



**STANFORD  
BIO-X**

**UNDERGRADUATE  
SUMMER RESEARCH  
PROGRAM 2018**



*2018 Undergraduate Summer Research Program (USRP) Participants*

# STANFORD BIO-X UNDERGRADUATE SUMMER RESEARCH PROGRAM



*2017 Undergraduate Summer Research Program (USRP) Participants*

The Stanford Bio-X Undergraduate Summer Research Program (Stanford Bio-X USRP) is now 14 years old and has partnered with 264 Stanford faculty mentors in order to provide a ten-week summer research opportunity to 567 students to date.

The program aims to foster the interdisciplinary spirit of Stanford Bio-X in a new generation of up-and-coming scientists by exposing Stanford undergraduates to **ten weeks of hands-on laboratory research experience**. In addition to the ten weeks of laboratory research, students attend **weekly faculty talks** by twenty-seven Stanford Bio-X faculty affiliates to introduce them to the cutting-edge research taking place in laboratories across campus. The program concludes with a **scientific poster session** alongside graduate students, faculty, and Stanford Bio-X community members from across campus and beyond.

Funding for the support of our program was provided by generous contributions from The Rose Hills Foundation, the Stanford University Vice Provost for Undergraduate Education, Linda and Andy Ach, John Ehmann, Jane and Owen Frost, Rett Frost, William Shepherd, Stanford Bio-X, and Anonymous Donors.

In 2018, 64 students and 2 student mentors are participating in the program.

# 2018 STANFORD BIO-X UNDERGRADUATE RESEARCH PROGRAM TALKS BY STANFORD FACULTY:

## June 27

Rajat Rohatgi (Biochemistry and Medicine – Oncology), “Cell-cell communication in development and disease”

Scott Dixon (Biology), “Understanding the effects of metabolism on tumor cell growth and death”

Seung Kim (Developmental Biology), “Systems for discovering molecular and cellular mechanisms underlying diabetes”

## July 11

Ash Alizadeh (Medicine – Oncology), “Transcriptome deconvolution for inference of tissue composition”

Euan Ashley (Medicine – Cardiovascular Medicine), “Paging Dr iPhone”

Melanie Hayden Gephart (Neurosurgery), “Brain tumor surgery and science”

## July 18

Jamshid Ghajar (Neurosurgery), “Eye tracking detection of attention: concussion and beyond”

Thomas Südhof (Molecular & Cellular Physiology), “The cell biology of synapse formation”

Tony Wyss-Coray (Neurology & Neurological Sciences), “Circulatory factors as regulators of brain aging and function”

## July 25

Stefanie Jeffrey (Surgery), “Liquid Biopsy in Cancer”

Ron Kopito (Biology), “Protein quality control”

Steven Boxer (Chemistry), “Viral fusion using surrogate receptors”

## August 1

Shirit Einav (Medicine – Infectious Diseases and Microbiology & Immunology), “A Host-targeted approach for combating emerging viral infection”

Carolyn Bertozzi (Chemistry), “From patient to bench: rare genetic diseases as windows into human biology”

Jonathan Pollack (Pathology), “The Whole Tooth”

## August 8

Helen Blau (Microbiology & Immunology), “Muscle Regeneration: No Pain, No Gain!”

Paul Wang (Medicine – Cardiovascular Medicine), “Innovation and the Future of Heart Rhythm Therapy”

Eric Appel (Materials Science & Engineering), “Supramolecular Biomaterials: From fundamentals to advanced healthcare solutions”

## August 15

Anson Lee (Cardiothoracic Surgery), “Multidisciplinary Approach to Atrial Fibrillation”

Peter Santa Maria (Otolaryngology – Head & Neck Surgery), “The translational journey of tympanic membrane regeneration”

Ravindra Majeti (Medicine – Hematology), “Stem Cells in Human Acute Myeloid Leukemia”

## August 22

Lisa Giacomini (Neurobiology), “Identifying the algorithms for calculating a neural map of space”

Dennis Wall (Pediatrics – Systems Medicine and Biomedical Data Science), “Opportunities and challenges of AI in healthcare”

Craig Heller (Biology), “Reversing the Learning Disability of Down Syndrome”

## August 29

Michael Lin (Neurobiology and Bioengineering), “Designing proteins for optical reading and writing of biology”

Theo Palmer (Neurosurgery), “Is the Y chromosome a risk factor in autism?”

Paul George (Neurology & Neurological Sciences), “Engineering the Optimal Environment for Neural Recovery”



# Stanford Bio-X Undergraduate Summer Research Program Alumni:

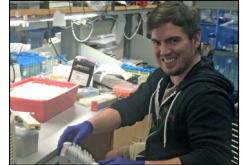
Alumni of the program are extremely successful. They have gone on to pursue doctorates and medical degrees all over the world, published in high-impact journals, and accepted exciting positions in industry and beyond.



2017 Stanford Bio-X Undergraduate Summer Research Program participant Alan Wei in the lab of Dr. Carla Shatz

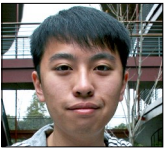
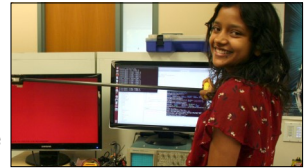
**Alan Wei, 2017 cohort (above)**, received a 2018 NSF Graduate Research Fellowship and will be pursuing a PhD in neuroscience next year at Johns Hopkins University.

**Daniel Fuentes, 2010 cohort (pictured at right)**, is completing his PhD in the Stanford Cancer Biology program this summer. He received the Stanford Firestone Medal for Excellence in Undergraduate Research in 2012 and an NSF Graduate Research Fellowship in 2013. Daniel has published numerous articles in *Nature* and *Cell*, with a first-author publication in *eLife* in progress.



**Nicole Urman, 2014 cohort (left)**, is a first year medical student at Stanford. She has published multiple papers, including a first-author paper that was based off of her honors thesis research, for which she won Stanford's Firestone Medal. Nicole was also recently awarded a 2018 American Skin Association Hambrick Medical Student Grant Targeting Melanoma and Skin Cancer to continue working on another one of her projects, which is now a phase 2 clinical trial.

**Deeksha Goyal, 2015 cohort (right)**, is completing a master's degree in computer science at Stanford, as well as working on her own startup through the LightSpeed Innovations Accelerator Program.



**Timothy Wu, 2015 and 2016 cohort (left)**, will be starting his medical training at Stanford School in 2018. He recently published a first-author paper in *PLOS ONE*, which is a continuation of work he performed during his Stanford Bio-X USRP training.

**Isabel Goronzy, 2015 and 2016 cohorts and 2017 honorary fellow and student mentor (right)**, will start the Medical Science Training Program at UCLA and Caltech next fall. She will pursue an MD from UCLA and a PhD from Caltech simultaneously. Isabel recently published a first-author paper in *Chemical Science* and received a 2018 NSF Graduate Research Fellowship.



**Lina Kheour, 2016 cohort (left)**, is currently a Community Health and Prevention Research Master's student at Stanford. Lina recently received the Empowering Asian/Asian American Communities Fellowship and the Special Achievement award for Stanford's Asian American Awards, and was named a Haas Center Public Service Scholar, as well as a Cardinal Service honoree. She will attend UCSF for medical school in the fall of 2018.

# 2018 Stanford Bio-X Undergraduate Summer Research Program Participants:



**Leila Abdelrahman, Chemistry**  
**Mentor: Ravindra Majeti, Medicine (Hematology)**

Leila is studying how the disruption of certain genes can convert cancerous B-cells into healthy immune cells. Utilizing a combination of RNA and DNA sequencing, she hopes to understand why one gene in particular profoundly improves this conversion. This work can lead to future therapies that target this specific gene and enhance the conversion process, thus providing a novel form of leukemia treatment.



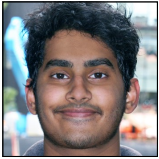
**Anthony Agbay, Bioengineering**  
**Mentor: Carolyn Bertozzi, Chemistry**

Protein glycosylation, the process by which proteins add sugar side chains to their amino acids, is the most widespread modification of proteins. However, tools to precisely study the function of glycosylation in health and disease are lacking. Anthony will be using chemically modified sugars developed in the Bertozzi lab to investigate the mechanism and importance of protein glycosylation.



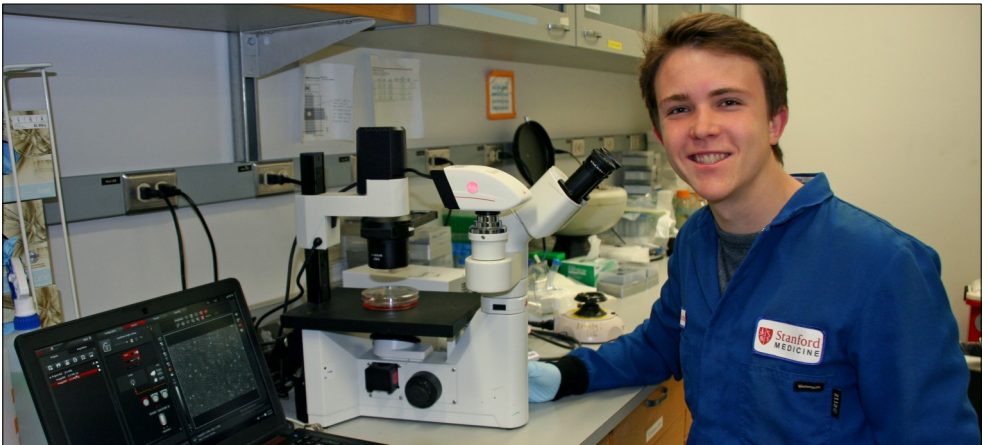
**Stephanie Andersen, undeclared**  
**Mentor: Melanie Hayden Gephart, Neurosurgery**

The Gephart lab has found CEACAM6 to be an overexpressed gene in a specific type of lung tumor. Cells with overexpressed CEACAM6 inadequately adhere to their substrate and have shown to be resistant to programmed cell death. Stephanie's project will define cellular-based assays to study the resistance of patient-derived lung tumor-cells to programmed cell death.



