

STANFORD BIO-X UNDERGRADUATE SUMMER RESEARCH PROGRAM



2023 COHORT

“There is no question that the Bio-X grant was a key facilitator of my professional success. Particularly because I was a first-generation college goer, I really needed that extra time with Dr. Schnitzer and his group to learn about academic and research culture.”

—2005 USRP Participant Allison Waters, now an Assistant Professor of Psychiatry and Neuroscience at Mount Sinai

STANFORD BIO-X UNDERGRADUATE SUMMER RESEARCH PROGRAM



2022 Undergraduate Summer Research Program (USRP) Participants

In Summer 2023, the Stanford Bio-X Undergraduate Summer Research Program enthusiastically welcomed our full cohort of 70 exceptional Stanford students to research in laboratories across the campus.

77 Faculty, students, and staff from 35 departments and the Stanford Bio-X Institute contributed their time and effort to the talks, workshops, journal clubs, and other events that enriched the **19th year** of the Stanford Bio-X Undergraduate Summer Research Program with the goal of creating a vigorous, valuable, and fulfilling in-person research experience to fast track the sharpening of students' skills and techniques.

Since 2006, Stanford Bio-X has provided a ten-week summer research opportunity to a total of **926** students. In addition to supporting students to conduct full-time research during the summer, Bio-X enlisted assistance from its Stanford community in order to incorporate unique interactive and collaborative experiences for the cohort. 20 Bio-X postdocs, graduate students, researchers, Bio-X USRP alums and senior-level undergraduates helped to facilitate fulfilling new connections and networks and to enrich the students' learning experience. Structured components of the program include:

30 Faculty Talks (3 talks each Wednesday during the 10-week program), see pages 6-7:

These talks expose students to a variety of scientific fields and enrich their summer interdisciplinary research experience. Faculty share their personal academic journeys as well as their research with students, providing them the opportunity to hear more about the broad range of research within Stanford. Students meet faculty in a variety of scientific fields and have the chance to network with each other as potential future collaborators and colleagues.

5 Workshops (offered in the spring and summer quarters), see page 40:

Throughout the program, workshops explore a variety of research-related skills to prepare for, and enrich, the ten-week immersive experience. These workshops include how to analyze manuscripts, how to formulate scientific questions, how to design experiments, how to give oral presentations, and more. In addition to the undergraduate cohort receiving valuable training, the graduate students and postdoctoral fellows who develop these workshops gain the opportunity to practice their teaching and presentation skills and collaborate with one another on programming content. The workshops also become a resource for the summer cohort for broader career and research advice by expanding their network of colleagues at Stanford.

Professional Panel Discussion, see page 41:

The Bio-X USRP alumni continue to do remarkable things in medicine, academia, and industry. To provide an opportunity to network and educate, three former students—a double board-certified adult psychiatry and child & adolescent psychiatrist, a professor at Stanford, and an MBA grad currently engaged in public equities across several sectors—discuss and answer questions about their professional journeys, sparking ideas about what is possible post-graduation for this cohort of bright and talented students.

5-Week Journal Club Series (11 groups exploring different topics), see pages 42-43:

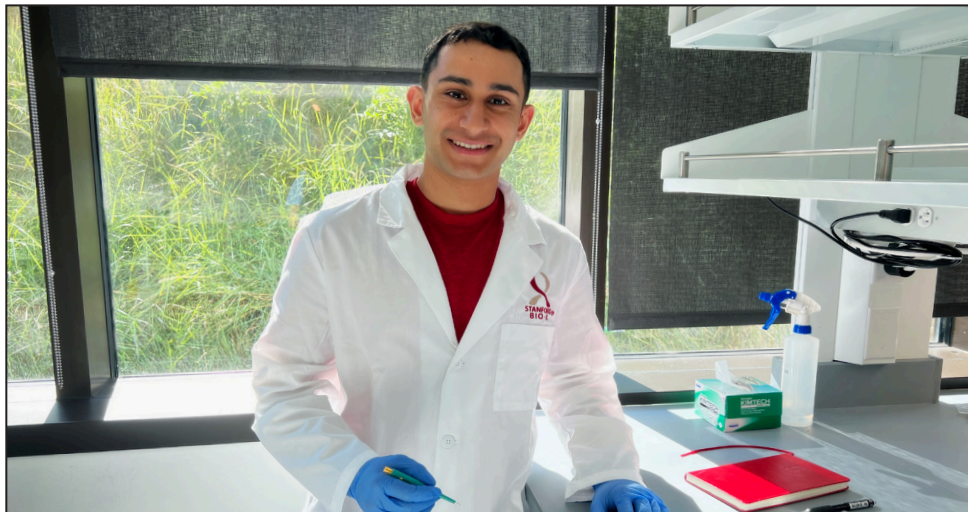
The journal club series facilitate critical thinking among the students as they work in small groups to lead intellectually rigorous discussions regarding recent publications, innovations, and challenging scientific problems. Reading, understanding, and sharing insights from published manuscripts is a critical part of involvement in any research community, and practicing these skills during the Undergraduate Summer Research Program will serve these bright young researchers well as they continue their research careers. Like the workshops, this educational program also offers the postdocs, graduate students, and researchers leading the clubs a unique opportunity to develop their teaching skills, share their research insights, improve their mentorship capabilities, and expand their interactions with undergraduate students, enhancing their own career development as well as the student cohort's summer experience.

Poster Session, see page 43:

At the conclusion of the program, students apply the different skills they learned from Bio-X workshops and throughout the program to create and present a scientific poster summarizing the results of their summer research. This highly-attended event also allows students to discover new fields, learn about the breadth of work supported by the program, and network with colleagues, faculty members, and even professionals from other fields, as well as refining their skills at visual and verbal research presentation.

Stanford Bio-X remains committed to fostering a strong interdisciplinary training for these up-and-coming scientists and ensuring that each of our undergrads has a fulfilling summer which enhances their research skills and helps prepare them for future careers in science and medicine.

Funding for the support of our program was provided by generous contributions from The Rose Hills Foundation, Vicky and David Rogers, Pitch and Cathie Johnson, Brian and Karen Mariscal in honor of Judy Pinsker-Smith, Stanford Bio-X, Dr. Carla Shatz, and Anonymous Donors.



Shay Sharma completed his Stanford Bio-X summer research training with Dr. Hawa Racine Thiam

Stanford Bio-X Undergraduate Summer Research Program Alumni:

Countless students who have participated in the Stanford Bio-X Undergraduate Summer Research Program have indicated that the experience changed the course of their time at Stanford and influenced their future careers. Alumni of the program are extremely successful. They have gone on to:

- pursue doctorates and medical degrees all over the world, at dozens of institutions
- become faculty members in the sciences at leading universities and hospitals
- publish in high-impact journals including *Cell*, *Science*, *Nature*, *Nature Medicine*, *Neuron*, *PNAS*, and dozens more
- receive awards and scholarships like NSF Graduate Fellowships, the Rhodes Scholarship, the Churchill Scholarship, the Gates Cambridge Scholarship, the Soros Fellowship for New Americans, the David M. Kennedy Honors Thesis Prize, the Firestone Medal for Excellence in Undergraduate Research, and countless others
- accept exciting positions in industry and beyond, at dozens of biotech, pharmaceutical, and healthcare companies
- start their own companies, including NeuCures, THEON Therapeutics, shimmer, Kinsol, Y-Trap, Diffeo, Taste, Epitoire Biosciences, Fancy That, Benchling, Stronger Brains, and many other innovative startups and non-profits at the intersection of science, technology, and health



2021 and 2022 USRP Participant Isaac Applebaum's research with Drs. Robert M. Waymouth, Grant Rotskoff, and Ronald Levy used machine learning to design polymers for gene delivery, with implications for mRNA-based vaccines and cancer immunotherapy. Isaac is now a Corporate Development Analyst at Kriya Therapeutics, a biotech startup developing innovative gene therapies.



Elizabeth Schmidt completed her Stanford Bio-X summer research training with Dr. Guosong Hong

Stanford Bio-X Undergraduate Summer Research Program Alumni:



2017 Undergraduate Summer Research Program (USRP) Participants



Alice Spurgin Holland, 2007 cohort (left), is a Board Certified Neuropsychologist with the Neuropsychology Service at Children's Medical Center Dallas and an Associate Professor in Psychiatry at UT Southwestern Medical Center. Alice also serves as Research Director for the CMCD Neuropsychology Service. She has been elected to serve as the President of the National Academy of Neuropsychology in 2025, and served as the President of the Texas Psychological Association in 2019. She has been the recipient of numerous awards, including the Jerry Sweet Leadership Award, the Karl F. Heiser Presidential Award for Advocacy, and a "20 Under 40" Young Professionals Award from People Newspapers.

Geoffrey Schiebinger, 2009 cohort (right), is an assistant professor of mathematics at the University of British Columbia. Before coming to UBC, Geoffrey earned his PhD in Statistics from UC Berkeley and then was a postdoc at the Broad Institute of MIT and Harvard and the MIT Center for Statistics + Data Science. His group develops mathematical tools for analyzing time-courses of high-dimensional gene expression data, leveraging tools from optimal transport, at the intersection of probability, statistics, and optimization.



Brittany Bankston, 2012 cohort (left), is a Principal & Product Director at the Boston Consulting Group. Brittany was the CEO and co-founder, and is on the Board of Directors, of the Black Product Managers Network, a community of diverse product leaders who are passionate about advancing in their careers and increasing representation. The Network seeks to create the most authentic, recognizable and impactful way for Black PMs to advance their careers.

Cameron Backes, 2015 cohort (right), is the CEO of Stronger Brains Inc., a not-for-profit organization which helps children build healthier brains and the foundational neuro-cognitive skills required to overcome social, emotional and learning challenges. Leveraging his training at Stanford, Cameron designed and developed Stronger Brains's initial product, and now uses his interdisciplinary knowledge base and skill set to lead the company, focusing on product and business strategy and development.



Cindy Nguyen, 2017 cohort (left), is a PhD student in Electrical Engineering at Stanford University, working on applying optimization methods to problems in computer vision and computational imaging. She is a recipient of the NSF Graduate Research Fellowships Program award, and her research at Stanford has been published in both *Science* and *Cell*. Cindy is also the co-founder and senior advisor of SHTeM, a research internship program for high school and community college students, aimed at helping first-generation/low-income and minority students interested in pursuing STEM or going to grad school.

Brandon Hwa-Lin Bergsneider, 2019 cohort (right), recently completed a MSc in Bioinformatics and Theoretical Systems Biology at Imperial College London on a Fulbright Scholarship, then worked on the bioinformatics team of the NIH Neuro-Oncology Branch as a Cancer Research Training Award Fellow. Brandon is now a first-year medical student at Stanford as a Knight-Hennessy Scholar. He is interested in using multi-omics technologies and computational techniques to better understand the biological bases of brain cancer, to determine why some patients respond to treatment and others don't, and to understand health disparities in cancer diagnosis and outcomes. He is also passionate about advocacy for universal healthcare coverage.



2023 Faculty Talks:

June 28

Paul J. Wang (Medicine - Cardiovascular Medicine), “How to Have a Career in Academics and Innovation”

Christopher Barnes (Biology), “Structural Insights for the Development of Broad Interventions to Emergent Coronaviruses”

Hawa Racine Thiam (Bioengineering and Microbiology & Immunology), “Neutrophil Biophysics – Learning from NETosis”

July 5

John Boothroyd (Microbiology & Immunology), “How a Protozoan Parasite Can Invade Almost Any Mammalian Cell and Then Co-Opt that Cell’s Functions for Its Own Nefarious Purposes!”

Rogelio Hernández-López (Bioengineering and Genetics), “Engineering T Cells to Fight Cancer”

Merritt Maduke (Molecular & Cellular Physiology), “From Chemistry to Physiology: A Journey through the Membrane”

July 12

Claudia Padula (Psychiatry & Behavioral Sciences), “The Impact of Alcohol and Cannabis Use on the Brain: Implications for Sleep”

Lu Chen (Neurosurgery and Psychiatry & Behavioral Sciences), “The Fragility of Memory – Understanding Fragile X Syndrome”

Gavin Sherlock (Genetics), “Constraints in Adaptive Evolution, Using Yeast as a Model”

July 19

Margaret Fuller (Developmental Biology, Genetics, and Obstetrics & Gynecology - Reproductive Biology), “How to Switch from Proliferation to Differentiation in an Adult Stem Cell Lineage”

Kabir Peay (Biology and Earth System Science), “The Importance of Finding Friends: How Fungal Mutualisms Reshape Our View of Nature”

Ashby Morrison (Biology), “Nuclear Sunscreen Protects Cells from Cancer Development”



Markus Covert, Professor of Bioengineering and (by courtesy) of Chemical & Systems Biology

July 26

Jill Helms (Surgery - Plastic & Reconstructive Surgery), “I Don’t Know How She Does It: Mimicking Nature to Create a Durable Soft Tissue Attachments”

Michael J. Rosen (Pediatrics - Gastroenterology), “Intestinal Organoids as a Window on Inflammatory Bowel Disease (and How I Got Here)”

Kevin Shea (Orthopaedic Surgery), “How Anatomy Research and Biomechanics Changed My Life as a Surgeon”

August 2

Tamar Green (Psychiatry & Behavioral Sciences), “Utilizing Genetic Fingerprints in Psychiatry: Harnessing the Power of Big Data”

Creed Stary (Anesthesiology, Perioperative & Pain Medicine), “Epigenetic Regulation of Sex-Differences in Stroke”

Neir Eshel (Psychiatry & Behavioral Sciences), “The Economics of Dopamine Release”



Hawa Racine Thiam, Assistant Professor of Bioengineering and of Microbiology & Immunology



Jill Helms, Professor of Surgery (Plastic & Reconstructive Surgery)

August 9

Joy Wu (Medicine - Endocrinology, Gerontology, & Metabolism), "Bone and Blood: How Osteoblasts Support Hematopoiesis"

Mark Skylar-Scott (Bioengineering), "Scaling 3D Biofabrication from the Petri Dish Towards Whole Organs"

Sergiu P. Pașca (Psychiatry & Behavioral Sciences - Sleep Medicine), "Functional Models of the Human Brain"

August 16

Jennifer Raymond (Neurobiology), "Big Ideas from the Little Brain: Insights from the Cerebellum about Learning and Meta-Learning"

Elizabeth Sattely (Chemical Engineering), "Discovery and Engineering Plant Chemistry for Plant and Human Health"

Melody Smith (Medicine - Blood & Marrow Transplantation), "Assessing of the Impact of the Intestinal Microbiome on Chimeric Antigen Receptor T cell Therapy"

August 23

Andrea Goldstein-Piekarski (Psychiatry & Behavioral Sciences - Sleep Medicine), "Sleep and Affective Brain Function: Neural Mechanisms of Affective Disorders and Treatment Response"

Keren Haroush (Neurobiology), "Neural Circuits of Social Interactions"

Markus Covert (Bioengineering), "Saving Lives, Saving the Planet - Via Simulation and Computational Modeling"

August 30

Monther Abu-Remaileh (Chemical Engineering and Genetics), "Lysosomal Dysfunction and Neurodegeneration"

Stephen Quake (Bioengineering and Applied Physics), "A Decade of Cell Atlases"

Avnesh Thakor (Radiology - Pediatric Radiology), "Precision Delivery of Therapeutic Extracellular Vesicles into Living Subjects"



Sergiu P. Pașca, Kenneth T. Norris, Jr. Professor of Psychiatry & Behavioral Sciences



2023 USRP Participants
Eli Wandless, Bryant Alexandre, and Sloan Charles

"I enjoyed listening to professors speaking both about their research and...their academic journeys. I would always leave [the faculty talks] inspired by the incredible work being done on Stanford's campus by very kind people who were very generous with their time."

