STANFORD BIO-X UNDERGRADUATE SUMMER RESEARCH PROGRAM 2015

STANFORD
BIO-X

Stanford Bio-X Undergraduate Summer Research Program

The Stanford Bio-X Undergraduate Summer Research Program (Stanford Bio-X USRP) is a unique summer experience which exposes interested Stanford students to ten weeks of intense hands-on laboratory research, 30 lectures by Stanford faculty, and a network of fellow scientists, providing them with the tools, knowledge, experience, and community to excel as scientists and follow their passions long after the summer concludes. The 2015 cohort included 65 students who conducted experiments in Stanford Bio-X affiliated faculty laboratories, and came together weekly at the Clark Center to listen to three faculty mentors describe their lab's research. Each year, the program concludes with a scientific poster session at which all student participants present the results of their ten-week endeavor alongside graduate students, postdoctoral fellows, faculty, and Stanford Bio-X community members from across campus and beyond.

Over the past 11 years, Stanford Bio-X has partnered with over 200 Stanford faculty mentors in order to provide the ten-week summer research opportunity to 371 students. Equipped with their laboratory experience and a broader knowledge of the discoveries taking place at Stanford and beyond, USRP alumni have succeeded in completing their PhD, MD, or MD/PhD programs, published their research in prestigious journals, and applied their skills and passions to their futures in their chosen fields.

The weekly faculty talks, which are completely unique to the USRP, offer a glimpse into the cutting-edge research taking place in laboratories from dozens of departments all across Stanford campus, facilitating interaction, conversation, and creative problem-solving – not just for the students, but also for the faculty and others in attendance. Videos online: https://biox.stanford.edu/research/undergraduate-research

Applications for the program have increased from a handful in 2009 to 170 in 2015. The application: it is available to any Bio-X affiliated faculty member, and all Stanford undergraduates are eligible to apply.

Funding for the Stanford Bio-X Undergraduate Summer Research Program was provided by generous contributions from the Vice Provost and Dean of Research, an anonymous donor, the Vice Provost for Undergraduate Education and The Office of Undergraduate Advising and Research (VPUE/UAR), Nikon Research Corporation of America, and Bio-X.

With its unique combination of research training, faculty talks, and presentation practice, the ten-week Stanford Bio-X USRP experience fosters the interdisciplinary spirit of Stanford Bio-X in a new generation of up-and-coming scientists. Read on to explore descriptions of the research conducted by the 65 students of the 2015 USRP cohort!

Undergraduate Summer Research Program Participants 2015

2015 Stanford Bio-X Undergraduate Research Talks by Stanford Faculty:

June 24
Chaitan Khosla "Assembly Line Antibiotic Biosynthesis"
Dean Felsher "Molecular Imaging of Cancer Addiction"
Vijay Pande "Deep Learning in Computational Biology and Computational Chemistry"

July 1
John Boothroyd "How Does the Intracellular Parasite Toxoplasma Co-Opt Host Functions?"
Sarah Heilshorn "Materials for Stem Cell Transplantation and 3D Bio-Printing"
Marius Wernig "Direct Reprogramming Towards the Neural Lineage"

July 8
Lisa Giocomo "Identifying the Algorithms for Calculating Spatial Maps"
Ron Kopito "Quality Control on the Protein Assembly Line"
Manish Butte "T Cell Activation and Cellular Mechanics"

July 15
William Newsome "Neural Mechanisms Underlying Decision-Making"
Jonathan Payne "Controls on the Evolution of Organism Size over the Past Four Billion Years"
Jin Billy Li "Functional Analysis of RNA Editing Events "

July 22
Thomas Südhof "Molecular Logic of Synapses"
Lucy Shapiro "Systems Architecture of a Bacterial Cell Cycle"
Michael Snyder "Analyzing Health and Disease Using Personal Omics Profiling"

July 29
Scott Delp "Dynamics of Walking and Running"
Michael Longaker "Scar Wars"
Robert Malenka "Synaptic Plasticity: The Brain's Response to Experience"

August 5
Euan Ashley "Smart Phone Medicine"
Michael Levitt "47 Years of Fun with Computers in Biology"
Michael Lin "Molecular Engineering of New Input and Output Interfaces with Biology"

August 12
Karl Deisseroth "Optical Tools for Probing Intact Biological Systems"
Theo Palmer "Modeling Human Neural Circuits with Induced Pluripotent Stem Cells"
Edward Graves "Observing and Understanding Tumor Cell Migration"

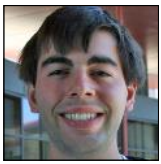
August 19
Yanmin Yang "Recalculating: BDNF Makes an Illegal U-turn in Huntington Disease"
Antonio Hardan "Pivotal Response Training: Findings from Behavioral and Biological Measures"
Firdaus Dhabhar "A Hassle a Day May Keep the Doctor Away: How Stress can Enhance Immune Function"

August 26
Oussama Khatib "Robotics in Human Motion and Motor Control Studies"
Michelle Monje "Myelin Plasticity in Health and Disease"
Jennifer Cochran "Engineered Proteins as Therapeutic and Diagnostic Agents"

2015 Program Participants:

Han Altae-Tran, Physics and Math
Mentor: Vijay Pande, Chemistry
Han is designing a statistical method for improving the accuracy of molecular simulation, a computational tool used extensively in drug design. By comparing simulations of known molecules to experimental results, he can modify the underlying physics governing the simulations to improve the accuracy of new simulations involving similar molecules. Because of the importance of water in drug binding, he plans to apply his method to improve simulations involving water.

Cameron Backes, Biology
Mentor: Manpreet Singh, Psychiatry & Behavioral Sciences
Cameron is working to discover a biological indicator that predicts the future onset of major depression versus bipolar disorder. This research will help to facilitate accurate differential diagnoses of these disorders during early stages of onset, and will help to expedite the treatment process by providing a mechanism to identify at-risk individuals.



Ryan Badiee, Biology
Mentor: Michael Lin, Bioengineering and Pediatrics
Ryan is developing a tool for use by future researchers who study how multiple proteins interact in a cell's pathways. Specifically, this entails a set of two tags that regulate protein expression and are each under the control of a different drug. The purpose of creating this tool is to allow for the study of how tuning the expression levels of two different proteins changes a cell's behavior and responses, which allows researchers to create models for understanding the pathways involved in anything from protein localization to cancer.

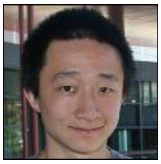
Matthew Benjamin, Biology
Mentor: Jonathan Payne, Geological & Environmental Sciences
Matt will be analyzing how body size has diverged between marine, freshwater, and terrestrial reptiles. He will compile data on habitat use and reconstruct phylogenetic relationships, then apply evolutionary models to determine if different habitats correspond with different optimal sizes. This analysis will help elucidate how habitat influences body size evolution.

Jordan Brzenzy, Chemistry
Mentor: John Boothroyd, Microbiology & Immunology
Jordan is studying immune reactions during parasite infection. It has been shown that genes play a large role in characterizing this response, and he is particularly interested in understanding how genetic differences in rats are correlated to different immune responses during *Toxoplasma* infection. Ultimately he would like to understand these results in the context of human Toxoplasmosis patients.

Joab Camarena, Biology
Mentor: Matthew Porteus, Pediatrics
Sickle cell disease (SCD) is a genetic disease affecting millions worldwide, in which mutant hemoglobin causes blood cells to become very rigid and hamper blood flow or even cell destruction. Joab will be looking at ways to optimize gene editing in hematopoietic stem cells (HSPCs) to combat SCD since gene edited HSPCs may be a potential cure for sickle cell disease. Joab's summer project, therefore, will entail testing one hypothesis that might increase the frequency of gene correction as a step towards potentially curing SCD.

"I felt like I gained some valuable lab experience that isn't necessarily exposed in a class-lab setting or in my previous research through the Bio department. Working on a distinct project that was my own (and not just working on running experiments for a mentor's project) relies on a lot of skills beside experimentation and technique."