**Niranjn Balachandar, Computer Science**  
**Mentor: Daniel Rubin, Biomedical Data Science, Radiology, and Medicine (Biomedical Informatics Research)**

Deep learning has brought about major breakthroughs in automated medical diagnoses. However, deep learning typically requires a large amount of patient data, so multiple healthcare institutions would have to pool patient data to build a robust deep learning model. There are also many regulatory hurdles to sharing patient data, so Niranjn will develop and deploy data-distributed deep learning methods in which computations are performed on local patient data, thus avoiding the need for data sharing. Such methods will propel collaborative deep learning efforts across multiple healthcare institutions.



Collin Schlager, 2018 cohort, completed his Stanford Bio-X summer research training in Dr. Rajat Rohatgi's lab

*“[During the program], 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

**Margot Bellon, Biology**

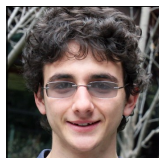
**Mentor: Stefanie Jeffrey, Surgery (General Surgery); and Sarah Heilshorn, Materials Science & Engineering**



Using various collagen hydrogel matrices, Margot will grow tumor cells from different sections of an aggressive patient-derived breast cancer tumor model. Margot will then utilize quantitative cell-counting techniques to determine how different collagen matrices influence tumor growth, and transcriptional analysis techniques to determine how different microenvironments influence gene expression in tumor cells from the primary tumor, circulating tumor cells, and metastases. These studies will better elucidate mechanisms to treat breast cancer by targeting the tumor cells through their surrounding matrices.

**Foster Birnbaum, undeclared**

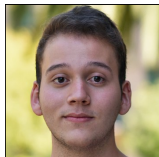
**Mentor: Helen Blau, Microbiology & Immunology**



The X-linked recessive disease Duchenne Muscular Dystrophy (DMD) affects 1 in every 3,500 males, causing heart failure around age twenty-five. Foster will investigate the movement of drugs such as beta-blockers (drugs that decrease the rate of heart beat) and ACE inhibitors (drugs that dilate blood vessels) into stem cell derived cells from DMD patients. This proposed study will establish a baseline profile for future drug discovery and drug toxicity screens.

**Ignacio Blanco, undeclared**

**Mentor: David Myung, Ophthalmology**



Ignacio's research will tackle cornea functionality wounds. Because the cornea lacks blood vessels, which allows for its transparency, it has limited ability to heal after sustaining a wound, leaving it susceptible to ulceration, scarring, and becoming opaque. Ignacio will experiment by using a cross linked collagen-PEG gel carrier as a vehicle to carry mesenchymal stem cells (MSCs) to promote wound healing in the cornea. His aim is to control and characterize the growth of MSCs and their output within collagen gels for the repair of wounded corneas.

**Susanna Bradbury, Biology**

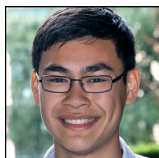
**Mentor: Karl Deisseroth, Bioengineering and Psychiatry & Behavioral Sciences**



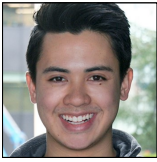
Many aspects of behavior are subject to our internal states; for instance, when making a difficult decision, our performance is better when we are alert, compared to drowsy. Susanna's Stanford Bio-X research will be focused on determining the cellular and molecular mechanisms that underlie this internal state-driven enhancement of decision-making through manipulation of cell types and neurotransmitters in the larval zebrafish. This research will help establish the cell types and molecules that adapt decision-making abilities in complex and changing environments. The work will have broad relevance for various psychiatric disorders where decision-making is often disrupted and are treated with drugs that target neuromodulatory systems.

**Noah Brazer, undeclared**

**Mentor: Jonathan Pollack, Pathology**



In prostate cancer, a key clinical need is distinguishing those cancers that need to be treated from those that do not. The current best indicator is tumor grade, i.e. how disorganized the tumor appears under the microscope. Noah's studies aim to understand the molecular basis for low versus high grade prostate cancer, with implications for new biomarkers of tumor aggressiveness that will help to better determine who to treat, and possibly find new avenues for prevention and treatment.



### **Cody Carlton, Computational Biology**

**Mentor: Anson Lee, Cardiothoracic Surgery**

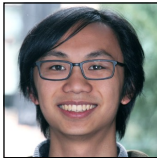
The focus of Cody's project is to develop algorithms that give insight into the mechanism of post-operative atrial fibrillation (irregular heartbeat). These algorithms will identify premature atrial contractions and the onset of atrial fibrillation, and detect other heart rhythm anomalies using data that has not been measured by current medical devices. These insights will help us guide our treatment and prevention of post-operative atrial fibrillation.



### **Annette Chang, undeclared**

**Mentor: Russ Altman, Bioengineering, Genetics, Medicine (Biomedical Informatics Research), and Biomedical Data Science**

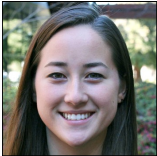
The mechanisms behind differences in drug response between males and females are not well understood. Using the liver as a model, Annette's research aims to link sex-differential gene expression data to drug-target information to better understand how drug efficacy and toxicity relate to sex.



### **Jeffrey Chang, Physics**

**Mentor: Steven Boxer, Chemistry**

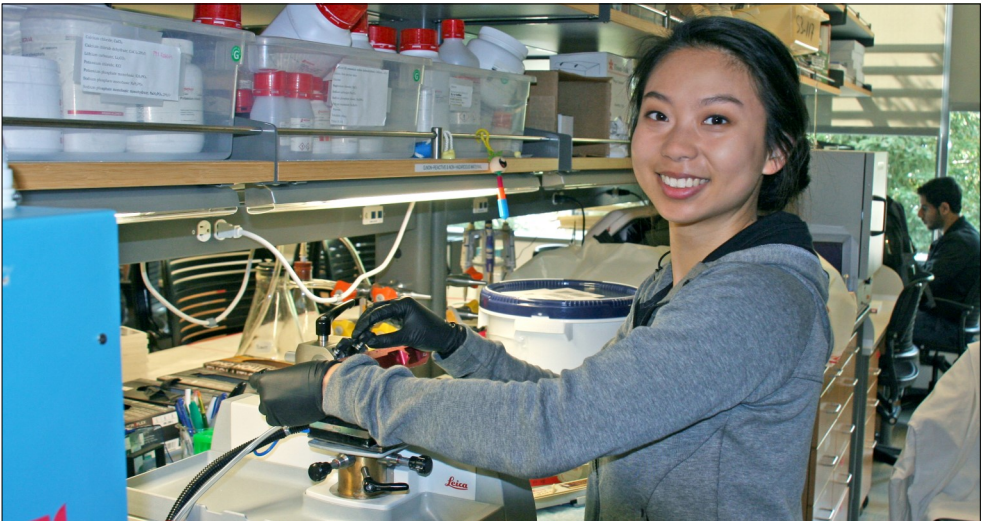
Reversibly photoswitchable fluorescent proteins (RSFPs) are glowing proteins that can be turned on and off upon irradiation with specific colors. These proteins have revolutionized super-resolution microscopy and deepened our understanding of cellular biology, but despite their widespread use, we have little experimental data explaining how exactly the chromophores in these proteins turn on and off. Jeffrey aims to elucidate the underlying biophysical mechanism by incorporating modified amino acids into the chromophore structure and observing how photoswitching properties are affected.



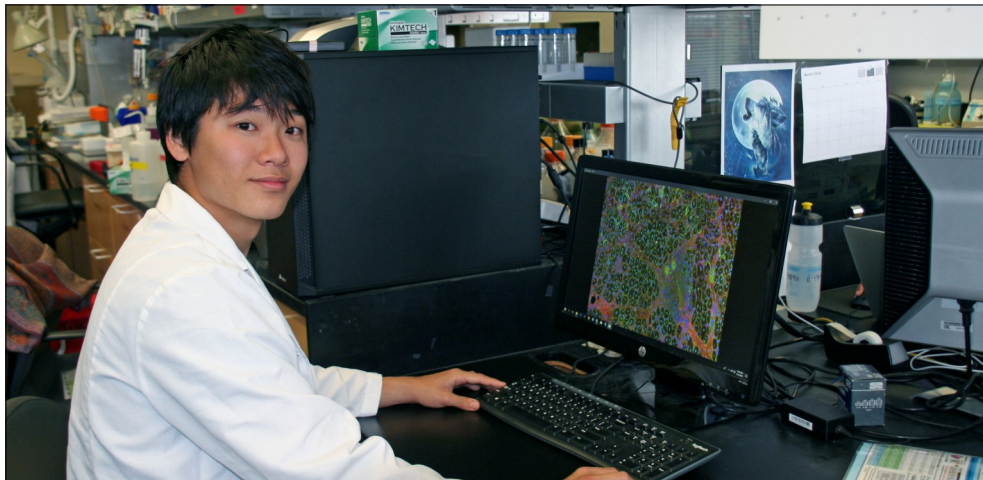
### **Kathleen Chang, Human Biology**

**Mentor: Seung Kim, Developmental Biology**

Many human diseases result from cell-cell communication failures. RNA interference (RNAi) is an established technique used to study the pathogenesis of diseases, yet it lacks capabilities to target multiple cells or multiple tissues. Kathleen's project is aimed at producing supplementary *in vivo* transgenic RNAi lines in *Drosophila* that will help develop tools to study independent genetic modification in two distinct cell types, so that novel genetic and cellular interactions between cells can be revealed.



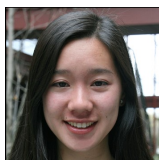
Alice Wang, 2018 cohort, completed her Stanford Bio-X summer research training in Dr. Sarah Heilshorn's lab



Hikaru Hotta, 2018 cohort, completed his Stanford Bio-X summer research training in Dr. Helen Blau's lab

### **Shannon Chiu, Chemistry**

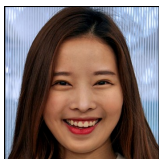
**Mentor: Carolyn Bertozzi, Chemistry**



Cancer cells express modifications in the glycoproteins on their surface compared to healthy cells, allowing them to escape detection from the immune system. Through glycocalyx engineering (the coating of proteins and sugars on the surface of the cell), Shannon will be tuning the physical and chemical properties of synthetic mucus glycoproteins to match those of native mucus. She will then biochemically investigate protein-glycan interactions at the cell surface to determine potential targets for cancer immunotherapy.

### **Dahee Chung, Biomedical Computation**

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



Identifying genes that are associated with the odontoblast cell is important for better understanding tooth development for regeneration. By using RNA sequencing, Dahee aims to compare genes that are highly associated with odontoblasts in teeth and osteoblasts in bone, and provide genome-wide characterization of gene expression which, can lead to novel regulators of tooth development.