—USRP Participant Audrey Kim

2023 Stanford Bio-X Undergraduate Summer Research Program Participants:

Grace Adebogun, Human Biology

Mentor: Jason Yeatman (Pediatrics, Education, and Psychology)

Exploring Various Aspects of the Multi-Element Processing Task in Relation to Reading Ability - A Cross-Sectional Study

Grace aims to explore the relationship between visual processing abilities and reading skills in children. Previous studies have shown a correlation between letter identification and reading ability. The team at the Yeatman lab plans to build on this finding by developing a language-agnostic dyslexia screener using a multi-element processing task using an eye-tracker. By studying how children (aged 5-12) process different visual elements, the researchers hope to gain insights into the neural mechanisms underlying reading and reading disabilities. The findings can contribute to the development of evidence-based educational interventions for children with reading disabilities, ultimately promoting literacy and supporting children's learning and development.

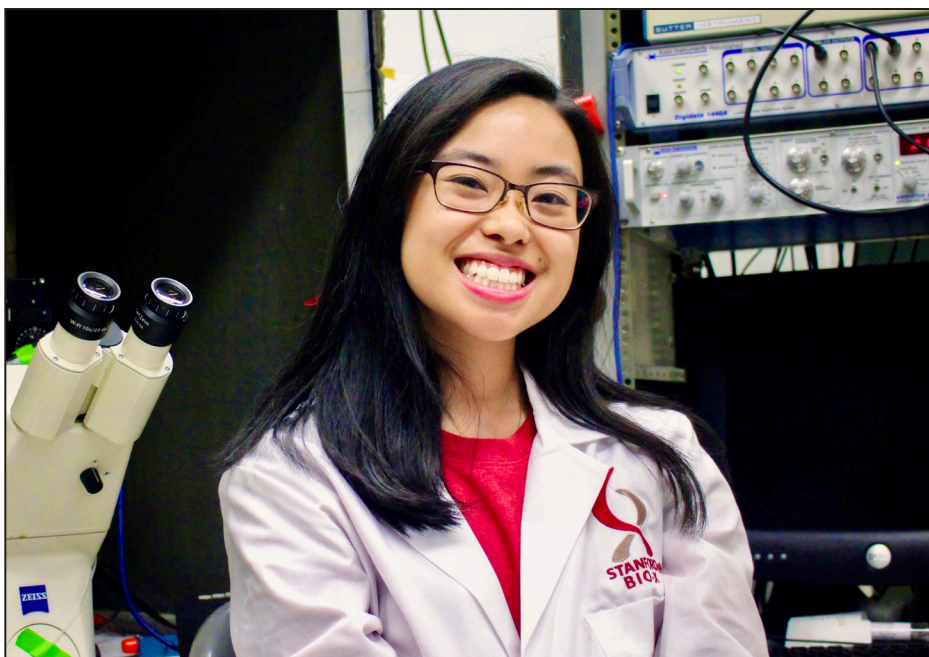
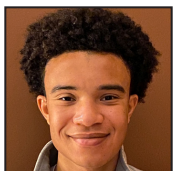


Bryant Alexandre, Human Biology

Mentor: Monther Abu-Remaileh (Chemical Engineering and Genetics)

Analysis of Metabolic Pathways Crucial to Salmonella Survival and Proliferation

Bryant will study the process in which the Salmonella bacteria obtain nutrients to grow and replicate in human cells. He is performing the Salmonella infection on human macrophage cells *in vitro* (outside of the human body) and extracting solely the Salmonella from inside the macrophage. He will then identify the nutrients that Salmonella bacteria are taking from human cells to grow and replicate. His work will help the Abu-Remaileh lab to create drugs that target production of these nutrients so that it is hard for Salmonella to find these nutrients in our cells, thus halting the infection. Starving bacteria in this way could be a great way to treat infectious diseases and combat the antibiotic resistance crisis.



Audrey Nguyen-Hoang completed her Stanford Bio-X summer research training with Dr. Merritt Maduke



2016 Undergraduate Summer Research Program (USRP) Participants

Christina Andronescu, Human Biology

Mentor: Maria Barna (Genetics)

Ribo-Cannon: A Novel Genetic Approach to Study Ribosomal Proteins

Christina will help the development of a novel genetic technique designed to assay ribosomal proteins (RPs) and study whether these RPs play active roles in translation. Given the current lack of methods to specifically study these ancient proteins, the project ultimately aims to fill this gap by creating a technique that precisely removes specific RPs from ribosomes post-assembly, and then carry out ribosome profiling to look for differentially regulated mRNA transcripts. The RPs that the Barna lab is studying are known to be important in early mouse embryonic development, suggesting the possibility of future developmental biology applications.

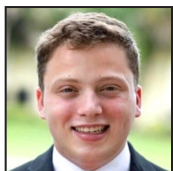


Ari Arias, Biology

Mentor: Helen Blau (Microbiology & Immunology)

15-PGDH Inhibition Improves Muscular Function in a Murine Model of Spinal Muscular Atrophy (SMA)

Spinal muscular atrophy (SMA) is a genetic disease that affects motor neuron function and muscle strength, leading to severe muscle atrophy. Currently, there are no effective treatments for the muscle degeneration associated with SMA. However, the Blau lab has discovered that inhibiting the enzyme 15-PGDH with a small molecule called SW can improve muscle mass and strength in aged mice. Ari aims to investigate whether the same approach can improve muscle function in a mouse model of SMA. This interdisciplinary project may provide valuable insights into the underlying mechanisms of SMA and potential therapeutic interventions.



Jessica Balbin, Chemistry

Mentor: Michael J. Rosen (Pediatrics - Gastroenterology)

Impact of COVID-19 Vaccines on the Adaptive Immune Response of Children Diagnosed with Inflammatory Bowel Disease

Inflammatory Bowel Disease (IBD) impacts ~80,000 US children with incidence rates rising from 2.4%-5.2% within the past decade. Little is known about the adaptive immune response to SARS-CoV-2 vaccines in pediatric IBD populations, and guidance to inform the number of vaccine doses is scarce. Jessica's project will involve measuring immune responses to the SARS-CoV-2 vaccine and evaluating ethnic immunological diversity, hypothesizing that children with IBD will require 2-3 additional COVID-19 immunizations to reach immunological protection.



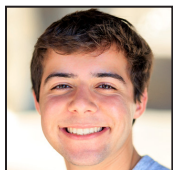


Grace Soontornviwath completed her Stanford Bio-X summer research training with Dr. Paul J. Wang

Max Benabou, Engineering

Mentor: William Giardino (Psychiatry & Behavioral Sciences)

Uncovering the Basis of Sex Differences in Emotional Behavior in Rodents



In his project, Max aims to uncover the neurobiological basis of sex differences in emotional behaviors by correlating stress stimuli given to rodents with the release of a neuropeptide in their amygdala region of the brain. The two variables Max will examine are biological sex and early life stress (maternal separation). This project will implement a diverse set of techniques focusing on optical neural recordings based on newly-developed fluorescent biosensors to monitor neuropeptide release *in vivo*.

Alvaro Bermudez-Canete, Bioengineering

Mentor: Avnesh Thakor (Radiology - Pediatric Radiology)

How Co-Transplanting Extracellular Vesicles (pFUS-EVs) Derived from Mesenchymal Stem Cells (MSCs) with Pancreatic Islets Ameliorates the Transplantation Outcomes for the Treatment of Type 1 Diabetes



Alvaro's research project focuses on improving the transplantation outcomes for the treatment of Type 1 diabetes by co-transplanting extracellular vesicles (EVs) derived from mesenchymal stem cells with pancreatic islets in mice. Currently, there is limited supply of human islets from cadaveric donors, but if successful, using mesenchymal stem cell-derived EVs would provide a significant leap forward in providing scalable therapies. Alvaro will test the effectiveness of EVs in enhancing the viability and functionality of islets. He will also investigate the ability of EVs to restore glycemic control in diabetic mice.

"My favorite part of Bio-X was the way it was organized so that I could practice what it would be like to work full-time in a lab, which solidified my goal of earning a career in research. The program allowed me to live on campus and gain confidence in my field of study. I have gained experience in bench lab work, mouse work, and EEG data analysis. I could not be happier with my time here."

—2022 USRP Participant Veronica Alonso

August Burton, Engineering

Mentor: Jonas Cremer (Biology)

Quantifying the Capacity for Microbial Hydrogen Sulfide (H₂S) Production via Protein Digestion in the Human Gut

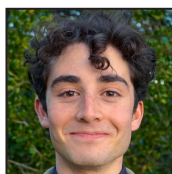


August's project focuses on understanding how the compound hydrogen sulfide (H₂S), produced by microbes in our gut, can lead to gastrointestinal inflammation and diseases like colorectal cancer. To achieve this, the Cremer lab uses a combination of biological experiments, bioinformatics, and mathematical modeling. They have developed a computer-based prediction tool to identify which gut microbes are capable of producing H₂S. The predictions will be tested in the laboratory using specialized assays to measure H₂S's rate of production. The experimental findings will be used to refine the predictive power of their tool, developing a comprehensive understanding of how H₂S is produced in the gut and its potential role in inflammatory diseases. The results can provide valuable insights for future research and potentially lead to new strategies for disease prevention and treatment.

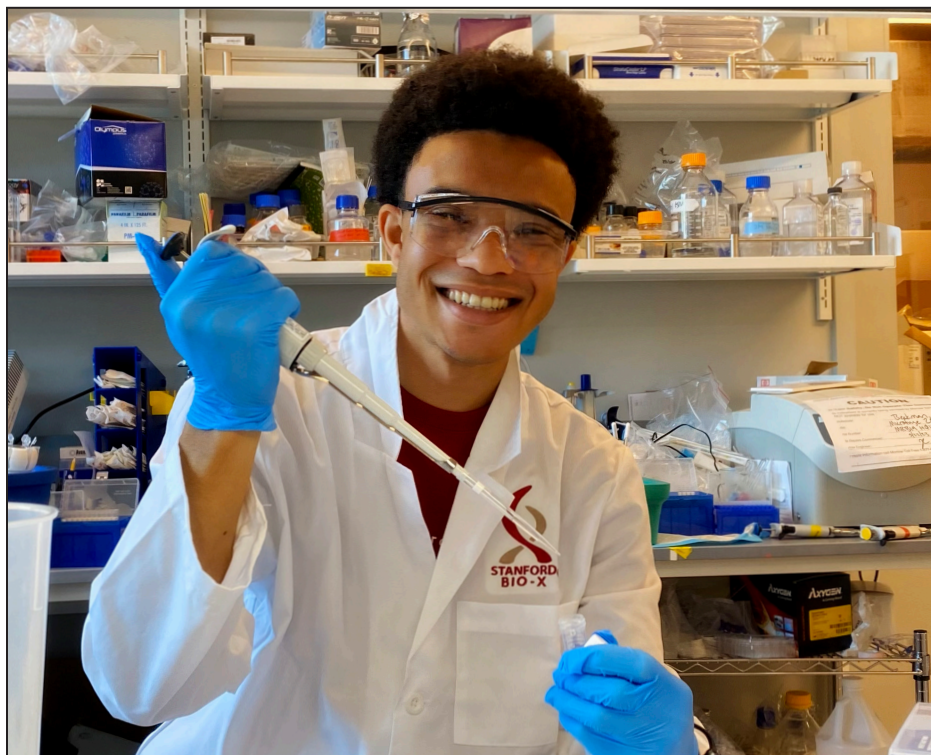
Nate Cadicamo, undeclared

Mentor: Claudia Padula (Psychiatry & Behavioral Sciences - Public Mental Health & Population Sciences)

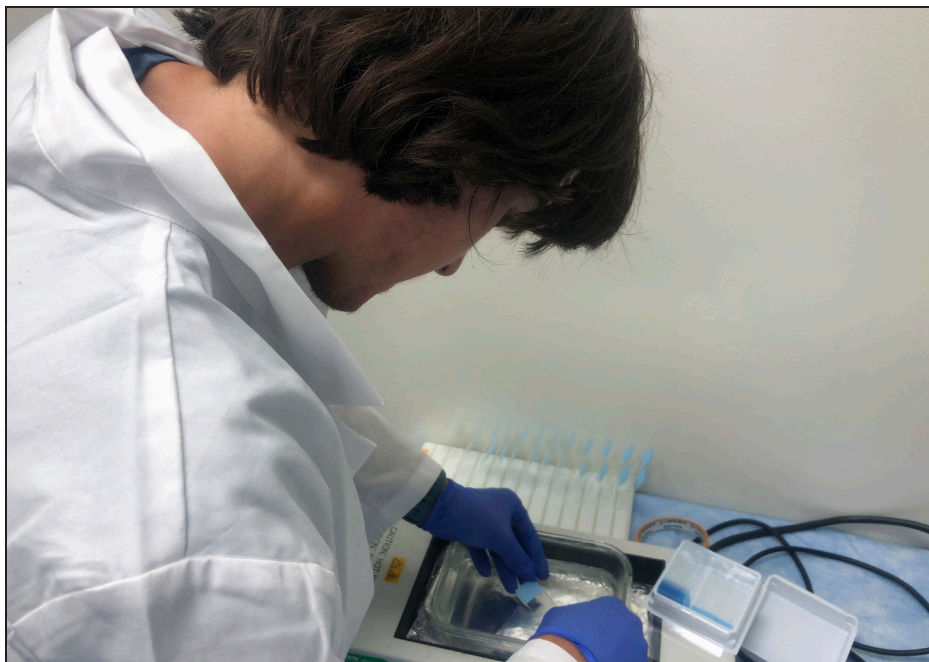
Associations Between Objective and Subjective Sleep Quality in AUD/ CUD Recovery



Nathanael is investigating how alcohol and cannabis use disorders affect sleep. He is using two non-invasive imaging techniques to measure brain activity during sleep for people in residential treatment. He is also comparing objective measures of sleep quality with self-reported experiences of sleep. The Padula lab plans to study these measures over time to see how they change during recovery.



Bryant Alexandre completed his Stanford Bio-X summer research training with Dr. Monther Abu-Remaileh



Michael James completed his Stanford Bio-X summer research training with Dr. Jill Helms and Dr. Katrin Andreasson

Natalia Castillo-Ramos, undeclared

Mentor: Jayakar Nayak (Otolaryngology - Head & Neck Surgery Divisions)
Re-engraftment of Transplanted Upper Airway Stem Cells to Study Durability of Cystic Fibrosis Airway Sinus Disease

Cystic fibrosis is a disease that causes problems in the cells found in the upper airways of the lungs, and is currently incurable. Natalia aims to test the efficiency of transplanted stem cells in their ability to recreate the upper airway epithelium on a mouse model of this disease. The approach is interdisciplinary and will combine stem cell biology, transplantation, and imaging techniques to confirm the presence of transferred cells into the mice.

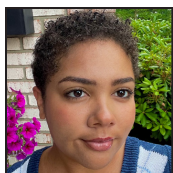


Sloan Charles, Psychology

Mentor: Andrea Goldstein-Piekarski (Psychiatry & Behavioral Sciences - Sleep Medicine)

Associations Between Sleep Disturbance, Domains of Depression, and Emotional Regulation Before and After Sleep Treatment

Sleep difficulties can affect our well-being by decreasing our ability to regulate emotions, which can lead to depression. In this project, Sloan will explore the impact of insomnia treatments on emotional brain functioning. This will be achieved by collecting and analyzing data through a multidisciplinary approach combining clinical assessments, self-reported data, physiological measures, and neuroimaging techniques. The results of Sloan's work may help us better understand the link between sleep quality and emotional well-being and could have important implications for improving mental health treatments.