—USRP Participant Lana Ho

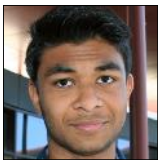


Christopher Chen, Biology
Mentor: Martin Jonikas, Biology
Chris is studying an algal mechanism to concentrate carbon dioxide, which makes algal photosynthesis more efficient than those of crops such as rice or wheat. Characterizing the protein interactions involved will provide a knowledge base that can make it possible to engineer this algal mechanism into higher plants, increasing resource efficiency and crop yields.

Monica Chin, Bioengineering
Mentor: Michael Longaker, Surgery
Mentor: Michael Longaker, Surgery
Monica is studying the role of a specific population of stem cells on the retention of tissue transplants. In order for transplanted fat to maintain a sufficient blood supply as it integrates itself into the native tissue, new blood vessels must form at the wound site. To test the hypothesis that specifically-marked cells enhance the viability of tissue transplants *in vivo*, she is monitoring the growth of transplanted fat in the skulls of mice.

Brian Chu, undeclared
Mentor: Euan Ashley, Medicine (Cardiovascular) and Genetics
Brian Chu is studying heart failure, which is when the heart is unable to pump hard enough to supply blood. He is looking at a protein that is known to play a role in the nervous system, but may also have beneficial effects in the heart. Specifically, he is quantifying the expression of that protein in heart tissue and measuring the strength of heart cells treated with that protein.

Coraal Cohen, undeclared
Mentor: Tracey McLaughlin, Medicine (Endocrinology)
Coraal will be working to determine the differences in ability to burn fat in overweight individuals. Specifically, she will be analyzing fat samples from individuals placed on either a low carbohydrate or low fat diet and determining the degree of fat-burning in their fat cells. Her hypothesis is that individuals who are insulin-insensitive will experience less weight loss on a low carb diet than those who are insulin sensitive.



Amartya Das, Mathematical and Computational Science
Mentor: Michael Snyder, Genetics
The human body contains over 10 times as many microbial cells than human cells, whose genomes collectively make up the microbiome. This summer, Amartya Das will be studying associations between the microbiome and Type 2 Diabetes (T2D) immunity in humans. To test these associations, he will specifically be performing genetic analyses of the microbiome and how it relates to the host as well as computational analyses of genomic and proteomic data. Ultimately, this research aims to expand our understanding of how T2D affects humans.

Lauren Ellis, Biomedical Computation
Mentor: Yoon-Jae Cho, Neurology
Lauren's project focuses on how chemical modifications of the genome ("epigenome") influence the initiation and maintenance of medulloblastoma, the most common malignant pediatric brain tumor. She aims to employ wet-bench experiments in conjunction with machine learning techniques to analyze specific epigenetic states of medulloblastoma at each phase of cerebellar development. Identifying differences between the basal epigenetic state of medulloblastoma and normal development will unveil potential avenues for therapy.

Ian Hull completed his summer research training in Dr. Thomas Südhof's lab

Bora Erden, Symbolic Systems
Mentor: William Newsome, Neurobiology

Bora is studying the neural basis of decision making in macaque monkeys. In a study in the lab, monkeys were trained to perform a perceptual decision making task and report their decision with either an arm or an eye movement. By analyzing the neural activity recorded from two brain areas while the monkeys performed the task, Bora plans to distinguish characteristics of the neural responses that are and are not constant across motor responses. Understanding these components and comparing them across brain areas will further our understanding of the decision making process in primates.

Kathryn Evans, Biology
Mentor: Karl Deisseroth, Bioengineering and Psychiatry & Behavioral Sciences

Kathryn is investigating the cell-type identity of the connections between two brain areas: the *substantia nigra pars compacta* from the fundus of the striati. Previous tracing studies indicate a high degree of connectivity between these structures, suggesting the fundus of the striati may provide important inputs to dopamine systems, which influence many aspects of learning and habit formation. Her first goal will be determining if the fundus of the striati inputs express the neuropeptide neurotensin, aberrant expression of which has been correlated with autism.

Tanvi Gambhir, undeclared
Mentor: Firdaus Dhabhar, Psychiatry & Behavioral Sciences

Tanvi is investigating the effects of major depressive disorder (MDD) on the immune system. To test her hypothesis that periods of MDD have deleterious effects on the immune system, she will analyze flow cytometry data to quantify the immune effects of MDD.

Omar Garcia, undeclared
Mentor: Paul Bollyky, Medicine (Infectious Diseases)

Omar is studying the interactions of different pathogens within the lungs of immunocompromised individuals. Specifically, he will be studying the chemistry behind the removal of iron by a virus that infects bacteria. The insight gained from this research could lead to a novel treatment for severe lung infections in cystic fibrosis patients.

"The most important lesson that I learned was how to critically think about research to develop appropriate questions. Then from the questions I learned how to design experiments that would hopefully address the question… Finally I learned how to implement the experiments I have designed and interpret the results."

—USRP Participant Tally Buckstaff

"I learned the value of carefully planning future experiments in detail. The clearer the picture I have of what I am attempting to do will help me greatly in successfully carrying out my experiments and also of troubleshooting problems should any arise. I love to learn, and these seminars were action-packed with fascinating science."
—USRP Participant Khang Dinh

Druthi Ghanta, Computer Science
Mentor: Carla Shatz, Biology and Neurobiology
Druthi is studying how modern imaging techniques can be automated to analyze dendritic spine data sets in neurobiology. Dendritic spine loss/gain is studied in neural development and neurodegeneration. In particular, she's trying to automate spine detection in high quality images of mice cortex captured using Stimulated Emission Depletion (STED) microscopy to more quickly and accurately quantify changes during neuronal development or degeneration.

Meghana Golla, Biomechanical Engineering
Mentor: Edward Graves, Radiation Oncology
Meghana is studying the effects of wound healing on tumor cell invasion and metastasis. She is utilizing a mouse model to investigate the attractive effects wound healing and irradiation may have on circulating tumor cells. Surgical resection and radiation therapy are considered standard of care in cancer therapy. This could improve our understanding of how residual tumor cells respond following cancer therapy and ultimately lead to tumor relapse.

Daniel Gonzalez, Music
Mentor: Joseph Lipsick, Pathology and Genetics
Dan is studying the structure and function of a protein subunit in a tumor suppressor protein complex. This complex is responsible for cell differentiation, division, and death, as well as gene regulation and expression. The work is currently being done in flies, where Dan is testing whether structural aberrations in the subunit lead to DNA binding abnormalities in the complex.

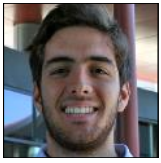
Isabel Goronzy, Chemistry
Mentor: Steven Boxer, Chemistry
Isabel Goronzy is investigating the mechanism of influenza infection, specifically, the entrance of the flu virus into a host cell via fusion of the viral and target cell membranes. Blocking this pathway could be developed into a novel anti-viral strategy. To explore how molecules in the viral and host cell membranes interact, she is imaging single virus particles binding to and fusing with a constructed biomembrane.

Deeksha Goyal, Computer Science
Mentor: Oussama Khatib, Computer Science
Deeksha Goyal is studying how the brain organizes motor control. Specifically, she wants to see if the brain separately stores information for objects and the forces they exert, versus information about how humans can manipulate them using force. To test this, she will be conducting experiments on people in MRI machines while they manipulate a robot that applies different forces to them.

Zane Hellmann, English
Mentor: James Chen, Chemical & Systems Biology and Developmental Biology
Zane is studying the effects of potent and selective small molecule inhibitors of the enzyme HIPK4, a protein kinase believed to be essential in the formation of sperm cells in mammals. He will be investigating the activity of these compounds in cultured cells and in mouse models of spermatogenesis. This research may shed insights into understanding some cases of male infertility and may also be used as the basis for a non-hormonal male contraceptive, offering an alternative to the current oral contraceptives that are only available for women.

