strategies*

Social hierarchies occur in numerous social species, and rank within them profoundly shapes physiological stress, motivation, and long-term health outcomes. Downward social mobility in particular is associated with depression and stress vulnerability, yet the neural mechanisms linking rank change to altered behavioral strategy remain unknown. While the medial prefrontal cortex (mPFC) is established as a key regulator of social dominance, how it encodes rank-dependent behavioral strategies, particularly during individual performance outside of direct competitive interaction, remains poorly understood. To address this gap, we developed the climbing beta task, a modular vertical pegboard assay that captures multidimensional behavioral readouts, including latency, tortuosity, path selection, and climbing strategy across configurable board layouts. Using SLEAP-based pose tracking, we will extract continuous behavioral manifolds to characterize rank-dependent strategies across dominant, intermediate, and subordinate animals, and critically, test whether these strategies update following experimental rank change through rehousing. Simultaneous Neuropixels recordings across mPFC subregions will test whether rank occupies a separable dimension within population geometry during individual task performance, and whether this geometry remaps after rehousing-induced rank change. Establishing how social reorganization reshapes both behavior and its neural substrates provides a mechanistic foundation for understanding how rank change translates into altered motivation and health vulnerability.

Helena Yang

Cognitive and Behavioral Neuroscience, Marshall

Mentored by William Pelham

*Digital Location Tracking and Adolescence*

We will co-present a series of studies examining parents' use of smartphone-based digital location tracking (DLT) applications (e.g., Life360, Find My) to monitor adolescents. Drawing on multiple projects, including a large nationwide longitudinal survey (n ~ 3,000) and a recent pilot study (n ~ 40) integrating objective smartphone usage data, this research investigates the prevalence, patterns, and relational implications of contemporary DLT practices. Preliminary findings suggest that DLT has become normative in US families, with 76% of parents reporting use and a substantial proportion checking location information frequently. Importantly, monitoring frequency demonstrates a non-linear association with adolescent and family outcomes, such that both very low and very high levels of checking may be linked to higher family conflict compared to moderate use. Early evidence also indicates discrepancies between parents' self-reported monitoring and objectively recorded app usage, showing the importance of multimethod measurement in understanding digital parenting behaviors. Building on these findings, our ongoing longitudinal study further examines when, why, and how parents use DLT and evaluates its prospective effects on adolescent behavioral and psychosocial adjustment across multiple timepoints. By integrating survey data, qualitative interviews, and objective usage metrics, this series of research aims to advance the understanding of parental monitoring in the digital age and its implications for adolescent development.

Angelina Ye

Chemical Engineering, Sixth

Mentored by Justin Opatkiewicz

*Student-Led Product Development of a Scalable Lip Gloss Formulation for the Collegiate Market*

Due to proprietary information, this abstract has been redacted.

Jack Ye

Public Health, Eighth

Mentored by Scott Biering

*Zinc Sequestration Inhibits MMP-9 Mediated Vascular Leak in Dengue Virus Disease*

Due to proprietary information, this abstract has been redacted.

Eric Yi

Electrical Engineering, Warren

Mentored by Abdoulaye Ndao

*Heterogeneous Modulus Transparent Substrate for Zero Poisson's Ratio Stretchable Displays*

Stretchable displays are critical for emerging wearable electronics, soft sensors, and next-generation AR/VR interfaces. Although recent advances have enabled foldable, twistable, and rollable displays, intrinsically stretchable substrates often exhibit significant lateral contraction under tensile strain due to their high Poisson's ratio, leading to unintended wrapping, distortion, and shrinkage. Here, we report a transparent heterogeneous-modulus elastomeric substrate designed to achieve near-zero Poisson's ratio while maintaining mechanical softness and optical transparency. The substrate consists of line-patterned hard polydimethylsiloxane (PDMS) embedded within a soft PDMS matrix, producing spatially heterogeneous strain distribution during stretching. In this architecture, the soft PDMS functions as a strain-absorbing medium, while the embedded hard PDMS patterns suppress lateral deformation perpendicular to the applied strain. As a result, the structure significantly dampens transverse contraction and realizes a near-zero effective Poisson's ratio. To demonstrate the utility of this platform for stretchable optoelectronics, LED arrays were integrated onto the heterogeneous substrate. The devices exhibit minimal vertical and lateral distortion during tensile deformation, enabling mechanically stable operation of stretchable light-emitting displays. This heterogeneous modulus strategy provides a simple, scalable approach to mechanically robust stretchable display platforms.