“I liked being able to network and meet with people, like other undergraduates and prominent scientists in many fields. I also liked being able to do my own hands-on research with the support of Bio-X and the research team.”

—2022 USRP Participant De'Angelo Hermesky

Evie Chen, Biology

Mentor: Anthony Wagner (Psychology)

Developing a Behavioral Paradigm: The Relationship Between Attentional Mechanisms and Memory Performance

As a critical component of higher cognition, memory is usually studied in isolation. The Wagner lab is interested in how another critical component of higher cognition, namely goal-directed attention, affects memory. Specifically, they want to investigate how fluctuation of moment-to-moment attention interacts with how well people can hold a task goal in mind to affect later memory. Evie will be involved in developing and validating experimental paradigms to answer these questions.

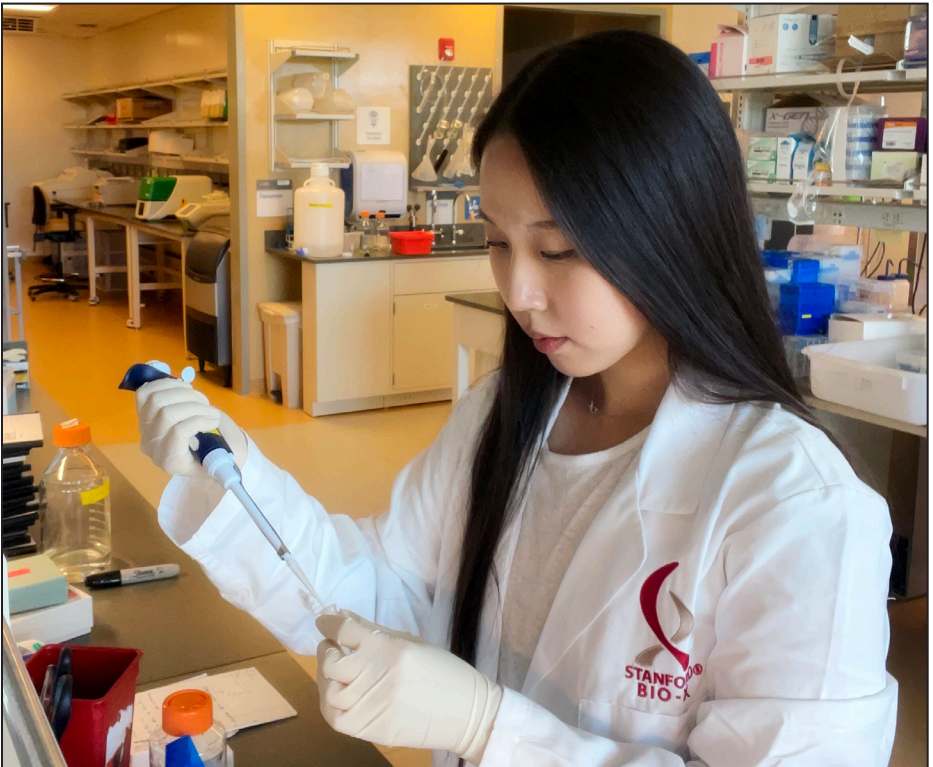


Julia DiCicco, Human Biology

Mentor: John Boothroyd (Microbiology & Immunology)

Dissecting the Involvement of the *Toxoplasma gondii* Gene 224060 in Dense Granule Protein Translocation

Julia's research project aims to understand how a specific gene, 224060, is involved in the movement of dense granule proteins (GRAs) within a parasite called *Toxoplasma gondii*. *Toxoplasma* is a tiny organism that can only survive inside the cells of its host, like humans or animals, and needs to transport certain proteins across membranes to live. The gene 224060 produces a protein that may play a role in this transportation process. Julia will use several techniques to determine the function of this protein in this specific translocation process. By studying *Toxoplasma*, insights can be gained into the biology of diverse organisms and provide valuable knowledge about host-parasite interactions that can impact both human and animal health.



Soyeon Park completed her Stanford Bio-X summer research training with Dr. Jonathan Lin

Gwendolyn Donahue, Biology

Mentor: Ian Gotlib (Psychology)

Diurnal Cortisol and Resting-State Functional Brain Connectivity in Adolescents: A Longitudinal Approach

The hypothalamic-pituitary-adrenal (HPA) axis is the collection of hormone-secreting glands from the nervous and endocrine systems, and its primary function is regulating stress responses. Dysregulation of a key HPA hormone, cortisol, may be implicated in the development of stress-related mental illnesses, such as depression and anxiety. The onset of these disorders is typically during adolescence, a period of growth and reorganization in both the brain and the HPA-axis; however, the neural regulation of cortisol in adolescents is not understood. Gwendolyn proposes to investigate this association by bridging analysis of hormonal and neuroimaging data with psychological-based techniques like behavioral and clinical measures.



Katherine Dong, Biology

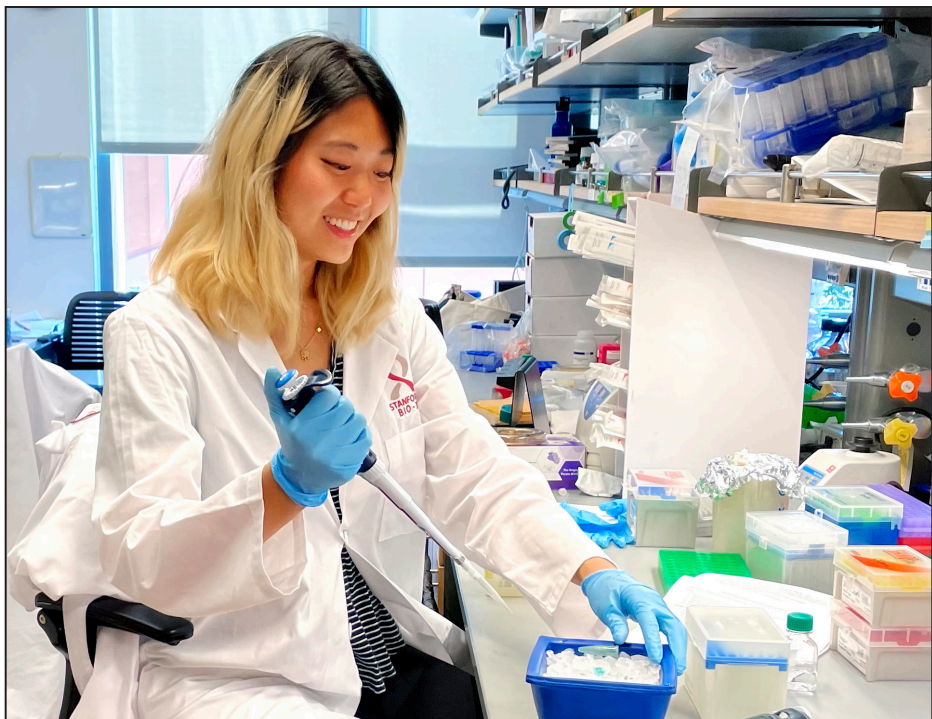
Mentor: Liqun Luo (Biology)

Profiling Cell Surface Protein Dynamics in Neural Circuit Assembly

Carefully choreographed events are critical for the assembly of the neural circuits controlling all brain functions. Cell surface proteins (CSPs) enable in-growing neurites to identify and connect with the correct targets. CSPs are not all fixed within the membrane and exhibit dynamics that underlie their ability to control signaling events critical for neurodevelopment. Endocytosis controls CSP dynamics by internalizing them from the surface into the cytosol. However, the identity and function of the CSPs undergoing endocytosis remains elusive. Katherine will employ molecular, genetic, and cell biological strategies to investigate the role for these cues in circuit formation.



2014 Stanford Bio-X Undergraduate Summer Research Program Participants



Victoria Xin completed her Stanford Bio-X summer research training with Dr. Calvin Kuo

Angelina Duran, undeclared

Mentor: Paul J. Wang (Medicine - Cardiovascular Medicine)

Guiding Mechanism For Epicardial Ablation Element in Catheter Ablation



Over five million people in the U.S. suffer from abnormal heart rhythms termed atrial fibrillation (AF). Although ablation therapy can relieve the electrical issues that underlie AF, most patients will suffer recurrence because the lesions created by current techniques are incomplete. To solve these issues, Dr. Wang and Dr. Babakhanian are developing a catheter solution that performs ablation from both sides of the heart and creates full-thickness ablations across the heart tissue for higher single procedure treatment rate. Angelina's project will involve helping to design the guiding mechanism used to dissect the tissue layers on the epicardial surface, to allow insertion of the epicardial ablation element due to difficulties reaching targets around left pulmonary veins.

Cameron Ehsan, Biology

Mentor: Ashby Morrison (Biology)

Investigating Links Between Chromatin and Metabolic Signaling



Changes in chromatin configuration are observed in various human diseases, including cancers. The INO80 complex is evolutionarily conserved across a wide range of species and plays a fundamental role in cellular processes. The genetic interactions between INO80 chromatin remodeling complex and elements of the mTOR signaling pathway, a key regulator of cell growth and metabolism, have been recently discovered. In this project, Cameron will investigate the interactions of INO80 chromatin remodeling complex in varied metabolic environments in the model yeast organism *S. cerevisiae*.

Mohamed Elhassan, Engineering

Mentor: Tamar Green (Psychiatry & Behavioral Sciences - Interdisciplinary Brain Sciences)

Towards Clinical Translation of Imaging Studies in Neurofibromatosis Type I

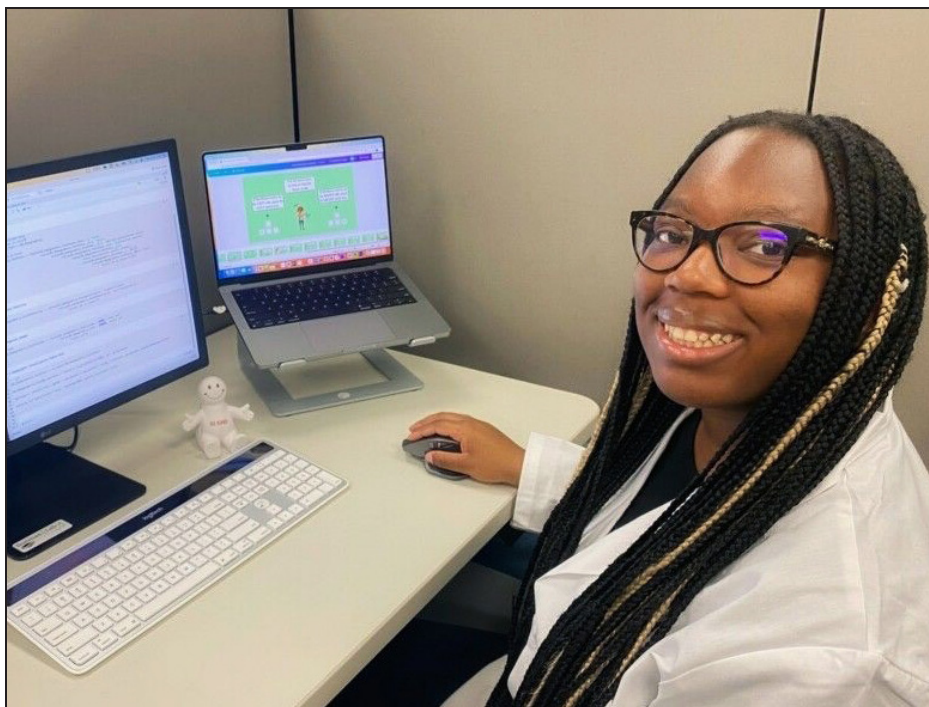
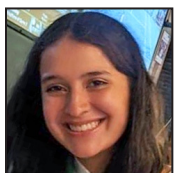
The team's research focuses on the clinical translation of imaging studies in neurofibromatosis type-I (NF1), a genetic condition that causes tumors to grow along an individual's nerves. Although the tumors are usually non-cancerous, they may cause a range of symptoms or lead to conditions such as attention-deficit hyperactivity disorder (ADHD). Mohamed's project will implement training in and application of a variety of cognitive and neuropsychological assessments to administer with enrolled study participants. His project plan includes participant assessments and interacting with participants throughout the study to gain further understanding of these syndromes and defining measurable effects on behavior and cognition.

**Kim Fernandez-Winters, Human Biology**

Mentor: Joy Wu (Medicine - Endocrinology, Gerontology, & Metabolism)

Assessing for Gene Set Associated with Osteoblast Differentiation and Bone Development

In this research project, Kim will use a gene editing tool called CRISPR/Cas9 to study the role of specific genes involved in cell proliferation and bone mineralization. She will focus on genes that are responsible for transporting small cellular components called vesicles. By using CRISPR/Cas9 and other molecular tools, she will modify the expression of certain genes in cells and examine their impact on bone mineralization. Additionally, she will use programming to interpret the data and statistical analysis to draw meaningful conclusions. The findings could have implications for medical treatments by identifying the genes that are most important in bone mineralization and replicating them in stem-cell-based treatments.



Grace Adebogun completed her Stanford Bio-X summer research training with Dr. Jason Yeatman



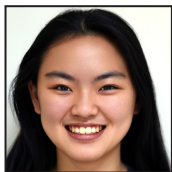
2012 Stanford Bio-X Undergraduate Summer Research Program Participants

Alyssa Guo, Chemistry

Mentor: Calvin Kuo (Medicine - Hematology)

Modeling Wilms Tumor in ALI Kidney Organoids

Alyssa's research aims to better understand Wilms Tumor, the most common type of kidney cancer in children, by using innovative air-liquid interface (ALI) kidney organoids as a 3D model. By manipulating the expression of two oncogenes, Alyssa will investigate their role in transforming kidney tissue and promoting tumor development. The organoids will then be examined for changes associated with tumorigenesis using staining methods and gene expression analysis.



Cyrus Hajian, undeclared

Mentor: Lauren O'Connell (Biology)

Examining Binding Dynamics in the Toxin Sponge Proteins of Poison Frogs

Species that acquire chemical defenses from their diet must also evolve protection mechanisms that prevent self-intoxication. The O'Connell lab has discovered a new class of serpins within poison frogs that act as toxin sponges. Cyrus will examine the hypothesis that poison frog alkaloid binding globulins (ABG) have co-evolved to specifically bind the alkaloids present in a particular species. This project is a collaboration between labs in H&S (Biology) and the School of Medicine (Pathology).



Lauren He, Biology

Mentor: Andrea Goldstein-Piekarski (Psychiatry & Behavioral Sciences - Sleep Medicine)

APOE Status in Sleep Patterns and Response to Treatment

Lauren is investigating the possible correlation between genetic markers associated with cognitive decline and the efficiency of insomnia treatments. She will analyze a large dataset obtained from the National Alzheimer's Coordinating Center using programming and statistical analysis. She will also collect data through physiological assessments and neuroimaging techniques, contributing to ongoing clinical efforts. By approaching this question from multiple perspectives, including sleep medicine, co-occurring psychiatric disorders, genotype, and brain imaging, the lab hopes to improve their understanding of the disease and formulate better treatments for each individual suffering from Alzheimer's disease.



Zuzana Hudacova, Biology

Mentor: Sergiu P. Pasca (Psychiatry & Behavioral Sciences - Sleep Medicine)
Characterizing the Role of Chromatin Regulatory Genes in Cortical Organoids



Recent progress in genetics has identified numerous genes with damaging mutations that are associated with neurodevelopmental disorders (NDDs), yet we lack an understanding of how these mutations lead to these disorders. Genes encoding chromatin regulators, which control the activity and structure of DNA, are among the most frequently mutated in NDDs. Through her project, Zuzana aims to characterize the molecular mechanisms underlying NDDs that stem from chromatin gene mutations by deleting these genes using the gene editing tool CRISPR/Cas9 and assessing the molecular and cellular consequences in cortical organoids, which are a stem cell-based model of developing brain.