Bora Erden completed his summer research training in Dr. William Newsome's lab

Ashley Henderson, Biology
Mentor: Lisa Giocomo, Neurobiology
Ashley Henderson is studying the function of grid cells in a part of the brain (the Medial Entorhinal Cortex) associated with navigation. The hypothesis is that by increasing the spacing of the smallest grid scale in mice, navigation precision will decrease.



Nicolas Herrera, Biology
Mentor: Yanmin Yang, Neurology
Nicolas is studying neuronal transport in Huntington's disease (HD). The hypothesis is that neurodegeneration in HD is exacerbated or initiated by a transport failure in neurons. He is designing and implementing "microfluidic chambers" to organize cell cultures, which allows for testing of intracellular trafficking.

Annie Hu, Biology
Mentor: Samuel Yang, Surgery
Annie is developing a method for distinguishing groups of *Streptococcus pneumoniae* based on their surface proteins. She is using high-resolution melt to "fingerprint" the different groups and to create a fast and cheap classification method for use in optimizing future pneumococcal vaccines and monitoring their effectiveness.

Daniel Hu, Bioengineering
Mentor: Sean Wu, Medicine (Cardiovascular)
Despite recent advances, heart disease kills more people than all other major diseases combined. New regenerative medicine techniques are being increasingly investigated as treatment options to restore cardiac function. Daniel Hu is working on developing a viable method for the 3D printing of functional bioartificial cardiac tissue. To accomplish this, there are two main aims. The first aim is to generate a biological scaffold through 3D printing. The second aim is to seed induced pluripotent stem cells (which will be differentiated into cardiac cells) into the 3D scaffold.

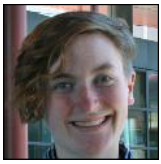
Ian Hull, Bioengineering
Mentor: Thomas Südhof, Molecular & Cellular Physiology
Ian is working to optimize the CRISPR/Cas system, a powerful new gene editing tool, for use in neuroscience research. He is investigating design algorithms for guide RNAs that effectively target genes that are important for neural function. The ability to easily edit these genes will help scientists understand the causes behind neurological disorders such as Alzheimer's or Huntington's disease.

Andrew Jacobs, Biology
Mentor: Kristy Red-Horse, Biology
Andrew Jacobs will be using a mouse model to analyze the role of the *notch3* gene in coronary artery development. Identifying the developmental steps from progenitor cell to mature artery in the embryo, including the significance of Notch3 signaling and how this pathway is induced, may reveal possible therapeutic targets that benefit millions of individuals suffering from coronary artery disease.

Dionna Jacobson, Biology
Mentor: Jin Billy Li, Genetics
Dionna Jacobson is studying how RNA editing affects neurological functions in the brain, as it has been implicated in neurological disease. Specifically, she is using the CRISPR/Cas9 genetic engineering system to examine the phenotypic outcomes of perturbing certain editing sites, which are computationally predicted to be neurologically important, in genes of flies.

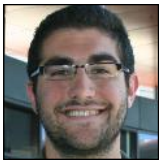
Gabrielle Kamalani, Biology
Mentor: Xiaoke Chen, Biology
The ability to detect hot and cold stimuli is crucial to animals' survival. For example, unpleasant temperatures, specifically noxious heat and cold, trigger strong escape-reactions in animals. Gabbi is studying heat and cold pain in mouse spinal cord and dorsal root ganglia neurons. Her goal is to identify heat and cold pain neurons through imaging and determine their behavioral importance by silencing the neurons. These studies will provide new understandings about the spinal circuitry of thermosensation.

Joshuah Kapilivsky, Chemistry
Mentor: Chaitan Khosla, Chemical Engineering and Chemistry
Josh is studying the production of structurally complex antibiotic molecules by large protein assembly lines. These protein complexes perform chemistry with greater efficiency and yield than modern techniques in synthetic chemistry and may be the future of antibiotic design and production.



Katrina Kent, Symbolic Systems
Mentor: Russell Fernald, Biology
Katrina is working to gain a better understanding of the neurological basis of aggressive and reproductive social behaviors by applying computational methods and information theory to neuroethology (the study of animal brains and behavior). This work has potential implications for a variety of human disorders, from PTSD to social anxiety. Katrina is working with data collected from *Astatotilapia burtoni*, a fish species with drastic phenotypic changes depending on its social environment: the code they produce will hopefully allow data to be collected faster and analyzed more thoroughly in the future in a variety of animal models.

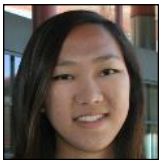
Deeksha Goyal completed her summer research training in Dr. Oussama Khatib's lab



Habib Khoury, Biology
Supported by: Nikon Research Corporation of America
Mentor: Yanmin Yang, Neurology
Intracellular trafficking is a complex system that needs to be well regulated or else it could lead to neurodegenerative diseases. Habib is specifically studying a protein that was identified by the lab as important for intracellular trafficking. He is trying to understand the function of the protein, the interaction of the protein with microtubules, and the mechanisms of its regulation.

Camila Kofman, Chemical Engineering
Mentor: Jennifer Cochran, Bioengineering
Camila Kofman is working to engineer enzymes that are capable of performing site-specific bioconjugation reactions, in which small molecules are bound to specific amino acid sequences. The hypothesis behind her work is that these enzymes will allow for highly selective antibody-drug conjugates that could be used to develop therapeutic approaches to target diseased cells, such as in cancer.

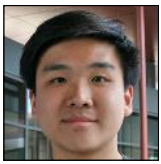
Nira Krasnow, Human Biology
Mentor: Ron Kopito, Biology
Nira is studying the pathogenesis of Huntington's disease, a neurodegenerative disease caused by the misfolding and aggregation of the mutant protein huntingtin. She will test the hypothesis that mutant huntingtin misfolding and aggregation interferes with cellular protein homeostasis using a proteomics approach to measure the stability of "normal" (non-mutant) proteins in cells expressing mutant huntingtin. This work will provide insight into the connection between mutant huntingtin misfolding and aggregation and Huntington's disease pathogenesis.



Lauren Kwa, undeclared
Mentor: Antonio Hardan, Psychiatry & Behavioral Sciences
Lauren Kwa is studying the role of neurosteroids in the pathophysiology of autism spectrum disorder (ASD). By measuring the concentrations of a series of neurosteroids in plasma and saliva samples and characterizing behavioral phenotypes of ASD, the associations between specific patterns of neurosteroids and specific phenotypes will be determined. This research will build the foundation for the use of neurosteroids to develop treatments that reduce irritability and improve sensory and social functions in individuals with ASD.

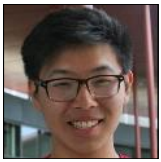
Georgia Toal completed her summer research training in Dr. Dean Felsher's lab

Druthi Ghanta completed her summer research training in Dr. Carla Shatz's lab

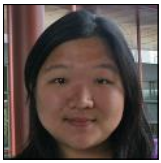


Thomas Lau, Computer Science
Mentor: Scott Delp, Bioengineering and Mechanical Engineering
Thomas Lau is designing and applying novel computer science algorithms to increase the accuracy and performance of existing computational models of simulation. Specifically, this project will focus on increasing the performance of existing simulation modules in OpenSim, an open-source simulation platform that lets users develop models of musculoskeletal structures and create dynamic simulations of movement.

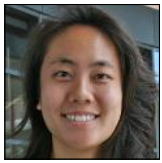
Kazuomori Lewis, Chemical Engineering
Mentor: Sarah Heilshorn, Materials Science & Engineering
Kaz's research explores the effects of novel biomaterials for use in treatment of spinal cord injury (SCI). Specifically, he is testing the hypothesis that a particular set of hydrogels developed by the Heilshorn lab has the ability to increase tissue sparing, ingrowth of endogenous cells, and also improve behavioral outcomes in an SCI rodent model.



Jason Li, Biology
Mentor: Marius Wernig, Pathology
Jason Li is studying autism spectrum disorder (ASD), a neurodevelopmental disorder associated with disruptive variations in gene regulation. Specifically, he will be examining the role of mutant CHD8, a gene associated with chromatin remodeling and a crucial ASD risk factor, by using induced neuron stem cells as a model.