### **Collin Cremers, Chemical Engineering**

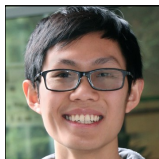
**Mentor: Gerald Fuller, Chemical Engineering**



Rheological data provides insights about the mechanical properties of cells, yet this information is rarely integrated with data about the morphological characteristics of those same cells. Collin's project utilizes a magnetic micromanipulation-based rheometer and fluorescence imaging to establish correlations between the mechanical and morphological features of endothelial cells. Because mechanical and morphological features are altered by several conditions, including cancer and atherosclerosis, this research has potential to establish new diagnostic methods for patients exhibiting cell inflammation.

### **Tyler Dao, Bioengineering**

**Mentor: Michael Lin, Neurobiology and Bioengineering**



Heterodimeric Dronpa is a GFP-like fluorescent protein that dissociates and switches off to a dim form under cyan light (488nm) and dimerizes to restore to a bright form under violet light (405nm). By fusing each Dronpa monomer to a protein and targeting sequence, Tyler will control protein localization and activity using light. This is superior to previous methods to control protein activity, since it requires no cofactors that could be toxic to the cell and features a built-in reporter of protein location and activity level to monitor Dronpa itself.



**Alex Doan, undeclared**

**Mentor: Julien Sage, Pediatrics (Hematology & Oncology)**



The retinoblastoma (RB) gene is a crucial tumor suppressor that regulates cell cycle progression. It has been shown from previous studies that the loss of RB function in humans and mouse models leads to cancer initiation and progression. While there have been numerous studies regarding RB's cellular function with other proteins in various pathways, there continue to be gaps in understanding RB's effect on aging and tumor formation. Alex is analyzing the phenotypic effects in mice models caused by varying different levels of RB expression throughout their lives. The study will help in the development of therapeutic methods for humans to slow the effects of aging or prolong tumor development through the manipulation of RB gene expression.

**Lara Elcavage, Chemical Engineering**

**Mentor: Paul Khavari, Dermatology**



While some RNA encoded by the genome is translated to produce functional proteins, other RNAs, such as small nucleolar RNAs (snoRNAs), have a variety of other functions. SnoRNAs are commonly involved in modifying protein-producing machinery, and aberrations in their expression have been observed in cancer cells. Lara's project uses CRISPR-Cas9, a technology that effectively and specifically changes genes within organisms, to systematically delete hundreds of snoRNA genes in order to examine which of these contribute to cancer initiation and progression.

**Ginger Gramson, Human Biology**

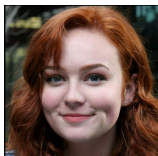
**Mentor: Gerald Crabtree, Pathology and Developmental Biology**



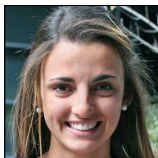
Chromatin regulators are mutated in about 50% of all human cancers, but their modes of leading to cancer are poorly understood. Ginger will use CRISPR/Cas9 to tag chromatin regulators with a protein domain that induces the recruitment of complexes to specific genome sites. This will help elucidate the kinetics and mechanisms in which the actions of chromatin regulators can lead to mis-regulation in the state of cancer.



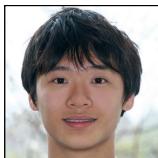
Ginger Gramson, 2018 cohort, completed her Stanford Bio-X summer research training in Dr. Gerald Crabtree's lab

**Victoria Gresbach, undeclared****Mentor: Eric Appel, Materials Science & Engineering**

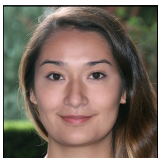
Dr. Appel's research group integrates chemistry, materials science, and biology to study advanced materials and their biomedical applications, specifically Polymer-Nanoparticle (PNP) hydrogels. Victoria is using these PNP hydrogels as a depot for subunit vaccine components. Normally, vaccines require repeated exposures and may cause adverse symptoms as a response. Subunit vaccines in PNP hydrogels only utilize a small portion of the antigen, which is released over an extended time period, to produce the same immune defense. Subunit vaccines in PNP hydrogels can be applied either to pathogenic diseases or as a therapeutic cancer treatment.

**Olivia Gugliemini, Human Biology****Mentor: James Chen, Chemical & Systems Biology and Developmental Biology**

ARHGAP36 is highly expressed in certain forms of medulloblastoma and neuroblastoma. Why ARHGAP36 is upregulated in these pediatric malignancies remains unknown, and Olivia will investigate whether ARHGAP36 promotes the differentiation of these cancer cells or maintains them in a stem cell-like state. Her studies will provide new insights into the molecular mechanisms that drive these deadly childhood cancers and assess the potential of ARHGAP36 as a therapeutic target.

**Hikaru Hotta, Bioengineering****Mentor: Helen Blau, Microbiology & Immunology**

Skeletal muscle is highly metabolic, and insulin insensitivity and type-II diabetes are associated with muscle wasting. Hikaru's Stanford Bio-X project uses a novel technique to study the genetic response of muscle to exercise and glucose uptake. Results from this will better our understanding of the link between metabolism and gene expression and can lead to new therapeutic targets for type-II diabetes.

**Lauren Houle, Biology****Mentor: Ron Kopito, Biology**

The ubiquitin proteasome system is a key mechanism cells use to maintain protein quality control. Lauren's research focuses on studying whether ubiquitylation of a particular protein within the proteasome interferes with the proteasome's normal catalytic function. This will help elucidate how an imbalance in protein homeostasis affects the proteasome's ability to function properly.

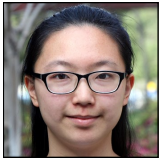
**Ryan Hsieh, Biology****Mentor: Tony Wyss-Coray, Neurology & Neurological Sciences**

The Blood Brain Barrier (BBB), a semipermeable barrier between the central nervous system and the blood, has been implicated in several neurodegenerative diseases, such as Alzheimer's, and has posed an issue to effective Central Nervous System (CNS) drug delivery. Ryan aims to help catalog a list of proteins that can cross the BBB and identify them through mass spectrometry. A deeper understanding of these BBB proteins could clarify brain aging and neurodegenerative disease progression and reveal BBB transporters as "Trojan horse" shuttles for CNS drug delivery.





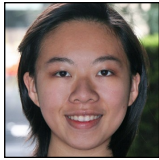
Vivek Lam, 2018 cohort, completed his Stanford Bio-X summer research training in Dr. Paul George's lab



**Caroline Huang, undeclared**

**Mentor: Joshua Knowles, Medicine (Cardiovascular Medicine)**

Insulin resistance is a morbid condition affecting millions worldwide that increases the risk for diabetes and cardiovascular disease. Caroline will help identify genes that contribute to the development of insulin resistance. Manipulation of these genes may help alleviate the risk of developing diabetes.



**Sharon Huang, undeclared**

**Mentor: Howard Chang, Dermatology and Genetics**

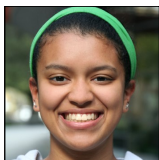
Mitochondria play a key role in regulating cellular processes. The pathways through which important mitochondrial proteins and their corresponding RNA localize at the outer mitochondrial membrane (OMM) is not well understood. Using drug perturbations and a newly developed technique called APEX-Seq, Sharon will determine the mechanisms that guide RNA localization to the OMM, which, in turn, may expose how these pathways are dysregulated in debilitating mitochondrial disorders, such as diabetes mellitus, Leber's hereditary optic neuropathy, Leigh syndrome, and many others.



**Milind Jagota, Electrical Engineering**

**Mentor: Ron Dror, Computer Science**

Cryo-EM is an experimental microscopy technique rapidly growing in popularity for molecular structure reconstruction. Milind will work to develop new algorithms for reconstruction from Cryo-EM images, with the goal of making Cryo-EM less data intensive. This project will involve image processing algorithms, as well as simulation and statistical modeling work.



**Layla Joseph, Human Biology**

**Mentor: Peter Santa Maria, Otolaryngology (Head & Neck Surgery)**

Chronic suppurative otitis media is a persistently discharging eardrum perforation in the middle ear, producing hearing loss in more than 50% of cases. Recent work in Dr. Santa Maria's lab has led to the creation of a suitable rodent model, and Layla will conduct studies using this model to identify potential therapeutic targets for intervention. She will accomplish this by studying the pathogenesis of bacterial biofilms within the middle ear in a model system that allows the lab to assess the effectiveness of new therapeutics in full organisms.

**Raina Kolluri, undeclared**

**Mentor: Jamshid Ghajar, Neurosurgery**



The incidence of concussions within athletes and military personnel due to head trauma is increasing at an alarming rate. The long-term effects of concussions are severe. Using SyncThink's eye tracking technology and the PAC-12 CARE Consortium concussion database, as well as working with Stanford Sports Medicine, Raina's project aims to assess student-athletes to categorize concussions into subtypes, assess recovery trajectory by subtype, and make initial headway on developing immersive visual orientation therapeutics for concussion.

**Sandra Kong, Computational Biology**

**Mentor: William Hiesinger, Cardiothoracic Surgery**



In patients with end-stage heart failure, left ventricular assist devices (LVAD) can be used to provide mechanical support for the heart by bypassing the left ventricle altogether. The aim of Sandra's project is to use 3D modeling, along with numerical simulations, to optimize the positioning of the LVAD. Through the use of patient-specific models, personalized procedures could be developed to reduce post-operative complications, improve patient experience, and extend the longevity of the device.