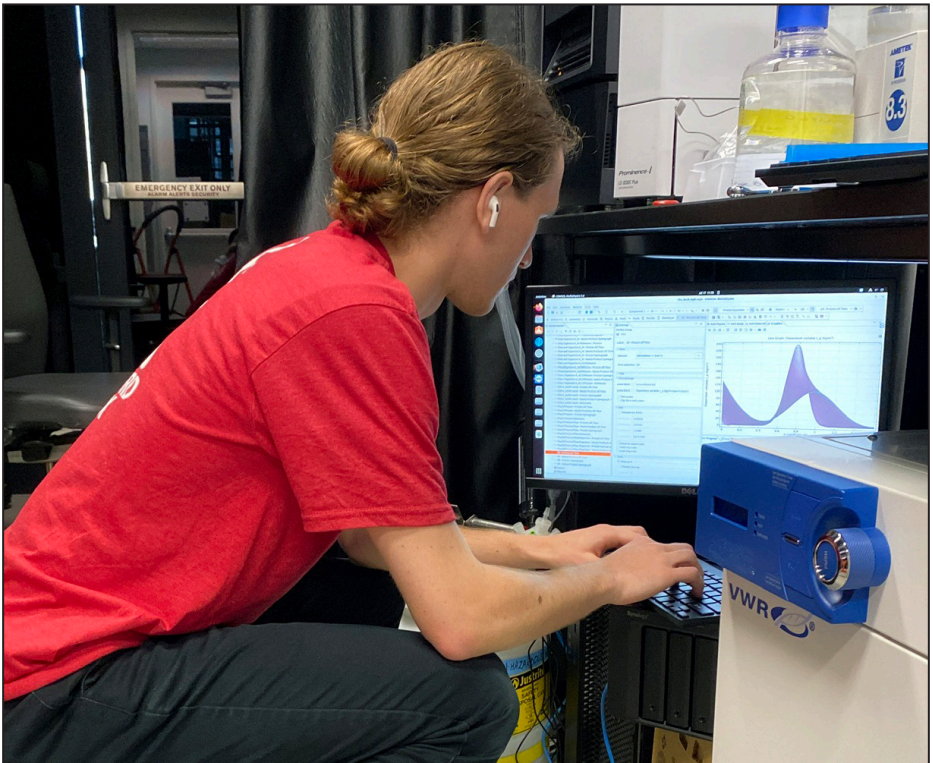
Michael James, Physics

Mentors: Jill Helms (Surgery - Plastic & Reconstructive Surgery) and Katrin Andreasson (Neurology & Neurological Sciences)

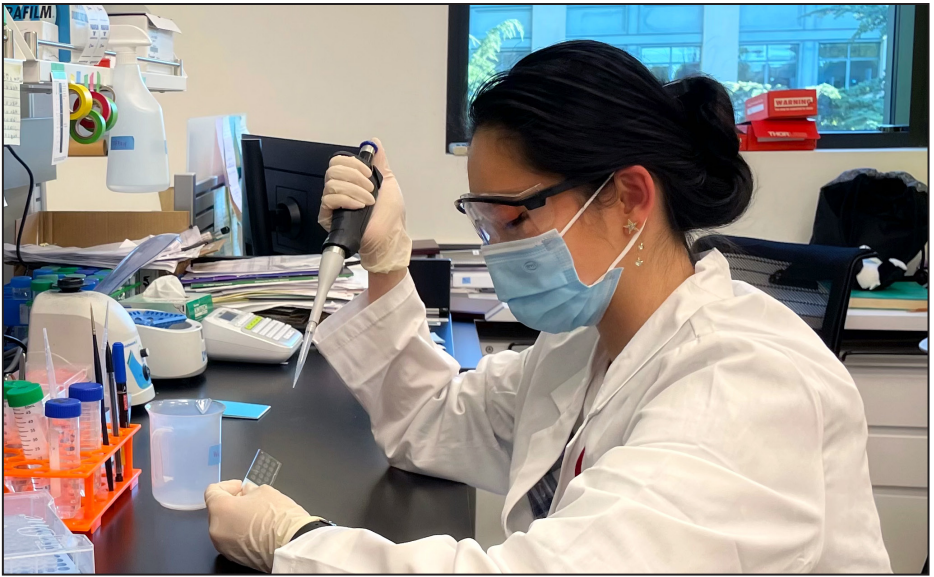
A Study of TREM-1's Inflammatory Effects



The goal of this project is to understand the role of chronic inflammation in aging by genetically inactivating a gene (TREM-1) that is believed to lead to the release of pro-inflammatory proteins in a mouse model. Michael's work builds upon preliminary results that suggest these mice have reduced amounts of immune cells. He will take an interdisciplinary approach by developing a new tissue staining protocol which can be combined with other imaging techniques like MicroCT scans to study bone structure and finally using statistical analysis to find significant differences between the disease model and regular mice.



August Burton completed his Stanford Bio-X summer research training with Dr. Jonas Cremer



Emily Li completed her Stanford Bio-X summer research training with Dr. Xiaoke Chen

Julia Johannsen, Biology

Mentor: Fan Yang (Orthopaedic Surgery and Bioengineering)

Enhancing Cell-Based Cartilage Regeneration via Engineering Hydrogels with Tunable Viscoelasticity

Julia plans to improve the regeneration of cartilage tissue by incorporating tunable levels of resistance to flow and elasticity (viscoelasticity) in 3D sliding hydrogels. By adjusting the bond strength of the crosslinks in the hydrogel network, the viscoelasticity of the hydrogels can be controlled. Julia's project will involve determining the optimal hydrogel formulation that supports robust cartilage formation using chondrocytes and mesenchymal stem cells. Through this research, a deeper understanding of the role of viscoelasticity in promoting cartilage regeneration will be gained, bridging the gap in knowledge in this field and advancing tissue engineering techniques.



Bryan Khoo, Management Science & Engineering

Mentor: Kevin Shea (Orthopaedic Surgery)

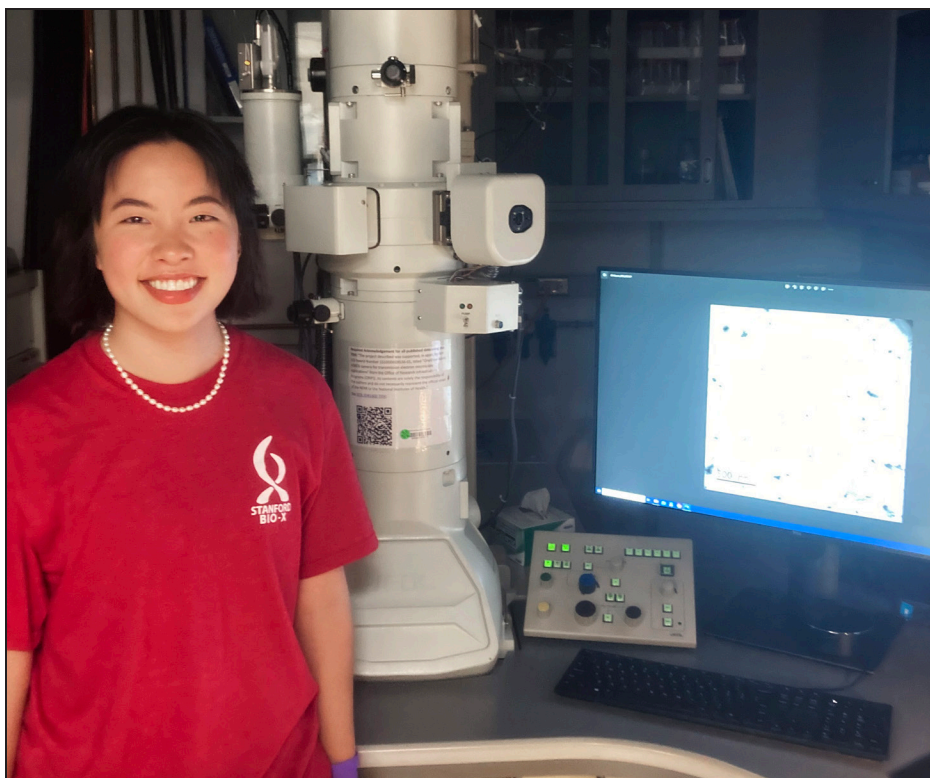
Modeling the Patellofemoral Joint and the Relation of the Trochlea to the Growth Plate

In this project, the Shea lab will study a database of 86 pediatric computerized tomography (CT) and high-resolution magnetic resonance imaging (MRI) scans to create a statistical shape model (SSM) for the pediatric/skeletally immature patellofemoral joint. Bryan's focus in the creation of this SSM is to define the relationship between the growth plate to the developing trochlear anatomy. Through understanding this relationship, surgeons can use guided growth suppression/stimulation to alter a dysplastic trochlea to match the ideal concavity depicted by the SSM. This can minimize patellar dislocation rates in young athletes, reduce frequencies of surgery, and ultimately allow for a future free of chronic patellofemoral osteoarthritis.



"It was truly amazing to spend two summers at Stanford working on research. I just graduated, receiving the Terman Scholastic Award, and [my] honors thesis including the research that I worked on over both summers... [would] not have been possible without the Bio-X summer program."

—2018 and 2019 USRP Participant Maya Varma



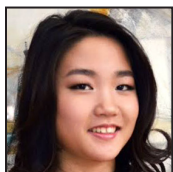
Katie Woo completed her Stanford Bio-X summer research training with Dr. Paul Bollyky

Ireh Kim, Biology and Music

Mentor: Helen Blau (Microbiology & Immunology)

15-PGDH Inhibition as an Antifibrotic for Dilated Cardiomyopathy

Ireh's project focuses on finding a potential treatment for dilated cardiomyopathy (DCM), a cardiovascular disease characterized by heart enlargement and fibrosis. The Blau lab aims to investigate the effects of inhibiting the enzyme 15-PGDH using a small molecule called SW033391 (SW) on cardiac fibrosis and heart function. The hypothesis is that inhibiting 15-PGDH will reduce fibrosis and improve heart function in mice with DCM. Ireh's project explores a potential therapy for DCM and hopes to gain a deeper understanding of the underlying mechanisms involved in cardiac fibrosis.



Joshua Konschnik, Mathematics

Mentor: Jan Skotheim (Biology)

Mathematical Modeling of Cell Size Control Mechanisms in *S. Cerevisiae*

Joshua will focus on understanding the mechanisms that control cell size in budding yeast (*Saccharomyces cerevisiae*) through mathematical modeling and experimental techniques. The team at the Skotheim lab will genetically engineer yeast strains with modified sensitivities to environmental factors. Using in-house microscopes, movies of these yeast strains will be captured and analyzed using cell segmentation and tracking software to investigate cell growth and division dynamics. The collected data will be compared to existing yeast strains with known cell size phenotypes to gain insights into population trends and improve current mathematical models of cell size regulation. This work will potentially contribute to the understanding and treatment of diseases such as cancer.



Abhi Kumar, Computer Science

Mentor: William Hiesinger (Cardiothoracic Surgery)

Toward Autonomous Surgery - Creating an AI Network for Learning Surgical Procedures

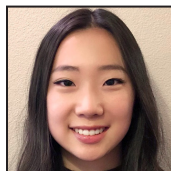


Autonomous surgery benefits medicine by supporting surgeons in their practice through offloading repetitive tasks during procedures, providing precise and accurate guidance, optimizing surgical workflow, and improving surgical outcomes. Abhi's project aims to produce an AI network that can recognize and classify surgical environments and procedures through recognition and association. For recognition, the plan is to teach the model to recognize anatomical structures and surgical tools followed by recognizing actions in surgical procedures. For association, the model will be developed to associate structures with their names (heart, liver, etc.), completing the process of surgical environment learning.

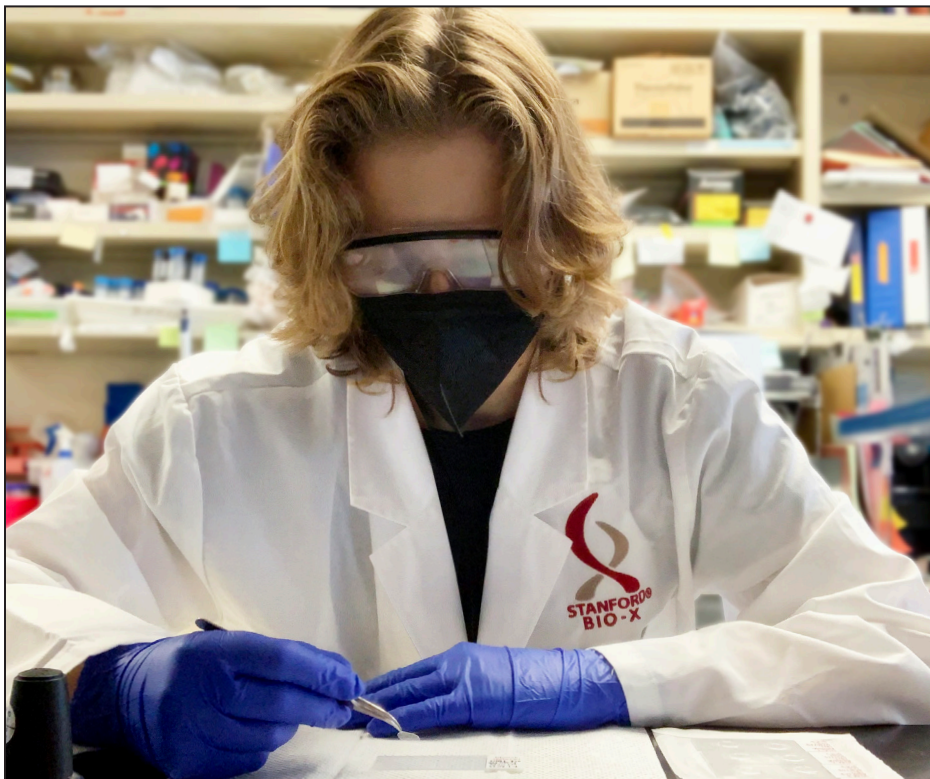
Abigail Kwon, Linguistics

Mentor: Josef Parvizi (Neurology & Neurological Sciences)

Intracranial Study of the Human Language Network



Abigail's project will investigate the neural activity in the human brain during different cognitive conditions; specifically language, arithmetic calculation, and episodic memory processing. By working with patients diagnosed with epilepsy who have been implanted with intracranial electrodes, Abigail will administer separate cognitive tasks. The data collected during these sessions will be analyzed to identify significant neural activity and examine whether there is an anatomical organization of brain regions involved in these processes. By studying the neural networks and mechanisms underlying language production and comprehension, this research contributes to the understanding of both languages and the human brain.



Julia DiCicco completed her Stanford Bio-X summer research training with Dr. John Boothroyd



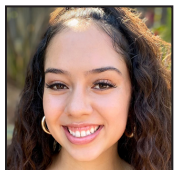
Ishaan Singh completed his Stanford Bio-X summer research training with Dr. Margaret Fuller

Chloe Laguna, Chemical Engineering

Mentor: Elizabeth Sattely (Chemical Engineering)

Discovery and Assay of Secreted Plant Molecules that Modulate Bacterial Metabolism

Chloe's research project focuses on the discovery and study of natural plant molecules, called diterpenes, that have the ability to influence bacterial metabolism. Specifically, Chloe will investigate the role of these diterpenes in helping grasses adapt to environmental stress. One particular molecule of interest is brachialactone, which is secreted by *Brachiaria* grass and has been shown to inhibit bacterial processes in the soil around these plants. Chloe will work on understanding the mechanism of action of brachialactone using specialized assays. The ultimate goal is that this knowledge is used to develop more sustainable agricultural practices.