Wenye Li, Electrical Engineering
Mentor: Philip Wong, Electrical Engineering
Wendy Li is developing and testing a chip in cell tag: a device small enough to fit into a cell for real time live cell analysis. This device will enable researchers to improve current understandings of cell biology in live cells and offer healthcare providers a method for faster cancer detection.



Lillian Liao, Biology
Mentor: Michael Clarke, Medicine (Oncology)
Lillian is investigating the mechanisms that regulate breast cancer stem cell self-renewal. Preliminary data from the Clarke lab suggest that overexpression of nerve growth factor receptor (NGFR) inhibits the growth of triple negative breast tumors *in vivo*, and that the cytokine TNF-alpha can upregulate NGFR expression in triple negative breast cancer cell lines (which have very little NGFR expression). She will first investigate the mechanism of NGFR and whether TNF-alpha can upregulate the NGFR gene through human cancer cell lines, and then use 3-D organoid culture systems to mimic *in vivo* conditions. It is pertinent to understand the mechanism by which NGFR can inhibit the growth of triple negative breast tumor since it can offer new therapeutic targets for a very aggressive form of breast cancer.

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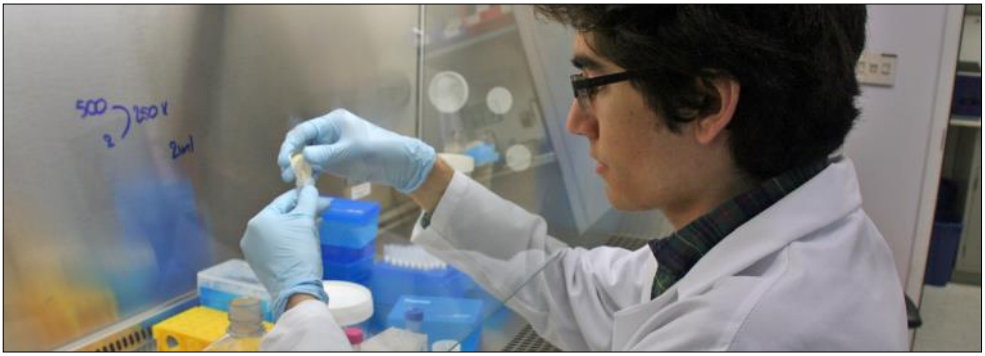


Omar Garcia completed his summer research training in Dr. Paul Bollyky's lab

Majed Magzoub, Bioengineering
Mentor: Calvin Kuo, Medicine (Hematology)
Majed will trace the origin of vascular endothelial stem cells – the cells responsible for blood vessel formation – by studying patterning of fluorescently labeled cell populations. This study will use both tumor and developmental models in mice to understand if these cells come from bone marrow or are resident in blood vessel tissue. Results will be useful for developing treatments that limit blood supply to starve tumors.

Alfonso Ocampo, Biology
Mentor: Michelle Monje, Neurology
Alfonso Ocampo is investigating the effects of chemotherapy on myelination cells in the mammalian brain. Many patients suffer from cognitive deficits, memory impairments, and delayed motor responses post chemotherapy treatment, known colloquially as "chemobrain". To better understand why some of these effects emerge, he will use a chemotherapy mouse model to better understand the effects of chemotherapy on myelinating cell populations in the brain.

Anupama Rajan, Computer Science
Mentor: Oussama Khatib, Computer Science
Anu is developing digital biomechanical arm models that will better model the kinematics of the human arm. This will improve the accuracy of simulated movements and help create simulation-based design to, for example, evaluate the risk of injury under certain conditions. She is working to identify a suitable level of detail for modeling the neuro-musculo-skeletal system. This will show how errors in modeling musculoskeletal systems limit our ability to use f-MRI experiments to confirm control theory hypotheses.

Aliyah Sarro-Schwartz, Biology
Mentor: Bianxiao Cui, Chemistry
Aliyah is studying the effects of nerve growth factor (NGF), a protein that acts on specific neurons (nerve cells), causing growth and promoting survival. By using optogenetics, she will study the precise spatial and temporal dimensions of the signaling pathways for NGF. Research into the specific functions of the signaling pathways will aid in the development of NGF as a treatment for diseases that involve neuron death, such as Parkinson's and Alzheimer's.

Yoseph Semma, Biology
Mentor: Manish Butte, Pediatrics
Mentor: Manish Butte, Pediatrics
Yoseph is studying a possible mechanism behind diseases where the immune response is too weak or too strong in fighting infections. He is looking particularly at the effect of a major enzyme (αTAT1) in T cell activation and proliferation. He will do this by comparing strength of the initial T cell activation signals, the organization of part of the complex signaling structure, and the response to infection between regular mice and those lacking the enzyme.

"I realized that to a very large degree, science is a collaborative effort. My interactions with my lab members helped me understand how strongly we rely on one another for technical advice and constructive criticism. As a microcosm of the scientific community, I felt that my lab experience helped me understand that lab work is as much about the science as it is about the interpersonal relationship that one builds in the process of collaboration and learning. Furthermore, I appreciated that the Bio-X talks gave me a survey of the fruits of scientific collaboration."

—USRP Participant Jeffrey Kwong

Meagan Shinbashi, Biology
Mentor: Craig Heller, Biology
Meagan's project focuses on the interaction between sleep and circadian rhythms and how sleep deprivation interferes with learning and memory. She uses Novel Object Recognition training in mice to test if sleep during the rest phase of the circadian cycle is critical for learning, and hypothesizes that sleep deprivation during this phase will result in learning impairment.

Matias Silvestre, Human Biology
Mentor: Luis de Lecea, Psychiatry & Behavioral Sciences
Matias will be studying the consolidation of different types of memory during sleep and the effects of manipulations of different neurotransmitter systems on this process. He will, among other techniques, utilize optogenetics and neurosurgery with the model organism of the mouse to investigate the neural bases of memory consolidation.

Zachary Sorey, undeclared
Mentor: Patricia Nguyen, Medicine (Cardiovascular)
Zach is studying hereditary cardiomyopathy: a disease inherited from parents that causes a weakening of the heart muscle, which in turn weakens the pumping action of the heart. He is studying a type of cardiomyopathy that is caused by a mutation in the phospholamban (PLN) gene. He is using induced pluripotent stem cells (iPSCs), stem cells made from the blood of a patient with the disease, and turns them into heart cells, or cardiomyocytes (iPSC-CMs). He then uses the iPSC-CMs to study and correct the mutation that causes the disease.

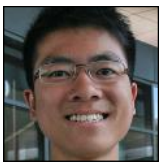
Sona Sulakian, Classics and Biology
Mentor: Lu Chen, Neurosurgery and Psychiatry & Behavioral Sciences
Sona is working on understanding the cellular mechanism in neurons that mediates synapse function in the brain and how these processes are changed in various behavior abnormalities and mental disorders.

Katrina Kent completed her summer research training in Dr. Russell Fernald's lab

"The program gave me a great appreciation for the sheer amount of research occurring just at Stanford. It was wonderful to be surrounded by peers who were all working on such interesting projects. I had definitely not been surrounded by such a motivated group of students in any previous grant program. The weekly lectures were very useful in providing me with directions and techniques to apply to my own project."
—USRP Participant Sam Lawrence

Gordon Sun, Bioengineering
Mentor: Robert Malenka, Psychiatry & Behavioral Sciences
Gordon is studying neuroligin, a molecule that is localized to synaptic connections between brain cells and helps shape the way brain cells communicate with one another. Deficiencies in synaptic transmission in specific neural circuits have been thought to result in neuropsychiatric disorders such as autism spectrum disorders. In particular, a point mutation (R451C) and deletion of neuroligin-3 have been linked to autism spectrum disorders.