**Vivek Lam, Chemical Engineering**

**Mentor: Paul George, Neurology & Neurological Sciences**



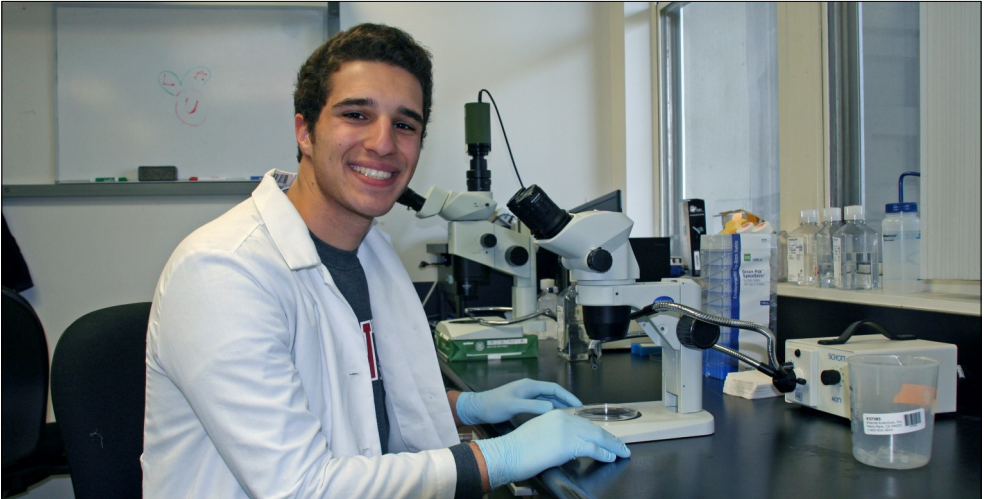
Stroke is a leading cause of long-term disability and death in the world. Stem cell therapeutics have emerged to improve the functional outcomes of stroke patients, but the materials and methods of transplanting these stem cells have yet to be established. By designing novel biomaterials with different mechanical, electrical, and geometrical properties, Vivek hopes to understand the characteristics that influence stem cell phenotypic changes and improve the efficacy of stem cell therapeutics.

**Vicky Le, Human Biology**

**Mentor: Julien Sage, Pediatrics (Hematology & Oncology) and Genetics**



Human patients with Small Cell Lung Cancer (SCLC) initially respond well to chemotherapeutic regimens; however, most cases become rapidly resistant to treatments and become lethal. Vicky will replicate this medical phenomenon in murine SCLC in order to generate a mouse model to study the genetic and microenvironment shifts. Generating chemoresistance in the context of a functioning immune system will provide the means to study future targeted therapies.

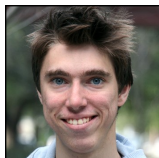




Maggie Rosenthal, 2018 cohort, completed her Stanford Bio-X summer research training in Dr. Antonio Hardan's lab

### **John "Jack" Lindsey, Mathematics**

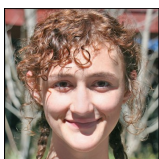
**Mentor: Shaul Druckmann, Neurobiology and Psychiatry & Behavioral Sciences**



Jack will combine approaches from machine learning, neuroscience, and mathematics to better understand how neural circuits process information in a recurrent manner. This will give important insight into how neural networks use previous experiences to make predictions about a person's environment, which can bring greater understanding of situations such as why certain people are more incentivized to learn when unsupervised compared to others.

### **Xóchitl Longstaff, Bioengineering**

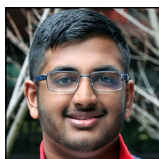
**Mentor: Bo Wang, Bioengineering**



Parasitic flatworms reproduce rapidly within humans. This ability comes from the flatworms' germline. However, little is known about the cellular and molecular mechanisms of this process. Xóchitl will utilize a fly model to characterize a novel protein that is involved in regulating the flatworm's germline development, which can bring better insight into developing methods to treat parasitic flatworms.

### **Sainiteesh Maddineni, undeclared**

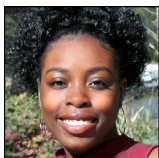
**Mentor: Jennifer Cochran, Bioengineering**



Sai's project focuses on developing an innovative therapeutic intervention for non-small cell lung cancer by studying a particular protein that is present in the tumor microenvironment and causes immunotherapies to be ineffective. Sai will produce and characterize a novel drug candidate that will be tested for its ability to stimulate the immune system to attack the tumor. This project has the potential to be translated clinically and extend to treating other aggressive cancers.

### **Chyna Mays, Bioengineering**

**Mentor: Reinhold Dauskardt, Materials Science & Engineering**



The stratum corneum, or outermost layer of the skin, is essential for protecting the body from infections and other environmental stressors. This layer also produces natural moisturizing factors (NMFs) to maintain the skin's hydration, elasticity, and resilience. Chyna will study how exposing the skin to different treatments, such as detergents, can affect the layer's mechanical properties to better understand how we can maintain the stratum corneum, thus maintaining the body's wellbeing.

### **Joseph Noh, Biology**

**Mentor: Irving Weissman, Pathology and Developmental Biology**



Joseph will be using imaging technologies to better characterize the cellular and molecular components of specific stem cells. The results from this project have the potential to harness those stem cells' regenerative properties and contribute to both the field of basic science and to clinical applications in bone marrow transplantation strategies.

**Ilham Osman, Human Biology****Mentor: Shirin Einav, Medicine (Infectious Diseases) and Microbio. & Immun.**

Dengue virus is a major global health threat, yet our understanding of how hosts respond to this infection is incomplete due to heterogeneous responses from individual cells even within a single host. A newly developed sequencing approach can help overcome this hurdle by painting a complete picture at the single cell level and the genome-wide scale. Ilham will use the results of sequencing different cells with this new approach, and thus contribute to the understanding of the virus-host interplay.

**Ellen Ouyang, Biology****Mentor: Nicolas Grillet, Otolaryngology (Head & Neck Surgery)**

Mutations in the gene LOXHD1 lead to hearing loss. LOXHD1 is curiously expressed in only two locations: hair cells and spermatids. Ellen's project hopes to determine the localization of LOXHD1 in the testis and whether mutations in LOXHD1 that cause deafness also induce morphological defects in the spermatids of a mouse model.

**Praveen Pallegar, Symbolic Systems****Mentor: Michelle Monje, Neurology & Neurological Sciences**

Cancer chemotherapy frequently results in long-term neurological dysfunction, such as slowed information processing and deficits in attention, concentration, working memory and learning, as well as fine motor skills. It is hypothesized that chemotherapy induces damage to neural precursor cells. Praveen's research will investigate the effects of chemotherapy on the environment surrounding these precursor cells to better understand this phenomenon.

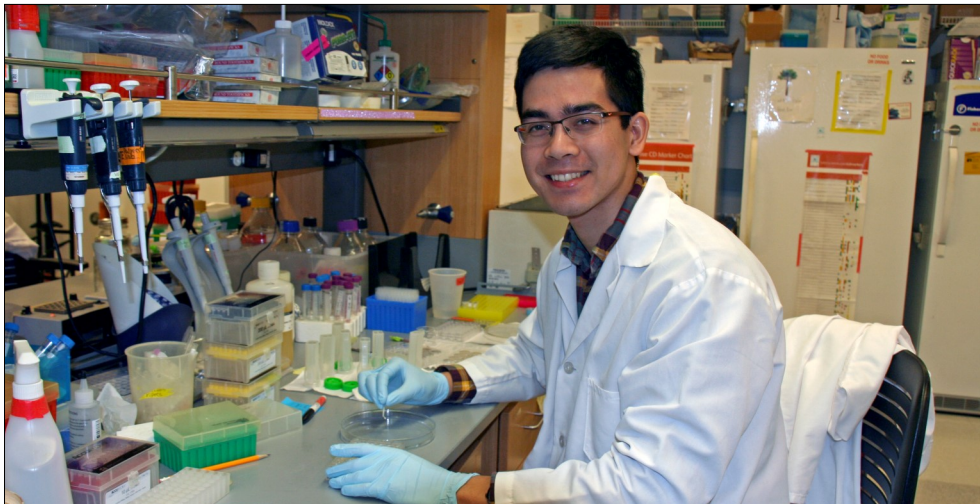
**Cole Paullin, Biomechanical Engineering****Mentor: Joseph Woo, Cardiothoracic Surgery**

1.7% of the US population is afflicted with a heart condition where blood flows backwards through the mitral valve when the left ventricle of the heart contracts. This condition historically has a survival rate that rivals that of cancer. There are multiple techniques used to repair the mitral valve, but there isn't any objective physiological data on what the best technique is. Cole will use a mechanical left heart simulator to better elucidate how the mitral valve works, and which surgical intervention is the most effective.

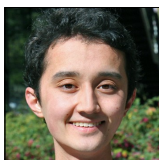
**Carson Poltorack, Biology****Mentor: Scott Dixon, Biology**

When normal tissues transform into cancerous ones, many sorts of adaptations help them evade the body's natural anti-cancer defenses. Carson is studying the role of ferroptosis, a form of programmed cell death, as an anti-cancer mechanism, and investigating how tumors can use surrounding proteins as a nutrient source to simultaneously grow and evade ferroptosis.





*John Rodgers, 2018 cohort, completed his Stanford Bio-X summer research training in Dr. Theo Palmer's lab*



**Nicolas Poux, Biology**

**Mentor: Irving Weissman, Pathology and Developmental Biology**

Nicolas will develop a new imaging tool that will better our ability to study systems such as cell migration, which is a crucial characteristic of cancer. This tool will provide a larger palette of fluorescent proteins, which will enable new clonal analysis studies of cells in cancer and other motile systems.



**Aaron Reed, Computer Science**

**Mentor: Euan Ashley, Medicine (Cardiovascular Medicine)**

Aaron's goal is to investigate the beneficial effects of exercise on human health at the molecular level. He will use current multi-omics approaches to analyze patient and animal data that are being collected from the MoTrPAC study. This is a \$200 million NIH-initiated study, for which the Ashley lab is the data and analysis hub, which focuses on assembling a comprehensive map of the molecular changes that occur in response to movement, and when possible, relate these changes to the benefits of physical activity.



**John Rodgers, Biology**

**Mentor: Theo Palmer, Neurosurgery**

Genetics and fetal environment are known to have roles in causing some neurodevelopmental disorders, and two specific risk factors are strongly implicated: the CHD8 gene and maternal immune activation during pregnancy. John will use a mouse model to study how these components interact and ultimately affect the offspring's behavior and brain development. This research will shed more light on how different elements combine to contribute to the onset of neurodevelopmental disorders.



**Maggie Rosenthal, Human Biology**

**Mentor: Antonio Hardan, Psychiatry & Behavioral Sciences**

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by the presence of social communication impairments and restricted, repetitive patterns of behavior or interests. Maggie's research aims to understand the genetic influence on neuronal development by utilizing neuroimaging analysis and cognitive and behavioral assessments on twin pairs with and without ASD. This will help identify neurobiological abnormalities in the brain, and determine the extent of association between genetic factors and abnormalities in individuals with ASD.