Allie Lee, undeclared

Mentor: Erin Mordecai (Biology)

Exploring the Effects of Land Use Change on Dengue Transmission

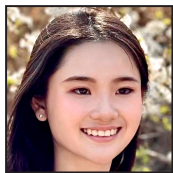
Allie aims to understand how changes in land use and urbanization impact the transmission of dengue, a viral infection transmitted by *Aedes* mosquitoes. Dengue cases have been increasing rapidly in the past two decades, particularly in tropical and urban areas, but the relationship between land use change and disease risk is not well understood. Allie will analyze multinational time-series data on dengue cases and use remote sensing techniques to track changes in land use. By employing statistical models and machine learning algorithms, she will identify the environmental factors that drive dengue transmission. The findings from this research will contribute to identifying high-risk areas and informing effective control strategies.



"I really appreciated being able to meet and learn from so many talented, bright and amazing students and faculty. Being able to be surrounded by a cohort that was passionate about research was a great experience."

—2022 USRP Participant Briana Martin-Villa

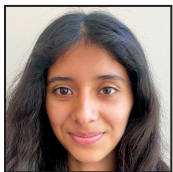
Emily Li, Biology
Mentor: Xiaoke Chen (Biology)



Studying Social Neuronal Pain Behavior Circuits in Mice

The Chen lab is interested in the neural circuit underlying social pain behavior in rodents, which is analogous to empathetic behaviors observed in primates. For Emily's project, they will focus on determining whether sensory input is necessary and sufficient to trigger this behavior and how this input correlates with other targets to mediate the social transfer of pain. To answer these questions, they will set up a social pain behavioral paradigm between two mice providing a stimulus and analyze their response. Emily will explore the neural circuit by silencing certain brain regions or neurons and observe any impact on the established response.

Genessi Lizama, undeclared



Mentor: Allan Reiss (Psychiatry & Behavioral Sciences - Interdisciplinary Brain Sciences and Radiology)

Enhancing Brain Plasticity and Cognition Employing Virtual Reality for Fitness with Portable Neuroimaging

Genessi will use surveys, neuroimaging, and virtual reality technology to investigate how virtual immersive interventions can impact the neurological and cognitive health of ADHD children and adults. This project hopes to improve the quality of life for children and adults diagnosed with ADHD.



Christina Andronescu completed her Stanford Bio-X summer research training with Dr. Maria Barna



Jasmyyn Lopez, Computer Science

Mentor: Christopher Barnes (Biology)

Towards the Development of Pan-Coronavirus Immunotherapies

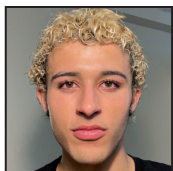
Given the recent spillover events from animal coronaviruses and the potential for novel SARS-like pandemics, it is crucial to develop strategies that elicit broadly neutralizing antibodies capable of recognizing diverse coronavirus strains that can be used in vaccines. The Barnes lab focuses on identifying these antibodies and designing protein-based immunogens to activate precursor B cells as the line of defense against the viruses.

Noah Lowe, Symbolic Systems

Mentor: Keren Haroush (Neurobiology)

Classifying Marmoset Monkey Gaze in Social Decision-Making Games Using Machine Learning

To understand the importance of gaze in social interaction, the Haroush lab analyzes marmoset monkeys playing social decision-making games where one monkey decides on the reward of a recipient monkey. Noah's goal is to find connections between the monkeys' gaze and whether the donor monkey behaves altruistically. This will help the team to understand the role of gaze in social decision-making and identify the neural circuits involved. This research is relevant for social disorders characterized by gaze aversion, such as Autism Spectrum Disorders and ADHD, where abnormal brain activity may give rise to atypical gaze patterns and behavior.



Robby Manihani, undeclared

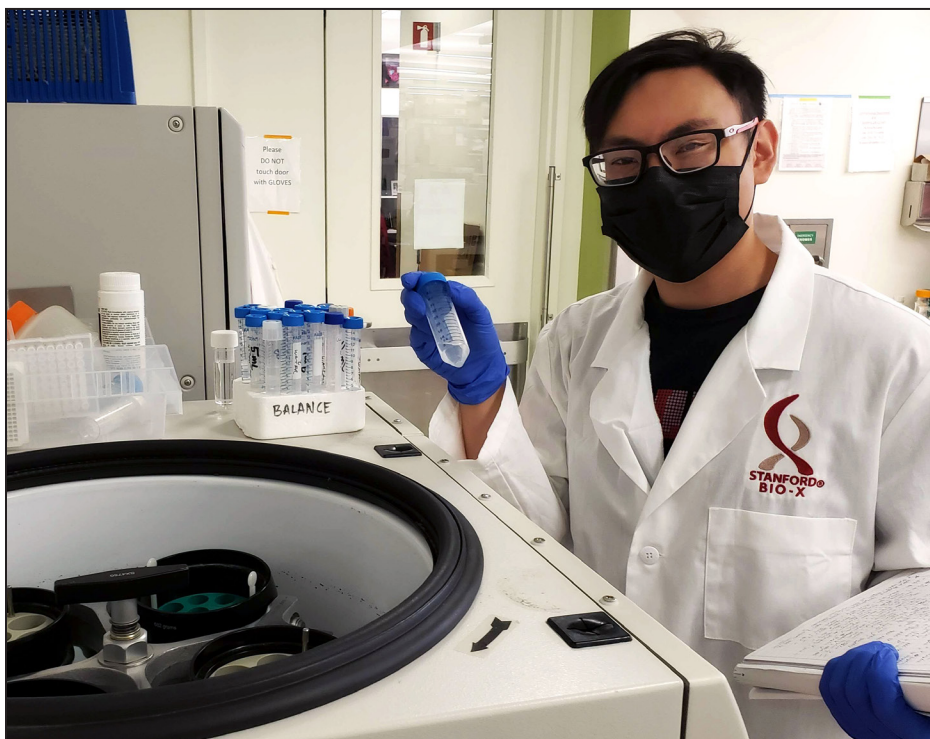
Mentor: Subhasish Mitra (Electrical Engineering and Computer Science)

Creating Error Detection Verification Techniques for Biomedical Devices

Brain-computer interfaces (BCIs) have the ability to revolutionize medicine by replacing degenerated neural pathways with embedded electronics. In his project, Robby is focusing on the design of a retinal BCI that electrically records from and stimulates retinal ganglion cells (RGCs) to reproduce vision in blinded patients. However, the artificial vision produced by modern devices is limited by imperfect electrical stimulation, leading to unnatural patterns of elicited RGC activity. His research strives to create an accurate model of RGC responses to electrical stimulation, thus enabling downstream performance improvements and better patient outcomes.



Zuzana Hudacova completed her Stanford Bio-X summer research training with Dr. Sergiu Pasca



Chris Basco completed his Stanford Bio-X summer research training with Dr. David Myung

Jaston McClure, Biology

Mentor: Martha Cyert (Biology)

The Role of Calcineurin on Nuclear Transport Under Oxidative Stress: Mechanisms and Implications

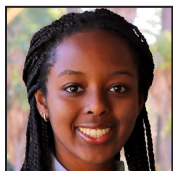


Calcineurin is a phosphatase essential for regulating the cardiovascular, nervous, and immune systems. Calcineurins interact with the nuclear pore complex (NPC) and regulate protein transport between the cytoplasm and the nucleus. The Cyert lab hypothesize that the NPC is partially regulated by calcineurin-mediated de-phosphorylation under disease conditions, such as cancer and oxidative stress. To investigate this, Jaston will implement a combination of fixed and live cell imaging of fluorescent transport reporters, followed by protein proximity assays and cutting-edge super-resolution microscopy. He will also use biochemical analyses such as western blotting and immunofluorescence to elucidate calcineurin's mechanism of action at the NPC.

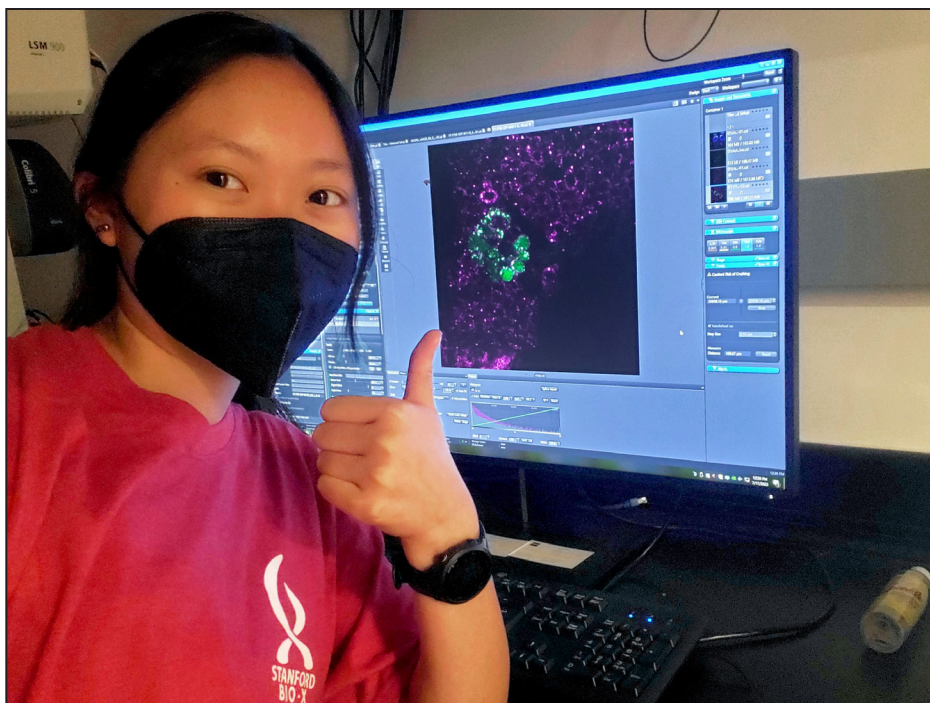
Lina Mohamad, undeclared

Mentor: Ansuman Satpathy (Pathology)

Engineering Immune Cells Towards Developing Patient Specific Cancer Treatments



Clinical trials in immunotherapy for cancer that target the genetic editing of a subtype of white blood cells, called T cells, have produced variable results. This has been attributed to variations in specific receptors on the surface of these cells that are specific for each patient. In the Satpathy lab, Lina will learn several gene editing techniques that can introduce or remove specific immune receptors. She will develop an editing strategy enabling simultaneous testing samples from multiple human donors. She will expand on this new approach to test large, varied donor cell populations, generating functional data to tailor each technique for specific patient needs.



Katherine Dong completed her Stanford Bio-X summer research training with Dr. Liqun Luo

Audrey Nguyen-Hoang, undeclared

Mentor: Merritt Maduke (Molecular & Cellular Physiology)

Molecular Recognition of a Novel Inhibitor by Voltage-Gated Chloride Channels in the Brain

The CLC-2 ion channel facilitates selective passage of Cl^- ions across cell membranes. In the central nervous system, CLC-2 is expressed in both neurons and glia and is proposed to regulate electrical excitability and ion homeostasis. CLC-2 has been implicated in various central nervous system disorders. Working in the Maduke lab, Audrey aims to determine the molecular basis for how the inhibitor "AK-42" interacts with and inhibits CLC-2.



Soyeon Park, undeclared

Mentor: Jonathan Lin (Pathology and Ophthalmology)

Testing Anti-Tau Properties of Small Molecule Integrated Stress Response Boosters

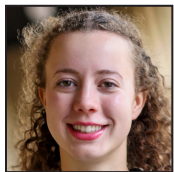
Soyeon's project aims to investigate the potential of small molecules to prevent the accumulation of tau protein in the brain, which is associated with neurodegenerative diseases like Alzheimer's Disease. The project focuses on the Integrated Stress Response (ISR), a critical mechanism for maintaining protein quality control in cells. The Lin lab has identified small molecules that boost the function of ISR and prevent tau buildup. To assess their effectiveness in preventing memory loss, Soyeon will administer these ISR boosters to mice with tau-related neurodegeneration and will use behavioral tests to evaluate memory performance and analyze brain tissue to assess cell death and tau levels. The study will help gain a comprehensive understanding of the underlying pathology of neurodegenerative diseases and explore potential therapeutic approaches at the molecular and behavioral levels.



Kristine Pashin, undeclared

Mentor: Anthony Wagner (Psychology)

The Effect of “Meaning” and “Salience” on Memory Precision



Kristine aims to unravel how repetitive learning of a target location within a room shifts visual attention from “salience” to “meaning”. Her project will leverage participants’ fixations to determine how individuals visually engage with an indoor room, generating “meaning-” and “salience-maps” of each room. By studying how different mechanisms of attention such as “meaning” and “salience” drive learning for a location in a room, the team can isolate how learning is expressed via eye movements and relate these outcomes to memory. These assays test certain aspects of brain function and could potentially be used as early indicator assays to diagnose neurodegenerative diseases such as Alzheimer’s Disease.

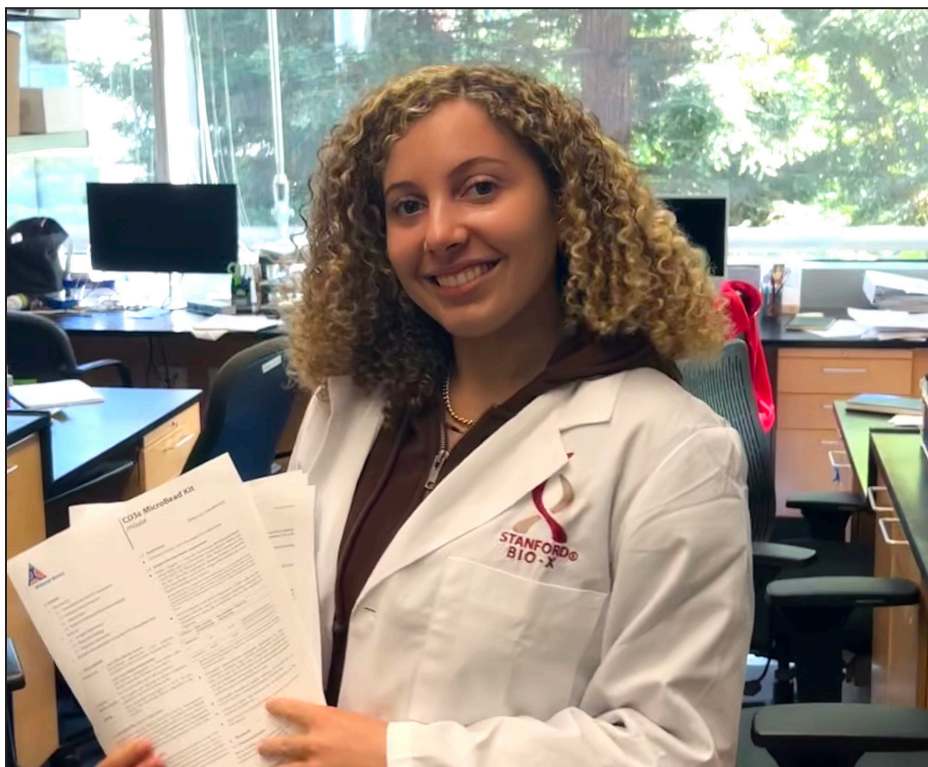
Autumn Parrott, Bioengineering

Mentor: David Relman (Medicine - Infectious Diseases and Microbiology & Immunology)

Identifying Strain Interactions That Affect Colonization in Microbial Communities



Autumn aims to understand why certain microbial strains become long-term residents of the microbiome while others do not. To investigate this, she will use strains isolated from stool samples to create synthetic microbial communities in a controlled environment. By manipulating the composition of the community and observing how the presence or absence of specific strains impacts the colonization of others, she will identify microbial interactions that play a role in strain colonization. Autumn will study ecological interactions in microbial communities by analyzing research papers on microbial ecology and use genome sequencing and bioinformatics to analyze changes in the microbial communities.