Lydia Tam, Biology
Mentor: Michelle Monje, Neurology
Lydia Tam is investigating how neuronal activity affects tumor growth in the brain. Specifically, she is investigating the role that neuroligin-3, a secreted protein, has on brain tumor proliferation.

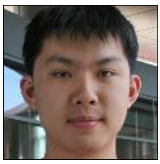


Chester Thai, undeclared
Mentor: Steven Artandi, Medicine (Hematology) and Biochemistry
Chester's research looks into the effect of telomerase, the immortality enzyme that elongates telomeres in cell chromosomes, on neural stem cell activity. Loss of neural stem cells, which promote development of new neurons, may lead to age-related cognitive loss and neurodegenerative disorders such as Alzheimer's and Parkinson's diseases. This project examines the proliferation and regeneration of telomerase-positive neural stem cells, with the ultimate goal of manipulating their function to treat neurodegenerative disorders.

Ada Thatcher-James, Psychology
Mentor: Ian Gotlib, Psychology
Ada is investigating predictors of depression, anxiety, and comorbid depression-anxiety in young girls who are at low or high risk for depression based on their mother's history of depression. The project will specifically examine the role of neuroendocrine reactivity to stress and maternal history of psychopathology as potential risk factors for the development of comorbidity.

Georgia Toal, Biology
Mentor: Dean Felsher, Medicine (Oncology) and Pathology
Oncogene addiction is the idea that turning off oncogenes causes tumor regression. Georgia is studying the concept of oncogene addiction on lipid metabolism genes. She will test this using both a kidney cancer cell line and mouse model.

Jason Wang, Biomedical Computation
Mentor: Maximilian Diehn, Radiation Oncology
Jason is studying the kinetics of circulating tumor DNA (ctDNA) in non-small cell lung cancer. ctDNA, which enters the bloodstream following cancer cell death, has the potential to serve as a noninvasive biomarker to detect and monitor tumors. By quantifying ctDNA's natural rate of degradation, he hypothesizes that the rate of tumor cell death caused by radio- or chemotherapy - the rate of ctDNA production - could then also be pinpointed.



Brian Wei, Science, Technology, and Society

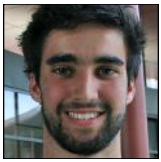
Mentor: John Boothroyd, Microbiology & Immunology

Brian Wei is studying invasion mechanisms of the parasite *Toxoplasma gondii*, a relative of the malaria parasite *Plasmodium falciparum* that can lead to serious disease in immunocompromised individuals. His hypothesis is that *T. gondii* selectively sheds surface proteins during invasion depending on how the proteins are associated with its membrane. To test this hypothesis, he is using a method to covalently tag specific surface proteins to determine which proteins are shed, providing valuable insight into the invasion mechanism of *T. gondii*, *P. falciparum*, and other disease-causing Apicomplexans.

Alex Wells, Biomedical Computation

Mentor: Scott Dixon, Biology

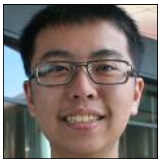
Alex Wells is analyzing the cell death pathway activated by the classic chemotherapeutic agent TMZ. TMZ is effective in only a subset of patients, and resistance to TMZ remains poorly understood. Through the use of a live-cell imaging system, Alex plans to identify the pathways that modify the response of GBM cells to TMZ and develop computational tools to analyze the data generated by this novel imaging system. This research has the potential to reveal new mechanisms of cell death regulation, which could be used to improve the effectiveness of chemotherapeutic drugs.



Drew Willoughby, Biology

Mentor: Theo Palmer, Neurosurgery

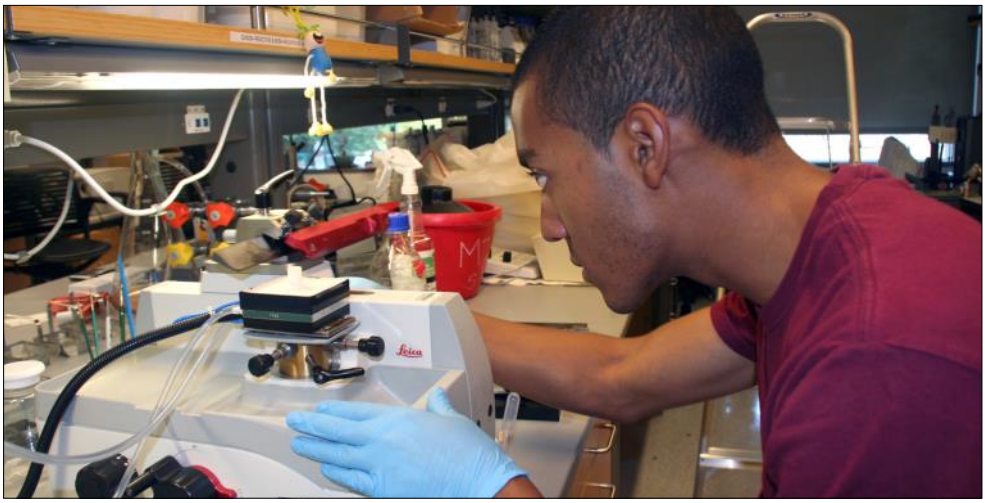
Drew is working on understanding the molecular mechanisms behind synaptic plasticity in an inflammatory or diseased brain. The ultimate goal is to find ways to improve neural transplants as treatments for neurodegenerative diseases, such as Parkinson's disease. Specifically, he is working to elucidate the functions of a candidate receptor on neurons, MHC-I, which could potentially be modulated in order to increase neural transplant connectivity and survival.



Timothy Wu, Biology and Symbolic Systems

Mentor: Peter Kao, Medicine (Pulmonary & Critical Care Medicine)

Timothy Wu is studying newly discovered transcription factors ILF2 and ILF3. They regulate genes essential to cell growth, proliferation, and cell cycle progression. The hypothesis is that these genes, when not properly regulated, may have potential to cause normal cells to become cancer cells. Specifically, he is responsible for using new technologies of CRISPR/dCas9 and Chromatin Immunoprecipitation to induce abnormal expression of ILF2 and ILF3 to evaluate their impact on other genes, and monitor any change in the growth or behavior of the cell.



Kazuomori Lewis completed his summer research training in Dr. Sarah Heilshorn's lab

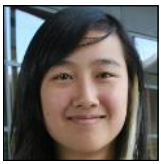
"Bio-X is an incredible experience for undergraduate students, and I'm using the things I learned during those summers every day even now that I am working more independently as a graduate student."

—USRP Participant Zahra Harati Taji

Johnny Xu, Human Biology

Mentor: Lucy Shapiro, Developmental Biology

Johnny Xu is studying noncoding DNA in the bacterium *Caulobacter crescentus* that are essential for them to continue living. Uncovering their functions will provide new insights into the function of how the chromosome is able to orchestrate *Caulobacter*'s unique ability to divide asymmetrically. This research will yield valuable paradigms for understanding the bacterial life cycle which will prove to be useful to the development of antibiotics.



Leena Yin, undeclared

Mentor: Richard Reimer, Neurology

Leena Yin is studying the parkin protein, the malfunction of which has been linked with Parkinson's disease. Because parkin is involved in the degradation of aged and damaged molecules in neurons, Leena is using fluorescent timer protein technology to track the turnover rates of synaptic proteins in mice with and without parkin expression.

Alex Yuan, Biology

Mentor: Daniel Jarosz, Chemical & Systems Biology and Developmental Biology

Fungal infections that do not respond to treatment are a growing medical problem. To address this issue Alex is studying how fungi acquire drug resistance. In particular, he is exploring how the activity of the chaperone Hsp90 affects the mechanism by which cells develop resistance to the common antifungal fluconazole.