**Collin Schlager, undeclared****Mentor: Rajat Rohatgi, Biochemistry and Medicine (Oncology)**

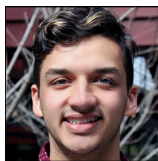
A fundamental challenge faced by many cells in our bodies is the ability to maintain a constant volume when placed under different stressors in their surrounding environment. Without maintaining this volume balance, there can be catastrophic consequences in cell physiology, especially in organs such as the kidney. Collin's goal is to uncover the molecular pathways that help cells adapt in such situations.

**Isaac Smith, Computer Science****Mentor: Ash Alizadeh, Medicine (Oncology)**

Tumor-infiltrating immune cells, like lymphocytes and macrophages, are vital to tumor development and survival in patients with cancer. Isaac will use machine learning to develop a system that uses protein mass spectrometry data to identify the relative abundance of these immune cells in disease tissues.

**Jan Sokol, Biomechanical Engineering****Mentor: Michael Longaker, Surgery (Plastic & Reconstructive Surgery)**

Currently, no effective treatment for cutaneous scarring exists, and, thus, there is a paramount need for novel treatments capable of preventing or reversing scarring. Jan will seek to identify the stem/progenitor cells in normal human skin, and the tissue origins of human scar-forming fibroblasts. This will be a first step towards determining novel therapeutic targets against the molecular mechanisms underlying scarring, fibrosis, and regeneration after wounding.

**Athreya Steiger, Biology****Mentor: H. Craig Heller, Biology**

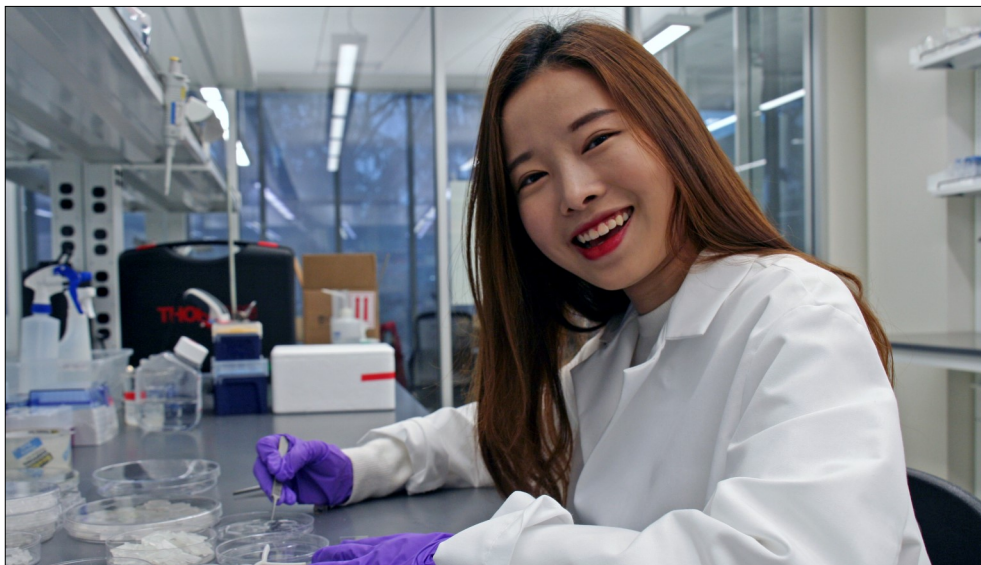
Disruptions in the circadian timing system have been shown to impair memory processing, although it is unclear if this impairment is in memory formation or recall. Using a hamster model, Athreya aims to uncover the mechanism by which loss of a regular circadian rhythm impairs memory processing. Understanding the mechanisms behind these disruptions holds promise in elucidating the neural basis behind the onset of diseases like Alzheimer's.

**Kevin Tang, Biology****Mentor: Irving Weissman, Pathology and Developmental Biology**

CD47 is a surface protein expressed on every cancer cell which functions as a "don't eat me" signal and allows tumor cells to flourish. Currently, there are clinical trials with antibodies that target and bind to CD47 to remove the "don't eat me" signal and allow immune cells to kill the cancer cells. Kevin's Stanford Bio-X project will aim to discover how different genetic variants of CD47 change the efficacy of these treatments in hopes of developing better treatments for future cancer patients.



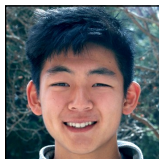




Dahee Chung, 2018 cohort, completed her Stanford Bio-X summer research training in Dr. Joy Wu's lab

**Kevin Tien, Computer Science**

**Mentor: Russell Fernald, Biology**



The African cichlid fish *Astatotilapia burtoni* has a robust repertoire of social behaviors, making it an ideal model for studying the hormonal regulation of social behavior. Kevin will be comparing the effects of increased testosterone, and the loss of receptors for testosterone, in the context of male aggression. These results will hopefully shed light on the hormonal regulation of social behavior and lead to novel hypotheses about gender-biased disorders such as autism.

**Eajer Toh, Electrical Engineering**

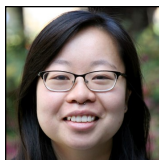
**Mentor: Paul Wang, Medicine (Cardiovascular Medicine)**



Atrial fibrillation (AF) is the most common arrhythmia affecting more than 2 million adults in the United States alone, and is often treated with a minimally invasive procedure called catheter ablation. However, conventional methods of catheter ablation contribute to suboptimal success. Eajer will design a new system to improve the accuracy of the procedure in hopes of increasing its success.

**Sarah Tran, Symbolic Systems**

**Mentor: Ivan Soltesz, Neurosurgery**



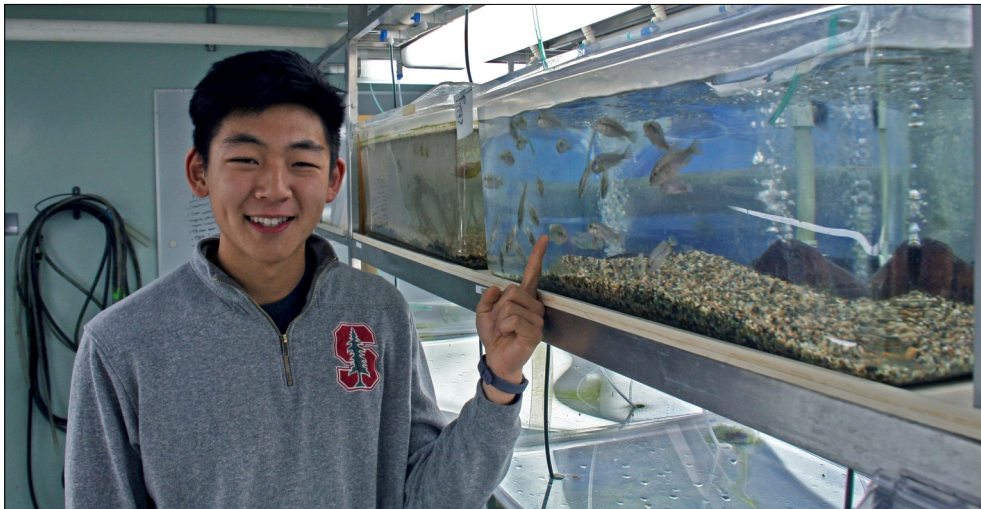
The hippocampus plays a critical role in memory consolidation and spatial navigation. The curve around the end of the hippocampus is called the dentate gyrus, and it is proposed that the dentate gyrus acts as an input for the hippocampus. Sarah aims to use the neural network simulator called NEURON to model how the dentate gyrus is easily shaped and molded through small-scale neural networks. This will bring greater insight in understanding synaptic plasticity through computational analysis.

**Angeline Truong, undeclared**

**Mentor: Anson Lee, Cardiothoracic Surgery**



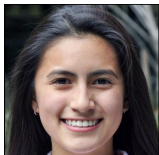
Angeline's project focuses on developing an *in-vitro* stretch assay which can evaluate the mechanical stretching that induces atrial fibrillation, or heart arrhythmia, in certain stem cells. Developing such an assay will make it possible to determine the molecular bases of atrial fibrillation, which is associated with increased heart failure, stroke, and hemodynamic abnormalities after cardiac surgery.



Kevin Tien, 2018 cohort, completed his Stanford Bio-X summer research training in Dr. Russell Fernald's lab

**Anaïs Tsai, undeclared**

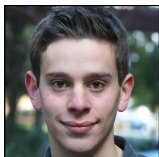
**Mentor: Tim Stearns, Biology and Genetics**



Primary cilia are antenna-like signaling organelles present in most human cells. Cilia control cell proliferation through the Hedgehog signaling pathway, and disrupting the signaling function of cilia in brain cells is the cause of medulloblastoma, the most common childhood brain cancer. Anaïs will bring together cell biology and genetic approaches to investigate how cilium-based signals control proliferation and differentiation, with the long-term goal of informing the development of therapeutics for ciliary signaling diseases such as medulloblastoma.

**Jacob Umans, Biology**

**Mentor: Theo Palmer, Neurosurgery**



The combined effects of maternal infection during pregnancy and mutations in the gene *Gabrb3* have been linked to an increased risk of autism spectrum disorder. Jacob intends to determine whether pretreating women with a pharmacological drug will be able to mitigate effects of the gene mutations during prenatal infection. Jacob's project will advance our understanding of the interplay between genetic susceptibilities and environmental disturbances in the pregnancy-related onset of neurodevelopmental disorders.

**Amanda Urke, Bioengineering**

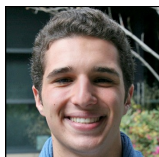
**Mentor: Lei Stanley Qi, Bioengineering and Chemical & Systems Biology**



Genetic tools repurposed from the bacterial CRISPR-Cas system have enabled targeted genome engineering. In particular, CRISPR activation (CRISPRa) shows promise in studying diverse diseases such as Amyotrophic Lateral Sclerosis (ALS), but is limited in its consistency and efficacy of activation. Amanda's project seeks to enhance the CRISPRa system so that studies can be done on a mutated gene that is found in 10-15% of genetic ALS cases.

**Panayiotis Vandris, undeclared**

**Mentor: Alan Cheng, Otolaryngology (Head & Neck Surgery)**

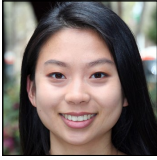


Damage to the vestibular system in the mammalian inner ear can result in debilitating imbalance. Panos will utilize a mouse model to better understand how the reestablishing the system's neural circuitry following injury allows for recovery of vestibular function, which can help with developing future therapies for patients with hearing loss and balance dysfunction.