Isabella Szabo completed her Stanford Bio-X summer research training with Dr. Melody Smith

Tristan Peng, Computer Science

Mentor: Michael Snyder (Genetics)

Wearipedia - The Stanford Wearables Project



Wearables, such as the Fitbit or Apple Watch among others, are increasingly popular within the general population as well as the clinical research community for documenting people's health. However, there is a lack of standardization for data extraction from these wearables, something that is imperative for clinical researchers conducting longitudinal studies using these devices. The Snyder lab is making wearables easy to use for clinical researchers by building a standardized programming library for data extraction. Tristan will be responsible for managing the entire wearable database as well as the website, which he will be focused on improving.

Claudia Phillips, Bioengineering

Mentor: Guosong Hong (Materials Science & Engineering)

Establishing the Mechanism for Primed Photoconversion and Two-Photon Photocleavage of PhoCl Fluorescent Proteins



Claudia aims to understand the mechanism behind a unique fluorescent protein called PhoCl. This protein exhibits a fascinating process called "primed photoconversion," where it can be converted or cleaved using two lower-energy photons instead of one high-energy photon. The project involves expressing, purifying, and crystallizing PhoCl proteins, as well as performing time-resolved x-ray crystallography to capture the structural changes during photoconversion. The findings from this study will contribute to the field of protein engineering and synthetic biology, potentially leading to the development of improved PhoCl variants with applications in cell imaging, optogenetics, tissue engineering, and medical device design.

Zimin Qian, undeclared

Mentor: Andrea Goldstein-Piekarski (Psychiatry & Behavioral Sciences - Sleep Medicine)

Recording and Analysis of Sleep Electroencephalogram (EEG) Data



In order to understand neural mechanisms and how sleep disruption contributes to depression, the Goldstein-Piekarski lab develops computational models and uses analysis of collected data on high-density EEG sleep recordings. Zimin's specific role in the study is to aid in the EEG recording data and identify any irregularities (noise). The analysis of various brain wave patterns allows the lab to categorize the waves as normal or as patterns with noise. Her research will help to develop novel interventions to target different aspects of sleep disorders.



Noah Lowe completed his Stanford Bio-X summer research training with Dr. Keren Haroush



Kristine Pashin completed her Stanford Bio-X summer research training with Dr. Anthony Wagner

Caitlin Ramos, Mechanical Engineering

Mentor: Mark Skylar-Scott (Bioengineering)

Fibrin-Print Optimization

Previous work in the Skylar-Scott lab included performing 3D FRESH bioprinting experiments, working with fibrin as the print material with the goal of ultimately 3D printing a fully functioning human heart. In this phase of the project, Caitlin's goal is to continue developing experiments to test the parameters that affect the precision of high-speed fibrin bioprinting, including viscosity of the print ink, depth of the FRESH support bath, print speed, and print extrusion rate. By varying these parameters, Caitlin hopes to find the perfect combination of variables to allow for high precision printing at high speeds.



Julián Rodríguez Cárdenas, Symbolic Systems

Mentor: Lu Chen (Neurosurgery and Psychiatry & Behavioral Sciences - Interdisciplinary Brain Sciences)

Investigating the Rules of Engram Allocation in the Hippocampus

Memories are stored across sparse ensembles of neurons, collectively called engrams. The hippocampal engram is believed to be the orchestral ensemble, eliciting memory recall by indexing engrams across brain structures. Julián will use *in vivo* longitudinal calcium imaging of the mouse hippocampus to investigate what features of neural activity before and during contextual fear conditioning influences its chances of being allocated to an engram containing the fear memory. He will use application of deep learning computational approaches, such as convolutional neural networks, to identify causal relationships between neural activity, engram allocation, and mouse behavior.



“My favorite part was being able to do research on-campus with the rest of my friends. I’ve had a great community this summer and getting to focus on my research with the support of that community has been great.”

—2022 USRP Participant Kaitlin Harold

Isabella Russo, undeclared

Mentor: Creed Stary (Anesthesiology, Perioperative & Pain Medicine)
MicroRNA Effect on Long Term Oxygen Consumption in Male and Female Astrocytes



Isabella aims to investigate the cellular mechanisms of sex differences in stroke with a focus on how a non-coding RNA may regulate mitochondrial dysfunction in sex-specific ways. The research will involve growing astrocyte cultures with varied levels of RNA in both male and female cultures. The team will then simulate stroke injury and measure the long-term oxygen consumption rates to determine mitochondrial function. The findings from this project could contribute to the development of novel stroke therapies.

Amin Sajjadian, Bioengineering

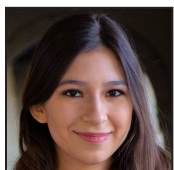
Mentor: KC Huang (Bioengineering and Microbiology & Immunology)
A High-Throughput Assay to Quantify Host-Microbe Interactions and Identify the Microbe-Derived Metabolites



Intestinal microbes affect host health through the production of a diverse milieu of metabolites. The Huang lab has developed a high-throughput assay to identify microbes which affect host health using the model organism *Drosophila melanogaster*. In this project, Amin will measure the lifespan of *Drosophila m.* fed fresh or spent cell-free bacteria media. After identifying health-promoting microbes, he aims to profile their corresponding metabolites using metabolomics. The results can inform novel therapies utilizing microbial-derived metabolites to promote host health.

Elizabeth Schmidt, Materials Science & Engineering

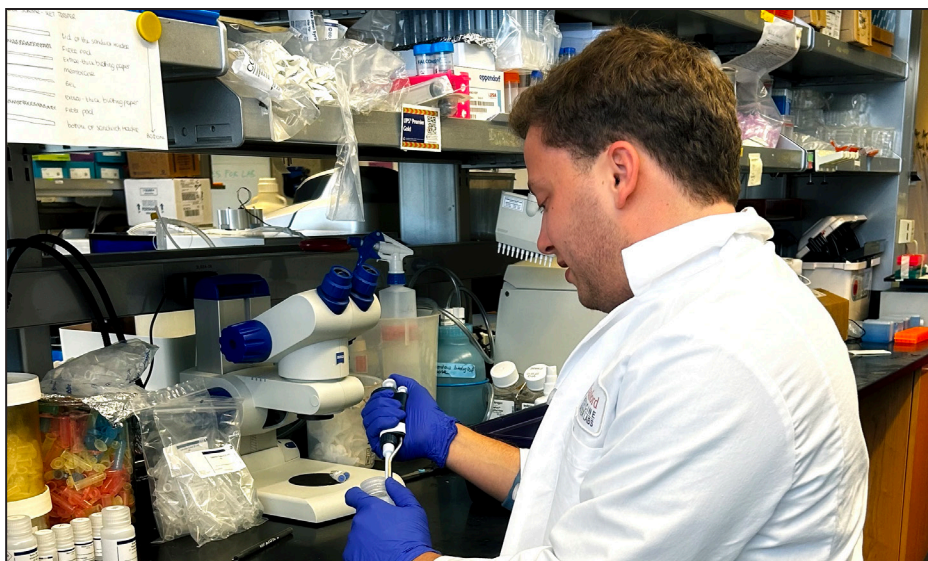
Mentor: Guosong Hong (Materials Science & Engineering)
Developing Intraplexus Nanoelectronics for In Vivo Injection into Post-natal Mice for Monitoring the Enteric Nervous System



Elizabeth aims to develop a technology called intraplexus nanoelectronics (IPNES) for monitoring the enteric nervous system (ENS) in postnatal mice. The ENS is an important part of the gut's nervous system, and understanding its development and function can help in addressing gastrointestinal complications in neonatal care. The project involves fabricating a multielectrode array using advanced nanofabrication techniques, which will be injected into mice to record electrical signals from the ENS over time. By monitoring the ENS in the same animals as they mature, the project will provide valuable insights into the neural circuits underlying ENS development.



Albert Zhang completed his Stanford Bio-X summer research training with Dr. Markus Covert



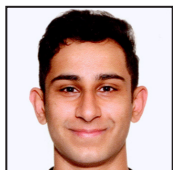
Ari Arias completed his Stanford Bio-X summer research training with Dr. Helen Blau

Shay Nair Sharma, undeclared

Mentor: Hawa Racine Thiam (Bioengineering and Microbiology & Immunology)

The Impact of Simulated Microgravity on Immune Cells Extravasation

Astronauts often experience weakened immune systems during space flights, and Shay's hypothesis is that microgravity alters the fluid flow in blood vessels, thereby impacting the ability of immune cells to exit blood vessels and reach sites of infection, a process called extravasation. The team will design a microfluidic device to simulate blood flow rates under different gravitational forces and determine the impact of fluid flow on immune cell extravasation. They will observe and measure the extravasation of immune cells using microscopy techniques and apply simulated microgravity using a Random Positioning Machine. The results of this study will not only contribute to our understanding of immune responses in space, but also provide preliminary data for a microfluidics device that the lab plans to send to the International Space Station.



Ishaan Singh, Mathematics

Mentor: Margaret Fuller (Developmental Biology, Genetics, and Obstetrics & Gynecology - Reproductive Biology)

Alternative mRNA Isoforms Drive Cell-Type Specific Protein Forms in an Adult Stem Cell Lineage

When a gene is expressed in cells, it must go through a process known as pre-mRNA processing as part of the transition from DNA to protein (the central dogma). This process can be regulated in many ways and can cause variations in the final protein produced, known as protein isoforms. A main question is whether variant protein isoforms expressed in different cell types in this way are localized to different parts of the cell, have different stability, or have special functions needed in certain cell types. To answer this question, Ishaan is studying the germ cells of male fruit flies, which are produced by male germ line adult stem cells throughout reproductive life through a series of intermediate cell types leading to sperm.



“My favorite part of Bio-X was the time I spent in my lab. While [I had] been in this lab for over a year... having so much undivided time to dedicate to my research confirmed that this is what I want to pursue.”

—2022 USRP Participant Allegra Minor

Grace Soontornviwath, undeclared

Mentor: Paul J. Wang (Medicine - Cardiovascular Medicine)

Bench-Top Heart Model for Ex Vivo Testing Surgery Approaches and New Catheter Technologies



A benchtop heart model that mimics human heart tissue properties and pressure can be used to practice catheter ablation and visualize sharp curvatures around the pulmonary veins to improve the success rate of catheter ablation. Grace's project consists of (a) helping to create the heart model using a hybrid approach of 3D printing and silicone molding, (b) researching the models and material properties available that can mimic human tissue by performing tensile testing with an Instron machine and thickness and friction testing using sensors, (c) analyzing how the model and ablation instruments interact, and (d) pressurizing the model while monitoring with sensors.

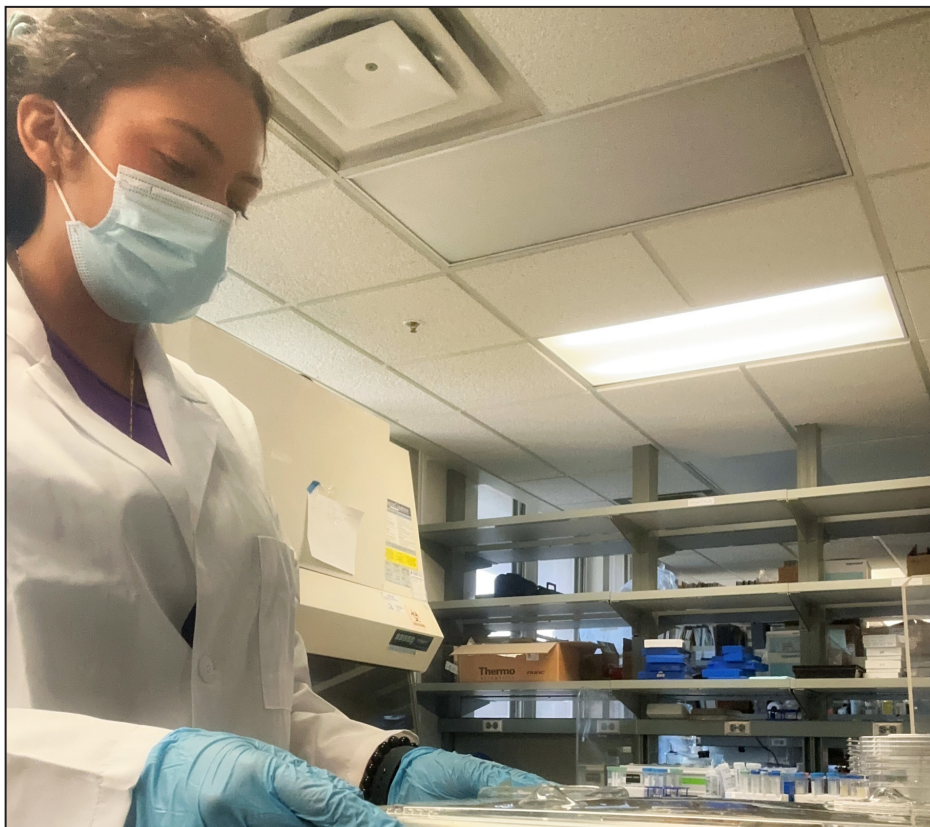
Isabella Szabo, undeclared

Mentor: Melody Smith (Medicine - Blood & Marrow Transplantation)

Off-the-shelf Fully Human CD5/CD7 Bispecific VH CAR- $\gamma\delta$ T cell Therapy to Treat T cell Malignancies



T cell malignancies are a serious and life-threatening disease characterized by the abnormal growth of T cells. Current treatments for relapses are ineffective. Isabella aims to develop a therapy that is ready-to-use and utilizes special cells called $\gamma\delta$ T cells from healthy donors. These cells are equipped with special tools, known as Chimeric Antigen Receptors (CARs), which are designed to target two markers on the cancer cells and offer a potentially novel way to kill T-cell malignancies.



Natalia Castilo-Roman completed her Stanford Bio-X summer research training with Dr. Jayakar Nayak



Mohamed Elhassan completed his Stanford Bio-X summer research training with Dr. Tamar Green

Anjali Temal, Psychology

Mentor: Neir Eshel (Psychiatry & Behavioral Sciences)

Investigating the Role of D1 Medium Spiny Neurons in Cost-Benefit Decision Making in Mice

Dopamine release in the striatum is critical for learning and motivated behavior, but how dopamine affects downstream target neurons remains unclear. Anjali's project involves training mice to perform a task that isolates key components of cost-benefit decision-making. The Eshel lab recently characterized dopamine dynamics during this task. The next aspect of this project is to record from one of the major targets of dopamine release, the striatal medium spiny neurons that express the dopamine D1 receptor, using a fiber photometry technique. Anjali's plan is to characterize the response properties of D1 neurons on the given task.