Yuan Zhang, Biology

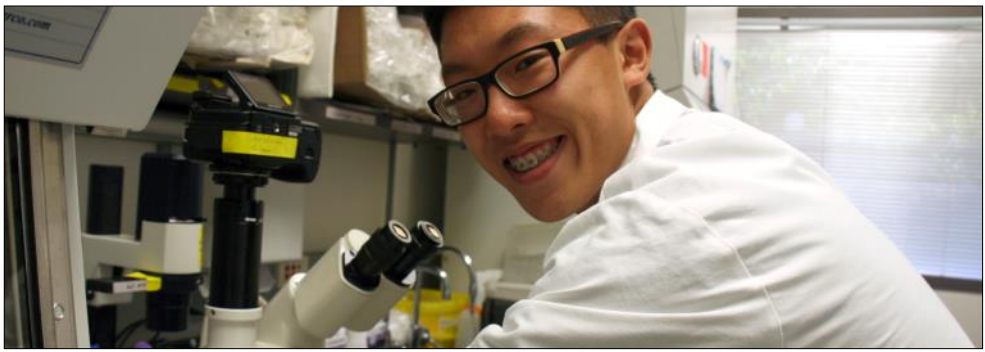
Mentor: Sean Wu, Medicine (Cardiovascular)

Yuan Zhang is studying the replacement of heart muscle cells (cardiomyocytes) lost due to heart injury and disease. With a model of human cardiomyocytes differentiated from stem cells, she is looking for small molecules to stimulate and enhance cardiomyocyte proliferation *in vitro*.

Isabelle Ziebold, Biology

Mentor: Michael Levitt, Structural Biology

The set of all known proteins of all biological organisms is growing rapidly due to improved sequencing technologies, but little is known about most proteins other than their amino acid sequence deduced from DNA sequencing. Isabelle is analyzing patterns in the structural domains of proteins to better understand their function and to determine relationships between protein families.



Brian Chu completed his summer research training in Dr. Euan Ashley's lab

2015 Poster Titles - presented August 26, 2015

"Applying Bayesian Model Averaging to the Optimization of Computational Water Models"
Han Altae-Tran[1,2,3], Lee-Ping Wang[5], Vijay Pande[4]
Departments of Mathematics[1], Physics[2], Electrical Engineering[3], and Chemistry[4] Stanford University; Department of Chemistry[5], UC Davis

"Investigating Diurnal Cortisol as a Biomarker for Developing Affective Disorders in Children"
Cameron Backes[1], Lara Foland-Ross[1], Ian Gotlib[2], Joelle LeMoult[2], Manpreet Singh[1]
Departments of Psychiatry & Behavioral Sciences[1] and Psychology[2], Stanford University

"Divergent Evolution *in vitro*: Engineering Specialized Drug Sensitivity in Proteases for Cellular Engineering Applications"
Ryan Badiee[1], Conor Jacobs[1], Michael Lin[2,3]
Departments of Biology[1], Bioengineering[2], and Pediatrics[3], Stanford University

"Evolution of Larger Body Size during Transitions from Terrestrial to Aquatic Habitats in Snakes (Suborder Serpentes)"
Matthew Benjamin[1], William Gearty[2], Jonathan Payne[2]
Departments of Biology[1] and Geological Sciences[2], Stanford University

"Polymorphic Residues in NLRP1Control *Toxoplasma gondii* Sensing"
Jordan Brzezny[1], Sarah Ewald[1], John Boothroyd[1]
Department of Microbiology & Immunology[1], Stanford University

"Optimizing HR of HBB Locus using CRISPR/Cas9 and RAAV6 in HPSCs"
Joab Camarena[1], Daniel Dever[1], Ayal Hendel[1], Matthew Porteus[1]
Department of Pediatrics[1], Stanford University

"Localization and Interactions of Photosynthetic Components in *Chlamydomonas reinhardtii*"
Chris Chen[1], Luke Mackinder[2], Martin Jonikas[1,2]
Department of Biology[1], Stanford University; Department of Plant Biology[2], Carnegie Institution for Science

"CD248 Defines a Subpopulation of Pro-Angiogenic Adipose Derived Stromal Cells"
Monica C. Chin[1], Stephanie M. Vistnes[1], Elizabeth R. Zielins[1], Elizabeth A. Brett[1], Charles Blackshear[1], Derrick C. Wan[1], Michael T. Longaker[1,2]
Department of Surgery (Division of Plastic & Reconstructive Surgery)[1]and Institute for Stem Cell Biology & Regenerative Medicine[2], Stanford University

"Evaluation of Candidate Agonists for the Orexin Receptor and Implications on Cardiac Function"
Brian Chu[1,2], Ching Shang[1,2], Marco Perez[1,2], Euan Ashley[1,2]
Center for Inherited Cardiovascular Disease[1] and Department of Medicine (Division of Cardiovascular Medicine)[2], Stanford University

"The Effect of Low Carb vs. Low Fat Dietary Interventions on Human Adipose Cell Size"
Coraal Cohen[1], Erin Avery[2], Lifen Liu[1], Elizabeth Colbert[1], Samuel Cushman[3], Christopher Gardner[2], Tracey McLaughlin[1]
Departments of Endocrinology[1] and Stanford Prevention Research Center[2], Stanford University; NIDDK[3], National Institutes of Health

"Using Genetic Variant Analysis to Find Novel Transcript Isoforms in Type 2 Diabetes"
Amartya Das[1], Brian D. Piening[1], Andrew M. Lipchik[1], Michael P. Snyder[1]
Department of Genetics[1], Stanford University

"Targeting Epigenetic Repression to Induce Neural Differentiation in Medulloblastoma"
Lauren Ellis[1], James Purzner[2], Matthew Scott[2], Yoon-Jae Cho[1]
Departments of Neurology[1] and Developmental Biology[2], Stanford University

"Representation of Decision Formation Signals in Premotor Cortex when Choice is Reported by Eye and Hand"
Bora Erden[1], Diogo Peixoto[1,2], William T. Newsome[1,3]
Departments of Neurobiology[1] and Howard Hughes Medical Institute[3], Stanford University; Champalimaud Neuroscience Programme[2]

"Rabies-Tracing Mediated Exploration of Inputs to the Substantia Nigra"
Kathryn E. Evans[1], Talia N. Lerner[2,3], Karl Deisseroth[2,3,4,5]
Departments of Biology[1], Bioengineering[2], and Psychiatry & Behavioral Sciences[4], Howard Hughes Medical Institute[5], and CNC Program[3], Stanford University

"Immunosenescence in Major Depressive Disorder"
Tanvi Gambhir[1,2], Dhivya Perumal[1,2], Krista Ring[1,2], Elissa Epel[3], Synthia Mellon[4], Owen M. Wolkowitz[3], Firdaus S. Dhabhar[1,2,5,6,7,8]
Laboratory of Stress Immunology[1], Department of Psychiatry & Behavioral Sciences[2], Stanford Institute for Immunity, Transplantation, & Infection[5], Stanford Cancer Institute[6], Stanford Neurosciences Institute[7], and Bio-X Program[8], Stanford University; Departments of Psychiatry[3] and OB/GYN & Reproductive Sciences[4], UCSF

"*Pseudomonas aeruginosa* Pf4 Phage is an Inhibitor of Aspergillus Fumigatus Biofilm Formation and Development"
Omar Garcia[1], Andrey Malkovskiy[1], Johanna Sweere[1], Gernot Kaber[1], John Penner[1,2], José Ferreira[1,2], Patrick Secor[3], Karl Clemons[1,2], David Stevens[1,2], Paul Bollyky[1]
Department of Medicine (Division of Infectious Diseases)[1], Stanford University; California Institute for Medical Research[2], San Jose; Department of Microbiology[3], University of Washington

"Automating the Analysis of Dendritic Spine Data Sets"
Druthi Ghanta[1,2], Maja Djurisic[2], Assaf Hoogi[3], Daniel L. Rubin[3], Carla J. Shatz[2]
Departments of Computer Science[1], Neurobiology[2], and Radiology[3], Stanford University

"The Wound Healing Response Promotes Tumor Cell Invasion and Metastasis"
Meghana Golla[1], Marjan Rafat[1], Megan Albertelli[1], Marta Vilalta[1], Todd A. Aguilera[1], Amato J. Giaccia[1], Edward E. Graves[1]
Department of Radiation Oncology[1], Stanford University

"[The program] provided me the unique experience of formulating research questions and thinking critically about my project. I think that the Bio-X research program really affords students the opportunity to get a hands-on experience to apply concepts learned in classes [to] real-life situations and thereby buttress the material in textbooks."