Madison Yu

Neurobiology, Eighth

Mentored by Kay Tye

*Prefrontal Encoding of Social Rank-Dependent Strategies*

Social hierarchies occur in numerous social species, and rankings within them profoundly shape physiological stress, motivation, and long-term health outcomes. Downward social mobility in particular is associated with depression and stress vulnerability, yet the neural mechanisms linking rank change to altered behavioral strategy remain unknown. While the medial prefrontal cortex (mPFC) is established as a key regulator of social dominance, how it encodes rank-dependent behavioral strategies, particularly during individual performance outside of direct competitive interaction, remains poorly understood. To address this gap, we developed the climbing beta task, a modular vertical pegboard assay that captures multidimensional behavioral readouts, including latency, tortuosity, path selection, and climbing strategy across configurable board layouts. Using SLEAP-based pose tracking, we will extract continuous behavioral manifolds to characterize rank-dependent strategies across dominant, intermediate, and subordinate animals, critically testing whether these strategies update following experimental rank change through rehousing. Simultaneous Neuropixels recordings across mPFC subregions will test whether rank occupies a separable dimension within population geometry during individual task performance and whether this geometry remaps after rehousing-induced rank change. Establishing how social reorganization reshapes both behavior and its neural substrates provides a mechanistic foundation for understanding how rank change translates into altered motivation and health vulnerability.

Amber Zhang

Sociology, Marshall

Mentored by Christena Turner

*Negotiating Masculinity in Chinese K-pop Fandom: Feminist Interpretations and Subtle Resistances in Fan Discourses*

This paper investigates the rising preference for androgynous male K-pop idols—an aesthetic characterized by "soft masculinity" and feminine qualities—within Chinese fandom, arguing that this trend signals an emergent form of feminist consciousness among young Chinese women.

This enthusiastic embrace of alternative masculinity emerges with an anti-patriarchal sentiment within the fandom, supported by the viral fan-discourse that pathologizes hegemonic masculine traits (e.g., the terms “Nanren Bing” and “Diewei”). This trend is further framed by the Chinese state's intensified gender policing, which seek to enforce traditional "masculine fortitude." The central question is whether the fans' preference for this non-conforming imagery is merely an aesthetic choice or a symbolic act of resistance against patriarchal authority in public life.

Building on literature concerning K-pop gender performance, such as Jung's concept of "versatile masculinity," this research shifts focus to the dynamic, active interpretations within Chinese fandom discourse. It argues that the fans' "collaborative creativity" plays a crucial role in constructing idol personas, implying that their preferences are an indicator of evolving gender ideologies.

The methodology includes a mixed-methods approach that begins with a content analysis of "floating comments" (danmu) on Bilibili to capture fan reactions to visual and performance elements that blur hegemonic gender boundaries. This data informs surveys and in-depth interviews designed to investigate the underlying reasons for the embracing of non-conforming images and their potential connection to resistance against patriarchal narratives. The study contributes to the sociology of digital resistance, proposing that in constrained digital environments, subtle, consumer-driven forms of opposition can still contribute to shifts in collective consciousness.

Zephyra Zhao

Human Biology, Eighth

Mentored by Laura E. Crotty Alexander

*Effects of Flavored In Vitro E-Cigarette Exposure on Inflammatory Response in Macrophages*

E-cigarettes (e-cigs) have rapidly evolved in design and chemical composition over the past two decades, incorporating flavorants whose long-term respiratory and immunological effects remain poorly characterized. The introduction and marketing of vaping products like JUUL have led to widespread adoption among adolescents and young adults, yet investigations into how flavored e-cigarette liquids influence immune responses are urgently needed. In this project, we aim to investigate the effect of flavored e-cig exposure on inflammatory response in THP-1 cell-derived macrophage subtypes. We hypothesized that flavored e-cig exposure can modulate immune profiles of macrophages. To expose the macrophages, we generated e-cig vapor extract (EVE) by exposing RPMI-1640 30 puffs of air, JUUL aerosols (Mint, Mango, Menthol, and Tobacco; 59 mg/mL nicotine salts), vehicle (propylene glycol/glycerol), or vehicle with nicotine salts. THP-1 cells were differentiated into M0 macrophages with 25 nM phorbol myristate acetate (PMA) for 48 hours, then exposed to 50% diluted EVE for 24 hours. Cells were subsequently returned to growth media or polarized to M1 (proinflammatory) or M2 (anti-inflammatory) for 24 hours. After which, RNA was collected for droplet digital PCR and media supernatants were collected for quantification of M1-(IL-1 $\beta$ , IL-6, TNF- $\alpha$ ) and M2- (TARC, IL-10) related cytokines by ELISA to determine whether EVE treatment alters polarization phenotype. The ELISA result indicated that certain flavors (mango, tobacco) reduced TARC expressions while mint increased it compared to air, and mint also increased TNF-alpha. The data suggest that e-cig flavorants may differentially affect macrophage polarization and modify host immunity.

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