Vivian Tien, undeclared

Mentor: Paul Khavari (Dermatology)

Investigating the Energy-Independent Role of Glucose in Insulin Response

The Khavari Lab has established an energy-independent role for glucose in which glucose binds to proteins to change their oligomerization and function. They have discovered an additional glucose-binding protein—TSC22D4, an insulin-responsive transcriptional repressor—and hypothesize that glucose is necessary during insulin signaling not only as a source of energy but through direct TSC22D4-glucose interactions. In their model, glucose binds TSC22D4, causing the protein to de-dimerize and release DNA to promote transcription of insulin-responsive genes. Vivian will be testing this model by using biochemical assays to confirm that glucose binding causes TSC22D4 to de-dimerize and changes in DNA interactions, as well as functional assays in cell culture to establish the role of TSC22D4 in insulin response.



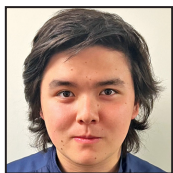
"I am so grateful to have been funded for my research, without which assistance I would not have been able to publish my work. Thank you very much for the opportunity."

—2022 USRP Participant Alice Serenska

George Tilton-Low, Bioengineering

Mentor: Tony Wyss-Coray (Neurology & Neurological Sciences)

Characterizing Microglial Internalization Receptors and Surface Receptor Dynamics



Lysosome-targeting chimeras (LYTACs) allow targeted degradation of cell-membrane and extracellular proteins. This therapeutic modality is of interest in the context of various neurological disorders, which increase with age and often involve toxic extracellular proteins. The aim of the Wyss-Coray lab is to develop cell-type specific LYTACs for the brain, focusing on microglia. Through a mass-spectrometry based approach, George intends to identify microglia-specific surface receptors that traffic to the lysosome and can be co-opted for targeted degradation. Then he will seek to characterize how microglial surface receptor dynamics are affected by both age and disease state. He hopes to identify receptors that can specifically degrade target proteins even in aged microglia.

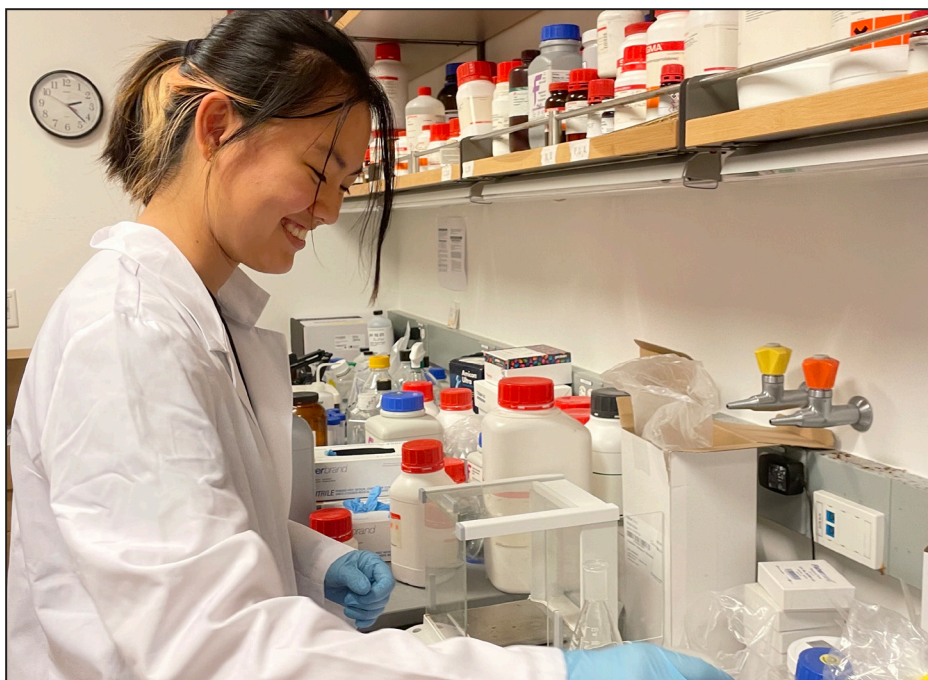
Esther Tok, undeclared

Mentor: Kabir Peay (Biology and Earth System Science)

Childhood Friends: Understanding the Impact of Serpentine Soils on Young and Mature Oak Mycorrhizal Communities



Mycorrhizal fungi form important symbiotic relationships with plants under stressful conditions, providing them with water and nutrients in exchange for sugars. Their fungal-plant relationships can change over age, as the needs of the fungi and plant change. Stressful environments often select specific mycorrhizal fungal communities to provide plants with the best benefits. Serpentine soil is a stressful environment present at Stanford's Jasper Ridge Biological Preserve: the soils are nutrient poor, have a high concentration of heavy metals, and a low calcium to magnesium ratio. In this project, Esther will collect soil samples from oak communities on serpentine and non-serpentine soils at Jasper Ridge. Then, she will identify and compare mycorrhizal fungal communities using PCR, DNA sequencing and BLAST. This study will contribute to our understanding on the influence of mycorrhizal fungal communities on plant growth in stressful and nutrient depleted environments.



Alyssa Guo completed her Stanford Bio-X summer research training with Dr. Calvin Kuo



Robby Manihani completed his Stanford Bio-X summer research training with Dr. Subhasish Mitra

Gloria Vergara Neyra, Bioengineering

Mentor: Rogelio Hernández-López (Bioengineering and Genetics)

Engineering Next-Generation Breast Cancer Cell Therapies: Targeting HER2 Heterogeneity

Breast cancer is one of the most diagnosed cancers in women in the world. Despite the great advances in the detection and treatment of breast cancers, certain forms of breast cancer remain difficult to treat. The Hernandez-Lopez lab is proposing to use our own immune cells to treat difficult cases of breast cancer. T cells can be isolated, modified, and injected back into the body, so that they are programmed to find and kill tumors. Their approach is to modify T cells to specifically recognize and kill breast tumor cells. Gloria is engineering T cells to recognize specific molecular signals of cancer; in this case the amount of a protein (HER2), and to execute potent killing responses. With her mentor, Gloria will test their engineered cells against a variety of models of cancer in cell culture. If successful, their approach will lay the foundation for further animal studies, potentially suggesting new approaches that down the road could have a major impact on our ability to effectively and safely treat some of the most difficult forms of breast cancer and will provide new approaches to other challenging solid cancers.



Ishita Verma, Biology

Mentor: Jill Helms (Surgery - Plastic & Reconstructive Surgery)

Molecular Control of Scarring: Enhancing Surgical Repair Healing in Pediatric Patients

Cleft palate is a common birth defect that can be treated through surgical intervention. However, surgical repair in pediatric patients results in scar tissue that restricts facial growth. Ishita aims to explore a novel treatment that would reduce scarring by targeted activation of local stem cells in a mouse model. After a period of healing, Ishita will assess facial growth using micro Ct-imaging which will be used to derive 3D renderings. Additionally, the tissue will be harvested and stained using histology/immunohistochemistry to quantify re-epithelialization/fibrosis. This will help her elucidate if stem-cell activation approaches can be effective and lead to normal facial growth in treated patients.



Eli Wandless, undeclared

Mentor: *Allan Reiss (Psychiatry & Behavioral Sciences - Interdisciplinary Brain Sciences)*

Exploring Virtual Reality as an Enriching Environment to Foster Brain Plasticity and Physical Fitness Employing Novel Portable Neuroimaging Techniques

As virtual reality (VR) applications grow and sedentary behavior and reports of cognitive impairments increase, evidence-based practices promoting both brain and cognitive health are needed. Eli's research aims to understand the impact of VR on brain and cardiovascular health. The VR conditions will be driven by algorithms that continuously adapt the difficulty level based on individual performance and, therefore, are personalized for the developmental level of each person's capabilities. Participants' physical health and brain activity will be measured before and after VR using a heart rate monitor and non-invasive brain monitoring techniques.

**Celestine Wenardy, undeclared**

Mentor: *Karl Deisseroth (Bioengineering and Psychiatry & Behavioral Sciences)*

Probing Synaptic Plasticity Mechanisms Underlying Learning and Memory

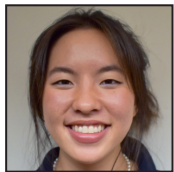
Celestine's project focuses on understanding how learning and memory occur in the brain, specifically in the hippocampus. She is using a combination of neuroscience, bioengineering, and behavioral sciences to study the synaptic and circuit mechanisms involved in memory formation. By integrating knowledge from various fields such as neuroscience, bioengineering, and behavioral sciences, this project aims to shed light on the complex processes underlying learning and memory. The findings may have implications for understanding memory disorders and developing potential therapies.

**Katherine Woo, Communication**

Mentor: *Paul Bollyky (Medicine - Infectious Diseases and Microbiology & Immunology)*

Optimization of Hydrogel-Mediated Bacteriophage Delivery to Fight Multi-Drug Resistant *Pseudomonas aeruginosa*

Multi-drug resistant bacterial pathogens (e.g. *Pseudomonas aeruginosa*) pose a critical threat to human health. Bacteriophage therapy has successfully treated *P. aeruginosa* lung infections via inhalation, but has so far failed to treat skin infections due to its delivery mechanism. To tackle this, the Bollyky lab and Chaudhuri lab have created prototype extended-release high-dosage phage hydrogels using dynamic covalent crosslinks to allow for local, sustained phage delivery. Katherine's participation in this project will include continuing to explore hydrogel-mediated bacteriophage therapy in pursuit of a more efficient and viable delivery system.





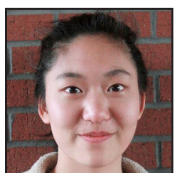
Esther Tok (pictured at far right) completed her Stanford Bio-X summer research training with Dr. Kabir Peay (pictured at left, with lab members, left to right, Anna Johnson, Lexi Triantis, and Eunice De Belen. Photo by Dr. Louis Berrios.

Victoria Xin, Human Biology

Mentor: Calvin Kuo (Medicine - Hematology)

Utilizing a Novel Organoid Model of the Blood-Brain Barrier to Study Mechanisms of COVID-19 Brain Pathophysiology

Victoria's research focuses on studying the mechanisms of COVID-19 brain pathophysiology by utilizing a novel organoid model of the blood-brain barrier (BBB). The BBB plays a crucial role in regulating the entry of substances into the central nervous system, and its disruption has been associated with neurological symptoms following COVID infection. The research objectives include characterizing the organoid model over time, identifying the specific brain cells targeted by the virus, and understanding the pathophysiology of infected organoids compared to uninfected controls.



Leyla Yilmaz, Biology

Mentor: Irv Weissman (Pathology - Pathology Stem Cell Institute and Developmental Biology)

Effects of Chemokine Receptor Inhibition on Aging Hematopoietic Stem Cells

Leyla aims to investigate the effects of chemokine receptor inhibition on aging hematopoietic stem cells (HSCs). Chemokine receptors play a role in triggering inflammatory responses, and recent studies have shown that blocking specific receptors can reduce myelopoiesis (formation of myeloid cells) in bone marrow. By studying mice of different ages and using various techniques such as flow cytometry and transplantation, the team will analyze the impact of chemokine receptor inhibition on HSCs and the balance between myeloid and lymphoid cells. Understanding stem cell aging and the role of chemokine receptors has implications for disease treatment and our overall understanding of aging processes.



"The workshops were very beneficial in chronologically guiding me through the research process. Being able to analyze difficult literature will be critical in developing my own research questions, and being able to present the research effectively is just as important as the research itself."

—2022 USRP Participant Abigail Maemoto

2023 Stanford Bio-X Undergraduate Summer Research Program Cohort Leads:

Chris Basco, Biology

Mentor: David Myung (Ophthalmology)

***In vivo* Corneal Regeneration with SPACKL and Hyaluronic Acid**

Corneal blindness affects over 12.7 million people worldwide, but only 1 in 70 patients can access a sight-saving corneal transplant. In this project, the Myung lab team will use a rabbit model to test the efficacy of a non-invasive corneal transplantation known as Sutureless, Photoactivated, Additive Collagen gel Keratoplasty (SPACKL) in combination with hyaluronic acid in promoting corneal regeneration. If their hydrogel demonstrates effective corneal healing, they will be a step closer to improving access to corneal treatment around the world.



Jaeah Kim, undeclared

Mentor: Karl Deisseroth (Bioengineering and Psychiatry & Behavioral Sciences)

Investigating Neural Circuits in Alzheimer's Disease and Opsin Engineering

Jaeah's project is concentrating on how the neural circuitry is affected in a mouse model of Alzheimer's Disease. Jaeah will investigate the properties of specific photoreceptive proteins (opsins) that under particular conditions potentially inhibit neural activity at the millisecond scale. To do this, Jaeah will integrate disease biology with neuroscience techniques and computational methods to understand properties like their spectral sensitivity and kinetics, which could lead to a better understanding of Alzheimer's disease progression.



Gabriela Rincon, Physics

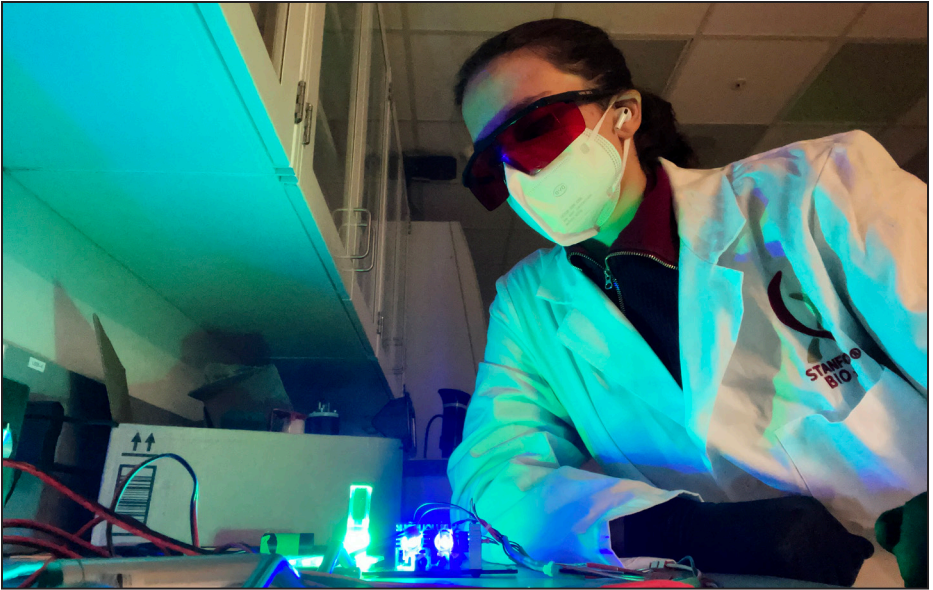
Mentor: Steve Quake (Bioengineering and Applied Physics)

A Portable Microscope for Nailfold Capillaroscopy

Nailfold capillaroscopy is commonly used to monitor the state of various diseases with vascular manifestations. In visualizing blood flow in the fingers, Gabriela hopes to create a microscope to observe changes over time in diseases such as diabetes that affect the blood flow. Ensuring that this microscope is portable will allow for data collection on many healthy and sick patients such that we can compare blood flow between the two and validate our microscope as a prognostic tool.



Angelina Duran completed her Stanford Bio-X summer research training with Dr. Paul J. Wang

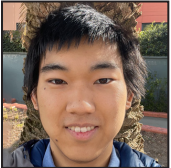


Claudia Phillips completed her Stanford Bio-X summer research training with Dr. Guosong Hong

Albert Zhang, undeclared

Mentor: Markus Covert (Bioengineering)

Using the *E. coli* Whole-Cell Model to Investigate Why *E. coli* Has Its Current Genomic Arrangement of tRNAs/rRNA Genes and Associated Growth-Rate Dependent Gene Dosage Effects



E. coli is one of the most well-studied organisms in biology. The Covert Lab is trying to build a computational model of an *E. coli* that can simulate its growth on a computer by curating decades of data that have been experimentally measured from this organism. When completed, such a model would allow them to quickly test scientific hypotheses, design industrial strains, or even make novel discoveries by running a few lines of code, instead of conducting time-consuming and laborious experiments. Albert's summer project will focus on expanding the predictive capabilities of this model by including a more detailed representation for the production of tRNAs, which are molecules in an *E. coli* cell that are responsible for carrying amino acids to proteins.