**Maya Varma, Computer Science**

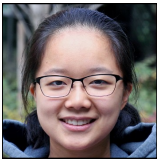
**Mentor: Dennis Wall, Pediatrics (System Medicine) and Biomedical Data Science**  
Autism spectrum disorder (ASD) refers to a group of neurological disorders characterized by social impairments, communication difficulties, and restricted and repetitive patterns of behavior. Maya's research focuses on identifying genetic links with the autism phenotype, potentially paving the way for novel genetics-based diagnostic methods.



**Alice Wang, Materials Science & Engineering**

**Mentor: Sarah Heilshorn, Materials Science & Engineering**

Poor cell survival and function after transplantation limits the therapeutic potential of the cells that have been transplanted for spinal cord injuries. The Heilshorn group has developed a protein-engineered biomaterial that has been shown to enhance cell survival and proliferation post-transplantation. Alice will investigate the mechanism of how this biomaterial affects the behavior of cells using a 3D *in vitro* model, and focusing on how the biomaterial's stiffness alters the cells' ability to secrete soluble factors.



**Vickie Wang, Psychology**

**Mentor: Xiaoke Chen, Biology**

The treatment of depression is currently limited by lack of knowledge about the underlying causes of depression. Vickie's project aims to address this gap by investigating the role of the paraventricular thalamus (PVT) in depression. Vickie will examine how manipulating neural activity within the PVT impacts depression-like behavior in mice and neural activity across the whole mouse brain.



**Dhara Yu, undeclared**

**Mentor: Lisa Giocomo, Neurobiology**

The entorhinal-hippocampal circuit is thought to be responsible for the computational processes associated with spatial navigation and memory. Using both single-cell and large-scale electrophysiological recording methods, Dhara is examining activity patterns of spatial variable-encoding neuron populations in this region, with the goal of investigating the differential roles of sensory cues and self-motion information in the generation of spatial representations.



Amanda Urke, 2018 cohort, completed her Stanford Bio-X summer research training in Dr. Stanley Qi's lab

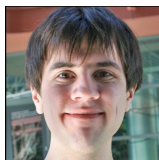
# 2018 Stanford Bio-X Undergraduate Summer Research Program Honorary Fellows:



## **Tae-León Butler, Human Biology**

**Mentor: Kathleen Sakamoto, Pediatrics**

Tae's research will continue to explore the dynamics of cell signaling pathways involved in production and progression of leukemias. Specifically, she will be analyzing biological assays and molecular biology techniques to study how certain cellular small molecules can be utilized in an effective, less toxic therapy for Acute Myeloid Leukemia.



## **Cole Deisseroth, Computer Science**

**Mentor: Gill Bejerano, Developmental Biology, Computer Science, and Pediatrics**

Diagnosing a rare disease involves matching a patient's phenotypes to the diseases the patient could have. When manually listing a patient's phenotypes, clinicians often disregard common phenotypes that are likely irrelevant to the disease, and thus misleading if used for diagnosis. Cole aims to utilize Stanford patient data to build phenotype frequency statistics that can be used to more accurately judge the usefulness of certain phenotypes, and thus enable faster, more accurate disease diagnoses.

## Posters Presented by 2018 Cohort on August 22, 2018

### **"Characterization of Enzymatic Turnover of Chemically Modified Sugars for Labeling the Glycocalyx"**

Anthony J. Agbay<sup>1</sup>, Benjamin Schumann<sup>1</sup>, Junwon Choi<sup>1</sup>, Marjoke F. Debets<sup>1</sup>, Thomas M. Wood<sup>1</sup>, Melissa A. Grey<sup>1</sup>, Simon Wisnovsky<sup>1</sup>, Carolyn R. Bertozzi<sup>1,2</sup>

Department of Chemistry<sup>1</sup>, Stanford University; Howard Hughes Medical Institute<sup>2</sup>

### **"The Role of Tyrosine Kinase Inhibitors in Anchor-Independent Survival of Lung Cancer Cells"**

Stephanie Andersen<sup>1</sup>, Dina Polyak<sup>1</sup>, Yingmei Li<sup>1</sup>, Melanie Hayden Gephart<sup>1</sup>

Department of Neurosurgery<sup>1</sup>, Stanford University

### **"Multi-Institutional Distributed Deep Learning for Automated Medical Diagnosis Tasks"**

Niranjan Balachandar<sup>1,2</sup>, Ken Chang<sup>3,4</sup>, Jayashree Kalpathy-Cramer<sup>3,4,5</sup>, Daniel Rubin<sup>1,2</sup>

Departments of Biomedical Data Science<sup>1</sup> and Radiology<sup>2</sup>, Stanford University; Martinos Center for Biomedical Imaging<sup>3</sup>, Department of Radiology<sup>4</sup>, and MGH & BWH Center for Clinical Data Science<sup>5</sup>, Massachusetts General Hospital

### **"The Effect of Different Microenvironments on Cell-Line and Patient-Derived Tumor Cell Growth and Protein Expression"**

Margot Bellon<sup>1</sup>, Praveen Kujur<sup>1</sup>, Dhanir Tailor<sup>2</sup>, Sarah Heilshorn<sup>2</sup>, Stefanie Jeffrey<sup>1</sup>

Departments of Surgical Oncology<sup>1</sup> and Materials Science & Engineering<sup>2</sup>, Stanford University

### **"Pharmacokinetic Study on Single Duchenne iPSC-Derived Cardiomyocytes on a Micropatterned Platform"**

Foster Birnbaum<sup>1,2</sup>, Luka Nicin<sup>1,2</sup>, Hengji Chen<sup>1,2</sup>, Gaspard Pardon<sup>3,4,5</sup>, Beth Pruitt<sup>3,4,5</sup>, Alex Chang<sup>1,2</sup>, Helen Blau<sup>1,2</sup>

Baxter Laboratory for Stem Cell Biology<sup>1</sup>, Departments of Microbiology & Immunology<sup>2</sup> and Mechanical Engineering<sup>4</sup>, and Microsystems Lab<sup>3</sup>, Stanford University; Department of Mechanical Engineering<sup>5</sup>, University of California, Santa Barbara

**“Novel Topical Therapies to Treat Alkaline Burns of the Cornea”**

Gabriella Fernandes Cunha<sup>1</sup>, Ignacio Jesus Blanco Varela<sup>1</sup>, Kyung Sun Na<sup>1</sup>, David Myung<sup>1</sup>  
Department of Ophthalmology<sup>1</sup>, Stanford University

**“Cell Type-Specific Influence of Neuroendocrine Hypothalamus on Response to Homeostatic Threats”**

Susanna Bradbury<sup>1</sup>, Matthew Lovett-Barron<sup>1</sup>, Ritchie Chen<sup>1</sup>, Karl Deisseroth<sup>1,2,3</sup>  
Departments of Bioengineering<sup>1</sup> and Psychiatry & Behavioral Sciences<sup>2</sup>, Stanford University; Howard Hughes Medical Institute<sup>3</sup>

**“Changes in Gene Expression of Co-Cultured Prostate Tissue During the Development of Benign Prostate Hyperplasia”**

Noah Brazer<sup>1</sup>, Jonathan Pollack<sup>1</sup>  
Department of Pathology<sup>1</sup>, Stanford University

**“A Novel Medical Device for Monitoring Post-Operative Atrial Fibrillation”**

Cody Carlton<sup>1</sup>, Anastasios Angelopoulos<sup>2</sup>, Joy Aparicio Valenzuela<sup>3</sup>, Terrence Pong<sup>3</sup>, Anson Lee<sup>3</sup>  
Departments of Biology<sup>1</sup>, Electrical Engineering<sup>2</sup>, and Cardiothoracic Surgery<sup>3</sup>, Stanford University

**“Automated Labeling and Analysis of Sex Bias in Drug-Gene Expression Data”**

Annie Chang<sup>1,2,3,4,5</sup>, Emily Flynn<sup>1,2,3,4,5,6</sup>, Russ Altman<sup>1,2,3,4,5</sup>  
Departments of Bioengineering<sup>1</sup>, Genetics<sup>2</sup>, Medicine<sup>3</sup>, Biomedical Data Science<sup>4</sup>, and Computer Science<sup>5</sup>  
and Biomedical Informatics Training Program<sup>6</sup>, Stanford University

**“Unusual Crystal Structures of a Photoswitchable Fluorescent Protein with a Substituted Chromophore”**

Jeffrey Chang<sup>1</sup>, Matt Romei<sup>2</sup>, Steven G. Boxer<sup>2</sup>  
Departments of Physics<sup>1</sup> and Chemistry<sup>2</sup>, Stanford University

**“Using the LexA-LexAop Binary Expression System to Develop Novel Genetic Tools for Gene Silencing in *Drosophila*”**

Kathleen Chang<sup>1</sup>, Sangbin Park<sup>1</sup>, Seung Kim<sup>1</sup>  
Department of Developmental Biology<sup>1</sup>, Stanford University

**“Synthesis of Glycopolypeptides for Engineering Cell-Surface Interactions in Immunity”**

Shannon H. Chiu<sup>1</sup>, Corleone S. Delaveris<sup>1</sup>, Carolyn R. Bertozzi<sup>1,2</sup>  
Department of Chemistry<sup>1</sup>, Stanford University; Howard Hughes Medical Institute<sup>2</sup>



**“Identifying Novel Gene Expression in Odontoblast Differentiation Comparing Incisor and Alveolar Bone Cells”**

Dahee Chung<sup>1</sup>, Joy Wu<sup>1</sup>

Department of Medicine (Division of Endocrinology)<sup>1</sup>, Stanford University

**“Monoclonal Antibody Aggregation at Fluid-Fluid Interfaces”**

Collin Cremers<sup>1</sup>, Aadithya Kannan<sup>1</sup>, Anna Sentmanat<sup>1</sup>, Ian C. Shieh<sup>2</sup>, Gerald G. Fuller<sup>1</sup>

Department of Chemical Engineering<sup>1</sup>, Stanford University; Genentech, Inc.<sup>2</sup>

**“Engineering Photodissociable Heterodimeric Dronpa for Optogenetic Control of Cellular Activity”**

Tyler Dao<sup>1</sup>, Namdoo Kim<sup>2</sup>, Michael Z. Lin<sup>1,2</sup>

Departments of Bioengineering<sup>1</sup> and Neurobiology<sup>2</sup>, Stanford University