—USRP Participant Debbie Lee

"N-Terminal Structural Modification of Mip40 Leads to Cell Cycle Defects and Functional Changes in the dREAM/MMB Tumor Suppressor Complex"
Daniel M Gonzalez[1,2], Laura Andrejka[1,2], Mei-Hsin Cheng[1,2], Joseph Lipsick[1,2]
Departments of Pathology[1] and Genetics[2], Stanford University

"Membrane Lipid Composition Regulating Influenza Binding Visualized on the Single Virion Level"
Isabel Goronzy[1], Robert Rawle[2], Peter Kasson[2], Steven Boxer[1]
Department of Chemistry[1], Stanford University; Department of Molecular Physiology & Biological Physics[2], University of Virginia

"Using Force Control to Study Motor Coordination in the Human Brain"
Deeksha Goyal[1], Samir Menon[1], Oussama Khatib[1]
Department of Computer Science[1], Stanford University

"Homeodomain Interacting Protein Kinase 4 Positively Regulates the Hedgehog Signaling Pathway"
Zane J. Hellmann[1], J. Aaron Crapster[1], Paul G. Rack [1], Michael Eisenberg[2], James K. Chen[1]
Departments of Chemical & Systems Biology [1] and Urology[2], Stanford University

"Investigating Behavioral Changes in Mice Following Medial Entorhinal Cortex Grid Cell Scale Expansion"
Ashley Henderson[1], Caitlin Mallory[2], Lisa Giocomo[2]
Departments of Biology[1] and Neurobiology[2], Stanford University

"Restoring BDNF Delivery on the Cortical-Striatal Axis: A Therapeutic Strategy for Huntington's Disease"
Nicolas Herrera[1], Michael T. Maloney[1], Yanmin Yang[1]
Department of Neurology & Neurological Sciences[1], Stanford University

"DNA Melt as a Rapid Fingerprint for Broad-range Pathogen Identification and Serotyping"
Annie Hu[1], Nadya Andini[1], Samuel Yang[1]
Department of Emergency Medicine[1], Stanford University

"Bioengineering of Functional Cardiac Tissues"
Daniel A. Hu[1], Vahid Serpooshan[1], Sean M. Wu[1,2,3,4]
Stanford University Cardiovascular Institute[1], Division of Cardiovascular Medicine[2], Institute for Stem Cell Biology & Regenerative Medicine[3], and Child Health Research Institute[4], Stanford University

"CRISPR/Cas-Mediated Genome Editing in Neurons"
Ian Hull[1], Louise Giam[2], Thomas Südhof[2]
Departments of Bioengineering[1] and Molecular & Cellular Physiology[2], Stanford University

"Localized Analysis of Pericyte Proliferation in Coronary Artery Maturation"
Andrew Jacobs[1], Katharina Volz[1], Kristy Red-Horse[1]
Department of Biology[1], Stanford University

"Examining the Function of Individual A-to-I RNA Editing Sites in *Drosophila*"
Dionna Jacobson[1], Tricia Deng[1], Lisa Zhang[1], Chris Li[1], Carrie Yan[1], Nora Nguyen[1], Jin Billy Li[1]
Department of Genetics[1], Stanford University

"The Coding of Cutaneous Temperature in the Spinal Cord"
Gabbi Kamalani[1,2], Chen Ran[1,2], Xiaoke Chen[1,2]
Department of Biology[1] and Bio-X[2], Stanford University

"Key Amino Acid Residues in the Ketosynthase Active Site of a Polyketide Assembly Line"
Joshuah Kapilivsky[1], Thomas Robbins[1], Chaitan Khosla[1,2]
Departments of Chemistry[1] and Chemical Engineering[2], Stanford University

"Computational Analysis of Social Behavior in a Fish (*A. burtoni*)"
Katrina Kent[1], Austin Hilliard[1], Russell Fernald[1]
Department of Biology[1], Stanford University

"Toward Understanding the Functional Relevance of Nemitin's Post-Translational Modifications in Neurons"
Habib Khoury[1], Ivan Millan[1], Yanmin Yang[1]
Department of Neurology & Neurological Sciences[1], Stanford University

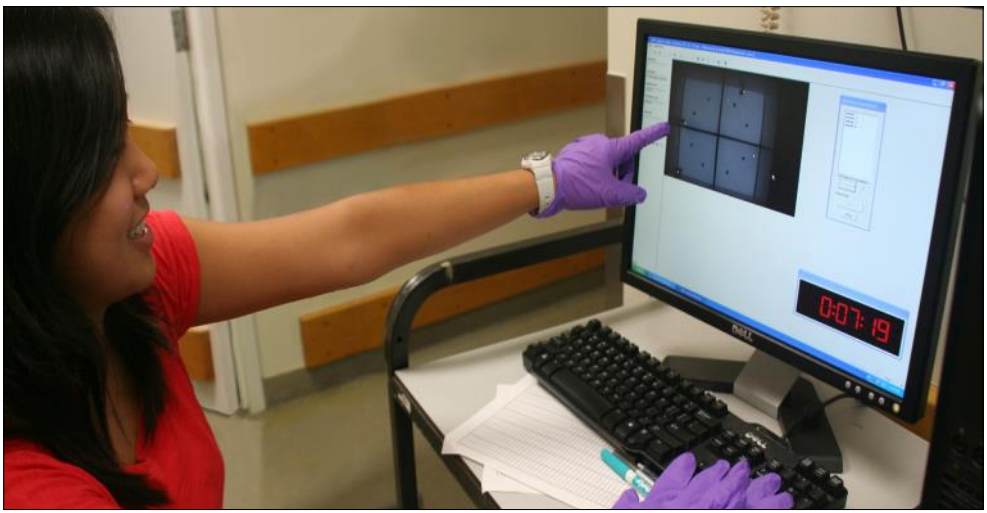
"Engineered Knottin-Protein Conjugates for Targeted Delivery of siRNA"
Camila R. Kofman[1], Sandra M. DePorter[1], Sungwon Lim[1], Jennifer R. Cochran[1]
Department of Bioengineering[1], Stanford University

"Mapping Changes in Proteome Stability in Response to Acute Protein"
Nira Krasnow[1], Airlia Thompson[1], Ron Kopito[1]
Department of Biology[1], Stanford University

"Assessing the Role of Neurosteroids in the Pathophysiology and Treatment of Autism Spectrum Disorder "
Lauren Kwa[1], Wenchao Sun[2], Robin Libove[1], Jennifer Phillips[1], Francois Haddad[3], Serena Tanaka[1], Antonio Hardan[1], Lawrence K. Fung[1]
Departments of Psychiatry & Behavioral Sciences[1] and Medicine (Division of Cardiovascular Medicine)[3] and Biomaterials & Advanced Drug Delivery Lab[2], Stanford University

"Improving Computational Performance for Real-Time Forward Dynamics Musculoskeletal Simulations"
Thomas Lau[1], Christopher Dembia[1], Michael Sherman[1], Ajay Seth[1], Scott Delp[1]
Department of Bioengineering[1], Stanford University

"Injectable, Long-Term Two Component Hydrogels for Spinal Cord Regeneration"
Kaz Lewis[1], Karen Dubbin[1], Laura Marquardt[1], Vanessa Doulames[2], Lei Cai[1], Giles Plant[2], Sarah Heilshorn[1]
Departments of Materials Science & Engineering[1] and Neurosurgery[2], Stanford University



Meagan Shinbashi completed her summer research training in Dr. Craig Heller's lab

"I learned many valuable techniques not just within the discipline of molecular biology, but also in chemical analysis of proteins and also computational analysis. The amalgamation of so many skills would have been rare in other summer experiences."