2019 Undergraduate Summer Research Program (USRP) Participants

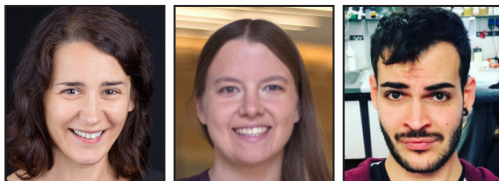
Workshops on Research Skills:

In 2023, Stanford Bio-X is hosting 5 workshops for the Undergraduate Summer Research Program cohort. The workshops are designed to help the students grow as researchers, discover new tools, and identify skills and techniques to help maximize their summer learning.

The workshops, led by a team of Stanford Bio-X graduate students and research scientists (pictured below), are scheduled throughout the program to guide and prepare the undergraduate students. The workshop moderators gain valuable teaching and presentation practice, as well as collaborating collectively to develop rigorous and meaningful workshop content.

The session leaders also become a part of the student cohort's network, acting as a valuable resource for advice and future mentorship, both in terms of the topics covered and the students' future careers.

Workshop Mentors:



Workshops:

Ins and Outs of Scientific Literature: Find, Read, Analyze, Cite

Led by Dr. Maja Djuric

In this workshop, Maja discusses the strategies for finding scientific publications of interest, and the way publication's stereotypic organization is used for critical but efficient reading of presented work. Rules that guide proper citation of existing literature are covered. Software tools used to consolidate publication search results, and retrieval while writing/citing, will be discussed at the end.

Data Reproducibility: From Experimental Design to Record Keeping

Led by Dr. Maja Djuric

Data reproducibility is at the heart of any experimental science. This workshop will start by examining the strategies for experimental design that ensure reproducibility of experimental outcomes both short-term and long-term. A well-organized and detailed lab notebook is a crucial part of that process. The workshop will also discuss aspects of efficient record keeping that apply to both paper and digital tools, and will finish with a brief overview of different digital tools that help with data analysis and visualization.

Oral Presentation Skills

Led by Dr. Annina Sartor

As a scientist, you'll frequently have to verbally communicate your thoughts and results both in formal settings (at conferences, poster sessions, and research meetings) and informally (to colleagues and other students). This workshop, will help students practice "elevator pitch" summaries of their summer projects and learn how to keep in mind the key message and target audience when planning oral presentations of any length.

Poster Design: Presenting Your Data

Led by Dr. Annina Sartor

How do you decide to represent your data? How do you think about the conclusions your audience will draw when looking at your poster? How do you make it pretty and ready for print? This workshop covers the features of a good scientific poster, some practical tips for how to make a poster from scratch using software available to students, and how to present the finished product at a poster session.

Diving into Research: Strategies to Design Solid Research Projects

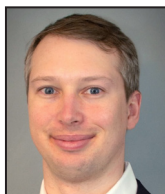
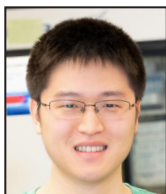
Led by Dr. Andrea Cipriano

This workshop focuses on the questions that researchers should address and the main steps to follow when designing a compelling research project. It provides practical examples and interactive activities to help students gain valuable insight and skills when facing a research project.

Professional Panel Discussion:

Participating in the Bio-X Undergraduate Summer Research Program confirms the chosen career paths of some students and opens up new avenues to explore for others. This year, three Bio-X USRP alumni—in academia, medicine, and industry—were invited to have a conversation with our cohort, to answer questions, and to share ideas. Who better to talk with the students than people who were once in these students' shoes?

Panelists:



Dr. Alex Gao participated in the USRP in 2010 and is now an Assistant Professor of Biochemistry at Stanford. Alex received a B.S. in chemistry and an M.S. in electrical engineering from Stanford, and a Ph.D. in biological engineering from MIT and the Broad Institute. Prior to joining the Department of Biochemistry as a faculty member, he was a Junior Fellow with the Harvard Society of Fellows. Dr. Gao's research journey began during his freshman year at Stanford, where he was a member of the Bio-X USRP cohort in 2010. The Gao Lab focuses on harnessing the genetic diversity of microbes, with the goal of developing new molecular technologies for health and medicine.

"Participating in the Bio-X USRP gave me the valuable opportunity to do research in the life sciences for the first time. This experience played an important role in shaping my research interests and career trajectory, while also giving me an appreciation for the transformative impact that undergraduate research experiences can have on professional development. The Bio-X program was terrific, fostering a cohesive community within my USRP cohort and giving us the chance to attend engaging faculty talks and a stimulating poster symposium. I am grateful for the exceptional staff members who were instrumental in creating such a positive and enriching program."

Dr. Cheri Wu, 2010 USRP cohort, is now a practicing psychiatrist. Cheri is a licensed physician in California and double-board certified in General Psychiatry and Child & Adolescent Psychiatry by the American Board of Psychiatry and Neurology. She completed both her General Psychiatry Residency and Child & Adolescent Psychiatry Fellowship at Stanford School of Medicine. She has formalized training in treating patients of all ages with a variety of conditions, including Mood and Anxiety Disorders, Attention-Deficit Hyperactivity Disorder (ADHD), Obsessive Compulsive Disorder, and Post-Traumatic Stress Disorder. She recently transitioned into her own private practice in order to have the ability to focus on providing high-quality patient care.

"As an undergrad at Stanford, I served as a research assistant with the Pediatric Bipolar Disorders Program to get exposure to the field of child psychiatry, which combined my interests in psychology, mental health, and working with youth. Participating in the Bio-X USRP allowed me to design my own research project at the intersection of psychiatry and genetics looking at anticipation and triplet repeat expansion in families with bipolar disorder. Looking back, my experience was pivotal in helping to guide me toward my chosen field, as well as instilling in me the value of lifelong learning and the importance of research in improving the lives of patients."

Everett Frost, USRP 2011 and 2012, is now a Portfolio Manager and Founder. Everett graduated from Stanford with a BS in Bioengineering, where he received the Firestone Medal for excellence in undergraduate research. He holds an MBA from Harvard Business School. Everett founded Mabery Investment Partners, an investment firm that runs a concentrated public equities portfolio focused on technology, healthcare, and financial services businesses. Before starting Mabery, Everett worked for Goldman Sachs, Paulson & Co., and Elliott Management.

"The Bio-X program is a special opportunity to collaborate with world class scientists and researchers at Stanford, and for me, it was a pleasure to dive deeper into neuroscience and bioengineering with Dr. Maloney and Professor Yang. It was also a wonderful chance to make lifelong friends in the program. My honors thesis that came from the research that Bio-X supported prepared me well for the rigors of a research oriented career after Stanford and for graduate school."

Journal Clubs:

The cohort students participate in journal club meetings to read and analyze scientific manuscripts related to their discipline of research. These 11 journal clubs also offer opportunities for them to collaborate in small groups and lead discussions about journal articles within their field of interest. The journal clubs are guided by Stanford graduate students, postdocs, and research scientists to provide intellectually challenging journal articles and to help facilitate high-level analysis, which also adds teaching and leadership experience to the journal club leaders' training at Stanford.

Journal Club Mentors:



Neuro-immune Interface

Led by Dr. Maja Djuricic

As a consequence of historically compartmentalized academic disciplines, nervous and immune systems have been thought of as functionally independent from each other. We will explore new work refuting the dogma that the brain is an immune-privileged organ and show new work on the bidirectional communication between the nervous and immune system. We will see that immune system influences brain and synaptic development, as well as brain aging, and vice versa that nervous system coordinates immune system's reaction to invading pathogens. Shared molecular mechanisms between neurons and glia on one hand, and immune cells on the other, depict a joint evolutionary history that informs how the two systems function interdependently in health and disease.

Health Psychology and Technology

Led by Dr. Cassie Eng

We will discuss cyberpsychology – the emerging field of how the culture of technology (social media, virtual reality, the internet, mobile devices, video games) affect the brain, behavior, and wellbeing. As mobile phone accessibility, video games, and social media use grow exponentially, understanding the effects of various human-technology interactions on neurological, cognitive, and physical health is of crucial importance. We will discuss papers addressing how evidence-based technology grounded in psychology and health neuroscience theories is capable of enriching – not hindering – the physical and mental wellbeing of individuals.

Synthetic Immunology in Cancer

Led by Dr. Daniel Alexander Hoces Burga

This interactive forum is dedicated to exploring the cutting-edge field of synthetic immunology and its applications in cancer research. In addition to gaining a fundamental understanding of immunology, our goal is to unravel the innovative strategies employed in engineering immune cells, which are paving the way for personalized and precise cancer treatments. Delve into the realm of synthetic immunology and discover its potential to reshape the landscape of cancer therapy!

Immune-endocrine Crosstalk in Health and Disease

Led by Gabriella Muwanga

The endocrine system is an essential regulator of body homeostasis, and it depends on hormones that bind to hormone receptors on target organs to perform its functions. On the other hand, the immune system protects the body from foreign invaders. These two critical functions are bound to intersect, which begs the question: How do these systems relate to each other? We will discuss the impact of this immune–endocrine crosstalk in health and disease states.

Malfunctioning Molecular Machines in Aging

Led by Dr. Kojo Opoku-Nsiah

We will examine the cellular mechanisms of aging and how misregulation of the protein homeostasis (proteostasis) network potentiates aging and age-associated diseases. Papers will focus on the molecular machines that govern proteostasis, the downregulation of their respective processes, and the consequential impact in aging. Topics will include: chemical biology, biochemistry, and cell biology.

3D Bioprinting of Cardiac Components

Led by Fredrik Solberg

3D bioprinting is advancing the field of regenerative medicine. In this journal club, we will investigate how 3D bioprinting can be used to engineer cardiac components. Papers will focus on various techniques of bioprinting, material selection, cellular composition, and tissue vascularization.

Journal Clubs (Continued):

Neuron-Glia Interactions

Led by Dr. Justin Trotter

We will dig into the growing field that covers the intersection of glia and neurons. Glia are fundamentally important for brain function at many levels, and it is increasingly clear that they perform critical roles in the normal and diseased brain. In fact, many of the molecules (and diseases) that have been primarily attributed to neuronal dysfunction (e.g. schizophrenia and autism) may be also due to glial dysfunction. We will not discriminate against types of glia - all are welcome (and so are neurons).

Stress Responses

Led by Alex Catherine-Nicole Van Elgort

We will aim to discuss papers around elucidating molecular mechanisms of cellular stress responses and adaptation. This can range from genotoxic stress, to proteotoxic stress and more!

Immunomodulatory Biomaterials for Tissue Repair

Led by Cassandra Villicana

We will cover papers that use biomaterials to modulate the immune system towards a regenerative response. Our aim will be to discuss and study immune cells which interact with biomaterials and focus on methods towards engineering biomaterials to harness the immune system to boost tissue repair.

Mechanics of Nerve Repair

Led by Dr. Lucy Wang

We will discuss strategies for repairing peripheral nerve injuries, focusing on the role of mechanical forces in determining repair outcomes.

Computational Immunology

Led by Maxim Zaslavsky

We'll read about topics like designing personalized cancer vaccines, predicting which Covid mutations cause immune evasion, building better antibodies, associating immune cell receptors to antigen targets, or tracking immune system changes in response to vaccination.

“Our journal club allowed me to learn and review skills necessary for understanding scientific writing and research; in addition, I feel more confident in my abilities to communicate such material to others!”

—2022 and 2023 USRP Participant Chris Basco

Scientific Poster Session:

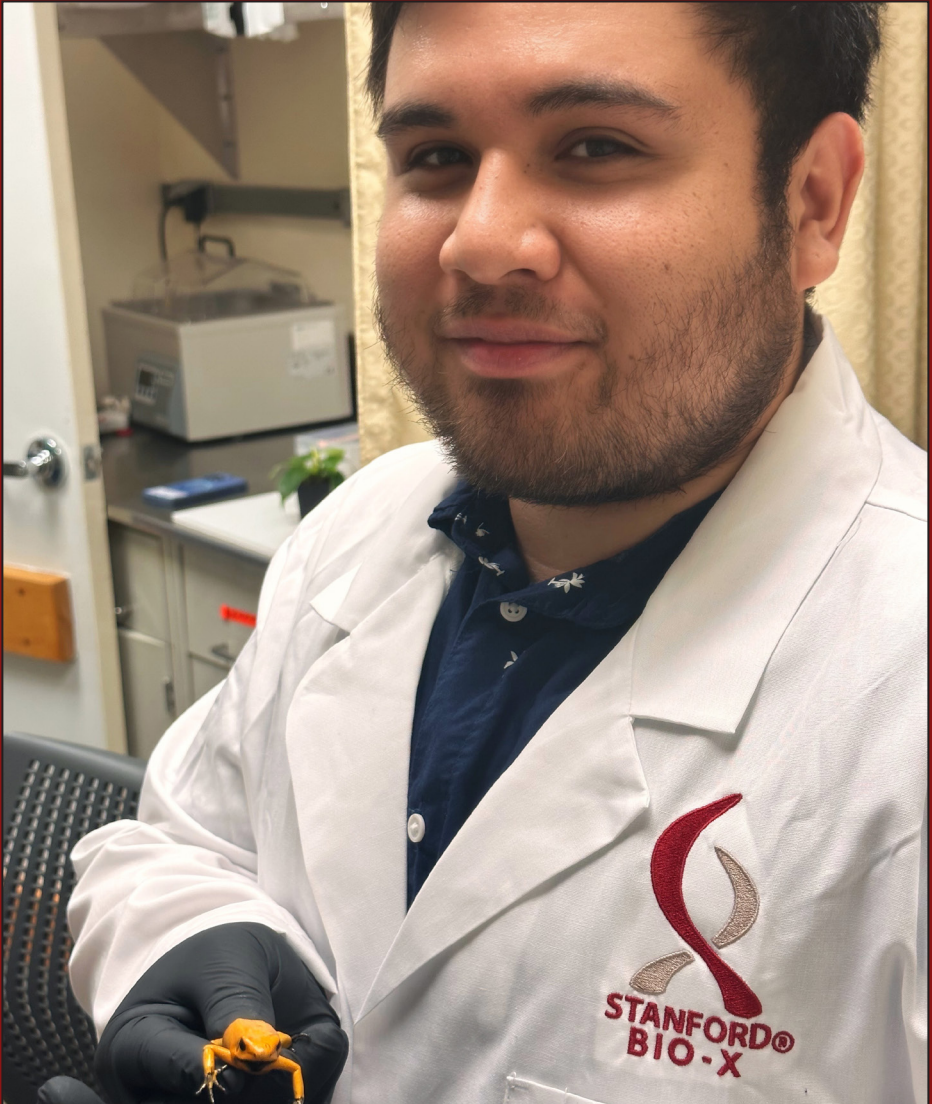
On September 1st, the cohort will present their posters at the Stanford Bio-X Interdisciplinary Initiatives Seed Grants Program Poster Session, which will include 230 scientific posters from Stanford faculty, postdocs, graduate students, research scientists, and other undergraduates!



2022 Stanford Bio-X Poster Session



Stanford Bio-X Undergraduate Summer Research Program



Cyrus Hajian completed his Stanford Bio-X summer research training with Dr. Lauren O'Connell

<https://biox.stanford.edu>
To learn more, please email us at:
contact-biox@stanford.edu