**“Phenotypic Effects on Mice by Transient and Long Term Knockdown of the Retinoblastoma Protein”**

Alex Doan<sup>1</sup>, Julia Aarand<sup>1</sup>, Julien Sage<sup>1</sup>

Department of Pediatrics<sup>1</sup>, Stanford University

**“Characterizing the Orphan Small Nucleolar RNA Protein Interactome”**

Lara Elcavage<sup>1</sup>, Zurab Siprashvili<sup>1</sup>, Paul Khavari<sup>1</sup>

Department of Dermatology<sup>1</sup>, Stanford University

**“Degron Tagging BCL7 Proteins Using CRISPR”**

Ginger L. Gramson<sup>1</sup>, Jacob G. Kirkland<sup>2</sup>, Gerald R. Crabtree<sup>1,2,3</sup>

Departments of Developmental Biology<sup>1</sup> and Pathology<sup>2</sup>, Stanford University; Howard Hughes Medical Institute<sup>3</sup>

**“Increasing Stability of Innate Activators through Polymer Nanoparticle and Hydrogen Encapsulation”**

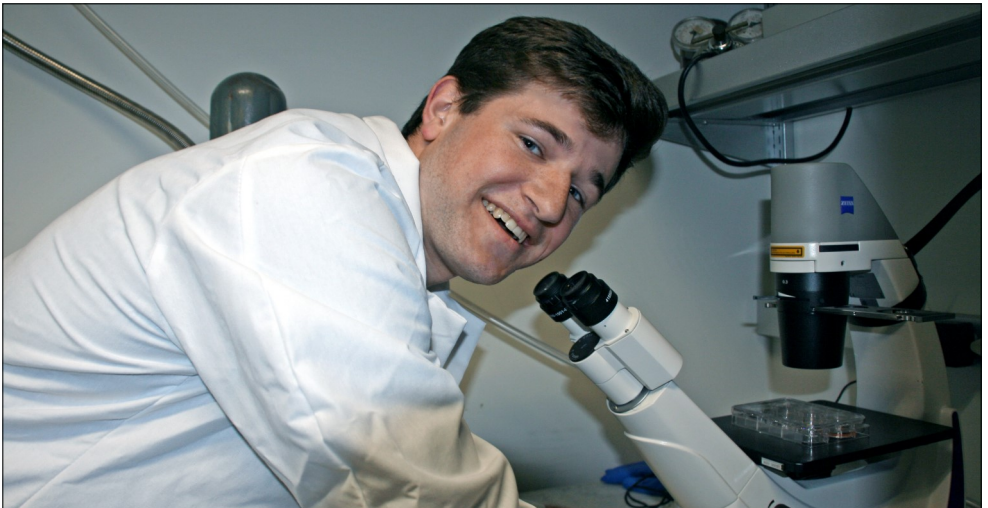
Victoria Gresbach<sup>1</sup>, Emily C. Gale<sup>2</sup>, Gillie Agmon<sup>3</sup>, Neil Patel<sup>3</sup>, Eric Appel<sup>1</sup>

Departments of Materials Science & Engineering<sup>1</sup>, Biochemistry<sup>2</sup>, and Bioengineering<sup>3</sup>, Stanford University

**“Investigating the Role of ARHGAP36 in Neuroblastoma Cell Lines”**

Olivia Gugliemini<sup>1</sup>, Taylor Johnson<sup>1</sup>, James Chen<sup>1,2,3</sup>

Departments of Chemical & Systems Biology<sup>1</sup>, Developmental Biology<sup>2</sup>, and Chemistry<sup>3</sup>, Stanford University



**“Glucose Metabolism Determines Histone Acetylation During Skeletal Muscle Hypertrophy”**

Hikaru Hotta<sup>1,2</sup>, Yu Xin Wang<sup>1,2</sup>, Nora Yucel<sup>1,2</sup>, Helen M. Blau<sup>1,2</sup>

Baxter Laboratory for Stem Cell Biology<sup>1</sup> and Department of Microbiology & Immunology<sup>2</sup>, Stanford University

**“An Investigation of the Translational Impact of Inducing Acute Cytosolic Protein Aggregation”**

Lauren Houle<sup>1</sup>, Colin Gottlieb<sup>1</sup>, Airlia Thompson<sup>1</sup>, Ron Kopito<sup>1</sup>

Department of Biology<sup>1</sup>, Stanford University

**“The Blood-Brain-Barrier Mediates Plasma Communication Between the Brain and Its Periphery”**

Ryan Hsieh<sup>1</sup>, Andrew Yang<sup>1</sup>, Davis Lee<sup>2</sup>, Sean Miller<sup>1</sup>, Tony Wyss-Coray<sup>1,2</sup>

Department of Neurology & Neurological Sciences<sup>1</sup>, Stanford University; VA Palo Alto Health Care System<sup>2</sup>

**“Mapping Causal Genetic Variants for Insulin Resistance”**

Caroline Huang<sup>1,2</sup>, Ivan Carlos Carcamo-Orive<sup>1</sup>, Brunilda Balliu<sup>1</sup>, Matt Durran<sup>1</sup>, Mike Gloudemans<sup>1</sup>, Trieu

Nguyen<sup>1</sup>, Chong Park<sup>1</sup>, Erik Ingelsson<sup>1</sup>, Stephen B. Montgomery<sup>1</sup>, Thomas Quertermous<sup>1</sup>, Joshua W. Knowles<sup>1</sup>

Cardiovascular Institute<sup>1</sup> and Stanford Bio-X Undergraduate Summer Research Program<sup>2</sup>, Stanford University

**“Examining the Nuclear Transcriptome”**

Sharon S. Huang<sup>1,2</sup>, Furqan M. Fazal<sup>1,2</sup>, Howard Y. Chang<sup>1,2</sup>

Departments of Dermatology<sup>1</sup> and Genetics<sup>2</sup>, Stanford University

**“End to End Learning of Protein Docking Potentials”**

Milind Jagota<sup>1</sup>, Raphael Townshend<sup>2</sup>, Rishi Bedi<sup>2</sup>, Ron Dror<sup>2</sup>

Departments of Electrical Engineering<sup>1</sup> and Computer Science<sup>2</sup>, Stanford University

**“*Pseudomonas aeruginosa* Promotes Neutrophil Extracellular Traps in Chronic Suppurative Otitis Media Model”**

Layla Joseph<sup>1</sup>, Kelly Khomtchouk<sup>1</sup>, Laurent Bekale<sup>1</sup>, Anping Xia<sup>1</sup>, Ali Kouhi<sup>1</sup>, Peter Santa Maria<sup>1</sup>

Department of Otolaryngology (Head & Neck Surgery)<sup>1</sup>, Stanford University

**“Post Concussive Symptoms Associated with Concussion Subtypes”**

Raina Kolluri<sup>1</sup>, Angela Lumba-Brown<sup>2</sup>, Jamshid Ghajar<sup>1</sup>

Departments of Neurosurgery<sup>1</sup> and Emergency Medicine<sup>2</sup>, Stanford University

**“Developing Patient-Specific Computational Models for Optimal Placement of Left Ventricular Assist Device (LVAD) Outflow Grafts”**

Sandra Kong<sup>1</sup>, Patpilai Kasinpila<sup>1</sup>, Robyn Fong<sup>1</sup>, Ramsey Nissan<sup>1</sup>, William Hiesinger<sup>1</sup>

Department of Cardiothoracic Surgery<sup>1</sup>, Stanford University

**“Aligned Scaffold for 3D Directed Cellular Migration and Growth”**

Vivek Lam<sup>1</sup>, Byeongtaek Oh<sup>1</sup>, Paul George<sup>1</sup>

Department of Neurology & Neurological Sciences<sup>1</sup>, Stanford University

**“Modeling Acquired Chemoresistance in Small Cell Lung Cancer Using Murine-Derived Immunocompetent Allografts”**

Vicky Le<sup>1</sup>, Garry Coles<sup>1</sup>, Julien Sage<sup>1</sup>

Department of Pediatrics (Hematology and Oncology)<sup>1</sup>, Stanford University

**“Uncovering Mechanisms of Cross-Regional Neural Information Transfer in Mouse ALM”**

Jack Lindsey<sup>1</sup>, Byungwoo Kang<sup>2</sup>, Shaul Druckmann<sup>3</sup>

Departments of Mathematics<sup>1</sup>, Physics<sup>2</sup>, and Neurobiology<sup>3</sup>, Stanford University

**“Competition and Cooperation in Syntrophic Microbial Communities”**

Xóchitl R.R. Longstaff<sup>1</sup>, Sam Roland Bray<sup>1</sup>, Bo Wang<sup>1,2</sup>

Departments of Bioengineering<sup>1</sup> and Developmental Biology<sup>2</sup>, Stanford University

**“Functional Characterization of a Novel Immunotherapy in Non-Small Cell Lung Cancer”**

Sainiteesh Maddineni<sup>1</sup>, Nishant Mehta<sup>1</sup>, Jennifer Cochran<sup>1,2</sup>  
Departments of Bioengineering<sup>1</sup> and Chemical Engineering<sup>2</sup>, Stanford University

**“Accumulated Skin Damage Due to Periodic Solar Exposure”**

Chyna Mays<sup>1</sup>, Christopher Berkey<sup>1</sup>, Ross Bennett-Kennett<sup>1</sup>, Reinhold H. Dauskardt<sup>1</sup>  
Department of Materials Science & Engineering<sup>1</sup>, Stanford University

**“A Non-Classical Role of Neogenin-1 and Netrin-1 Interaction in the Hematopoietic Stem Cell Niche”**

Joseph Noh<sup>2</sup>, Krzysztof Szade<sup>1</sup>, Gunsagar Gulati<sup>1</sup>, Monika Zukowska<sup>1</sup>, Allison Zhang<sup>1</sup>, Irving Weissman<sup>1</sup>  
Departments of Pathology<sup>1</sup> and Biology<sup>2</sup>, Stanford University

**“Role of Numb-Associated Kinases in Dengue Virus Infection”**

Ilham Osman<sup>1</sup>, Stanford Schor<sup>1</sup>, Shirir Einav<sup>1</sup>  
Department of Medicine (Division of Infectious Disease & Geographic Medicine)<sup>1</sup>, Stanford University