—USRP Participant Christine Yeh

"The Role of CHD8 Deregulation in Epigenetic Architecture of Autism Spectrum Disorder"
Jason Li[1,2], Bahareh Haddad Derafshi[1,2], Marius Wernig[1,2]
Institute for Stem Cell Biology & Regenerative Medicine[1] and Department of Pathology[2], Stanford University

"Miniaturized Inductive RFID tags for Cellular Level Sensing"
Wenye Li[1], Xiaolin Hu[1], Mimi Yang[1], H.-S. Philip Wong[1]
Department of Electrical Engineering[1], Stanford University

"Investigating the Regulation of NGFR in Human Triple Negative Breast Cancer Cells"
Lillian Liao[1], Meghah Vuppalapaty[1], Angera Kuo[1], Michael Clarke[1]
Institute for Stem Cell Biology & Regenerative Medicine[1], Stanford University

"The Role of MicroRNA-126 in Tumor Angiogenesis"
Cynthia Kosinski[1], Terry Reyes[1], Majed Magzoub[2], George Chen[3], Junlei Chang[1], Frank Kuhnert[1], Calvin J. Kuo[1]
Departments of Medicine[1], Bioengineering[2], and Biology[3], Stanford University

"Cell Intrinsic and Microenvironmental Etiologies of Chemotherapy-Induced White Matter Damage"
Alfonso Ocampo[1,2,3,4,6], Erin M. Gibson[1,2,3,6], Lauren S. Wood[1,2,3,4], James Lennon[1,2,3,4], Surya Nagaraja[1,2,3,4,5], Pam J. Woo[1,2,3,4], Hannes Vogel[1,2,3,6], Michelle Monje[1,2,3,4,6]
Departments of Neurology[1], Neurosurgery[2], Pediatrics[3], Neuroscience[5], and Pathology[6] and Institute for Stem Cell Biology & Regenerative Medicine[4], Stanford University

"Subject-Specific Volumetric Reconstruction of Biomechanical Arm Models"
Anupama Rajan[1], Samir Menon[1] Oussama Khatib[1]
Department of Computer Science[1], Stanford University

"Optogenetic Control of Nerve Growth Factor Mediated Pathways in Spatial Dimensions"
Aliyah Sarro-Schwartz[1], Qunxiang Ong[1], Allister McGuire[1], Ruyan Zhang[1], Bianxiao Cui[1]
Department of Chemistry[1], Stanford University

"The Role of Spectrin in T Cell Stiffness and Signaling"
Yoseph Semma[1], Kenneth Hu[2], Manish Butte[3]
Departments of Biology[1], Biophysics[2], and Pediatrics[3], Stanford University

"Significance of Sleep and Circadian Rhythms in Learning and Memory"
Meagan Shinbashi[1], Amy Xu[1], Bayara Chuluun[1], H. Craig Heller[1]
Department of Biology[1], Stanford University

"Optogenetic Stimulation of VTA Dopamine Neurons in DAT-Cre Mice to Induce a Sleep to Wake Transition"
Matias Silvestre[1], Ada Eban-Rothschild[1], Shibin Li[1], William Giardino[1], Luis de Lecea[1]
Department of Psychiatry & Behavioral Sciences[1], Stanford University

"Modeling Familial Dilated Cardiomyopathy with Induced Pluripotent Stem Cells"
Zachary Sorey[1], Ioannis Karakikes[1], Vittavat Termglinchan[1], Timon Seeger[1], Joseph Wu[1], Patricia Nguyen[1]
Cardiovascular Institute[1], Stanford University

"Investigating RA-mediated Homeostatic Plasticity *in vivo*"
Sona Sulakian[1], Lei Ray Zhong[2], Lu Chen[2]
Departments of Chemistry[1] and Neurosurgery[2], Stanford University

"Regulating Action Sequence via Basal Ganglia Indirect and Direct Pathway Circuitry"
Gordon L Sun[1], Patrick E. Rothwell[1], Robert Malenka[1]
Department of Psychiatry & Behavioral Sciences[1], Stanford University

"Mechanisms of Neuroligin-3 Activity-Dependent Cleavage and Secretion"
Lydia Tam[1], Humsa Venkatesh[1], Michelle Monje[1]
Department of Neurology[1], Stanford University

"Fate Mapping of Telomerase Expressing Cells from Neural Stem Cell Niche"
Chester Thai[1], Chandresh Gajera[1], Steven Artandi[1,2]
Departments of Hematology[1] and Biochemistry[2], Stanford University

"Risk Factors for the Onset of Depression, Anxiety, and Comorbid Depression-Anxiety: A Longitudinal Investigation"
Ada Thatcher-James[1], Joelle LeMoult[1], Ian Gotlib[1]
Department of Psychology[1], Stanford University

"Lipogenesis in Myc, Ras, and Bcr-Abl Lymphomas"
Georgia Toal[1,2], Arvin Gouw[1,2], Dean W. Felsher[1,2]
Departments of Medicine (Division of Oncology)[1] and Pathology[2], Stanford University

"Characterizing the Kinetics of Circulating Tumor DNA Degradation"
Jason Wang[1,2], Alex Lovejoy[2,3], Jake Chabon[1,2], Dave Kurtz[4,5], Maximilian Diehn[1,2,3]
Institute for Stem Cell Biology & Regenerative Medicine[1], Stanford Cancer Institute[2], Departments of Radiation Oncology[3], Medicine (Division of Oncology)[4], and Bioengineering[5], Stanford University

"Does *Toxoplasma gondii* Selectively Shed Surface Proteins from its Plasma Membrane during Host Cell Invasion?"
Brian Wei[1], Felice Kelly[1], John Boothroyd[1]
Department of Microbiology & Immunology[1], Stanford University

"A Web-Based Repository of Drug-Induced Cancer Cell Death Phenotypes"
Alex Wells[1], Marisa Hom[1], Scott Dixon[1]
Department of Biology[1], Stanford University

"The Regulation of Synapse Structure by Cytokine-Induced Expression of MHC Class I"
Drew Willoughby[1], Marc Carmichael[1], Theo Palmer[1]
Department of Neurosurgery[1], Stanford University

"Utilizing Inducible CRISPR Interference for Functional Study of ILF2 & ILF3 in Cell Growth and Proliferation"
Timothy Ting-Hsuan Wu[1], LingFang Shi[1], Dane Sessions[1], Peter N. Kao[1]
Department of Medicine (Division of Pulmonary & Critical Care Medicine)[1], Stanford University

"Measuring the Methylation State and Accessibility of a Nondisruptable Intergenic Region of *Caulobacter crescentus*"
Johnny Xu[1], Michael Melfi[2], Lucy Shapiro[1]
Departments of Developmental Biology[1] and Chemistry[2], Stanford University

"Developing a Tool for Measurement of Synaptic Vesicle Protein Half-Lives"
Leena Yin[1], Shaoyun Zhang[1], Richard Reimer[1,2]
Department of Neurology & Neurological Sciences[1], Stanford University; Veterans Affairs Palo Alto Health Care System[2]

"Hsp90 and the Evolution of New Traits"
Alex Yuan[1], Daniel Jarosz[2,3]
Departments of Biology[1], Chemical & Systems Biology[2], and Developmental Biology[3], Stanford University

"The Stimulatory Effect of Bioactive Lipids on Mesoderm Expansion and Cardiomyocyte Cell Cycle Reentry in an hiPSC Model"
Yuan Zhang[1,2], Arun Sharma[1,2], and Sean M. Wu[1,2,3]
Institute for Stem Cell Biology & Regenerative Medicine[1], Cardiovascular Institute[2], and Department of Medicine (Division of Cardiovascular Medicine)[3], Stanford University

"Understanding the Language of Genomes through Domain Architectures"
Isabelle Ziebold[1], Andrea Scaiewicz[2], Michael Levitt[2,3]
Departments of Biology[1], Structural Biology[2], and Computer Science[3], Stanford University

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