**“Localization in Testis of Deafness Associated Protein, LOXHD1”**

Ellen Ouyang<sup>1</sup>, Katherine Miller<sup>1</sup>, Nicolas Grillet<sup>1</sup>  
Department of Otolaryngology<sup>1</sup>, Stanford University

**“Chemotherapy Exposure Disrupts the Oligodendrogenic Microenvironment through Microglial Activation”**

Praveen N. Pallegar<sup>1</sup>, Erin M. Gibson<sup>1</sup>, Surya Nagaraja<sup>1</sup>, Alfonso Ocampo<sup>1</sup>, Lydia T. Tam<sup>1</sup>, Jacob J. Greene<sup>1</sup>, Lauren S. Wood<sup>1</sup>, Andrea K. Goldstein<sup>1</sup>, Lijun Ni<sup>1</sup>, Pamelyn J. Woo<sup>1</sup>, Ben A. Barres<sup>2</sup>, Shane Liddelow<sup>2,3</sup>, Hannes Vogel<sup>4</sup>, Michelle Monje<sup>1,4,5,6,7</sup>  
Departments of Neurology & Neurological Sciences<sup>1</sup>, Neurobiology<sup>2</sup>, Pathology<sup>4</sup>, Pediatrics<sup>5</sup>, and Psychiatry & Behavioral Sciences<sup>6</sup> and Institute for Stem Cell Biology & Regenerative Medicine<sup>7</sup>, Stanford University; Department of Neuroscience<sup>3</sup>, New York University

**“A Novel 3d Printed Device to Mimic Mitral Annular Dilation in an Ex Vivo Left Heart Simulator”**

Cole Paullin<sup>1</sup>, Annabel Imbrie-Moore<sup>2</sup>, Michael Paulsen<sup>1</sup>, Joseph Woo<sup>1</sup>  
Departments of Cardiothoracic Surgery<sup>1</sup> and Mechanical Engineering<sup>2</sup>, Stanford University

**“Arginine Starvation Robustly Suppresses Erastin-Induced Ferroptosis in Human Cancer Cells”**

Carson D. Poltorack<sup>1</sup>, Scott J. Dixon<sup>1</sup>  
Department of Biology<sup>1</sup>, Stanford University

**“Development of a High-Resolution Fluorescent Reporter System for Clonal Analysis”**

Nicolas Poux<sup>1</sup>, Jonathan M. Tsai<sup>1</sup>, Rahul Sinha<sup>1</sup>, Irving L. Weissman<sup>1</sup>  
Institute for Stem Cell Biology & Regenerative Medicine<sup>1</sup>, Stanford University

**“Utilizing Differential Network Methods for Analysis of Multiomics Data”**

Aaron Reed<sup>1</sup>, David Amar<sup>2</sup>, Euan Ashley<sup>2</sup>  
Departments of Computer Science<sup>1</sup> and Cardiovascular Medicine<sup>2</sup>, Stanford University

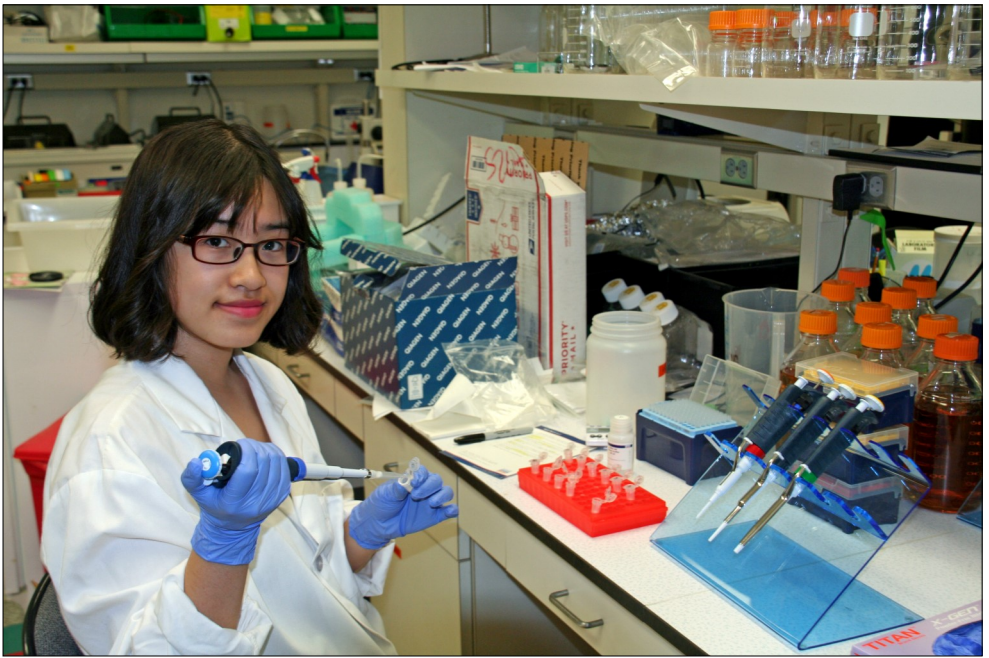
**“Determining the Combined Effects of Prenatal Inflammation and Heterozygous Loss of Function of CHD8, an Autism Risk Gene”**

John C. Rodgers<sup>1</sup>, Brooke A. Babineau<sup>2</sup>, Theo D. Palmer<sup>2</sup>  
Departments of Biology<sup>1</sup> and Neurosurgery<sup>2</sup>, Stanford University

**“Genetic and Environmental Influences on Social Processing in Twins with Autism”**

Margaret D. Rosenthal<sup>1</sup>, John P. Hegarty II<sup>2</sup>, Laura C. Lazzeroni<sup>2,3</sup>, Joachim F. Hallmayer<sup>2</sup>, Sue C. Cleve-land<sup>2</sup>, Jennifer M. Phillips<sup>2</sup>, Antonio Y. Hardan<sup>2</sup>  
Departments of Human Biology<sup>1</sup>, Psychiatry & Behavioral Sciences<sup>2</sup>, and Biomedical Data Science<sup>3</sup>, Stanford University





*Ellen Ouyang, 2018 cohort, completed her Stanford Bio-X summer research training in Dr. Nicholas Grillet's lab*

**“Genetic Dissection of Oncogenic Signaling Using CRISPR Methods”**

Collin Schlager<sup>1,2</sup>, Ganesh Pusapati<sup>1,2</sup>, Rajat Rohatgi<sup>1,2</sup>

Departments of Medicine<sup>1</sup> and Biochemistry<sup>2</sup>, Stanford University

**“Opportunities and Challenges with Estimating Immune Cell Fractions Using Mass Spectrometry Proteomics”**

Isaac M. Smith<sup>1</sup>, Binbin Chen<sup>1,2</sup>, Niclas Olsson<sup>7</sup>, Aaron Newman<sup>3,8</sup>, Joshua Elias<sup>7</sup>, Ash Alizadeh<sup>1,3,4,5,6</sup>

Departments of Medicine (Divisions of Oncology<sup>1</sup> and Hematology<sup>6</sup>), Genetics<sup>2</sup>, Chemical & Systems Biology<sup>7</sup>, and Biomedical Data Science<sup>8</sup>, Institute for Stem Cell Biology & Regenerative Medicine<sup>3</sup>, Center for Cancer Systems Biology<sup>4</sup>, and Stanford Cancer Institute<sup>5</sup>, Stanford University

**“A Computational Approach to Characterize Fibroblast Heterogeneity in Humans and its Role in Skin Scarring”**

Jan Sokol<sup>1</sup>, Mimi R. Borrelli<sup>2</sup>, Rachel E. Brewer<sup>2</sup>, Michael T. Longaker<sup>2</sup>

Departments of Biomedical Data Science<sup>1</sup> and Plastic & Reconstructive Surgery<sup>2</sup>, Stanford University

**“Memory Retrieval Impairment Caused By Circadian Rhythm Disruption”**

Athreya Steiger<sup>1</sup>, Norman F. Ruby<sup>1</sup>, H. Craig Heller<sup>1</sup>

Department of Biology<sup>1</sup>, Stanford University

**“Functional Characteristics of CD47 Splice Variants”**

Kevin Tang<sup>1</sup>, Rahul Sinha<sup>1</sup>, Victor Eng<sup>1</sup>, Irving Weissman<sup>1</sup>

Institute for Stem Cell Biology & Regenerative Medicine<sup>1</sup>, Stanford University

**“Androgen Receptor  $\beta$  Modulates Female Reproductive Physiology in Cichlid Fish”**

Kevin Tien<sup>1</sup>, Beau Alward<sup>1</sup>, Russell Fernald<sup>1</sup>

Department of Biology<sup>1</sup>, Stanford University

*"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

**"Mapping Monophasic Action Potential Signals to Study Cardiac Arrhythmias in Pigs Using Electrode Array Designs"**

Eajer Toh<sup>1</sup>, Meghedi Babakhanian<sup>1</sup>, James K. Bai<sup>1</sup>, Joy Valenzuela<sup>2</sup>, Kevin Cyr<sup>2</sup>, Anson Lee<sup>2</sup>, Paul J. Wang<sup>1</sup>  
Departments of Cardiovascular Medicine<sup>2</sup> and Cardiothoracic Surgery<sup>2</sup>, Stanford University

**"Parameter Sensitivity Analysis Framework for Multi-Objective Optimization of Neuronal Cell Models"**

Sarah Tran<sup>1</sup>, Aaron Milstein<sup>2</sup>, Ivan Raikov<sup>2</sup>, Ivan Soltesz<sup>2</sup>  
Departments of Symbolic Systems<sup>1</sup> and Neurosurgery<sup>2</sup>, Stanford University

**"Development of a Cardiac Stretch Assay: Understanding the Mechanistic Role of Stretch on the Induction of Atrial Fibrillation Using Neonatal Rat Cardiomyocytes"**

Angeline A. Truong<sup>1</sup>, Beatty Fann<sup>1</sup>, Joy Aparicio Valenzuela<sup>1</sup>, Kevin Cyr<sup>1</sup>, Carlos Cuenca<sup>1</sup>, Patrick D. Loftus<sup>1</sup>, Terrence Pong<sup>1</sup>, Anson Lee<sup>1</sup>  
Department of Cardiothoracic Surgery<sup>1</sup>, Stanford University

**"Hacking' the Hedgehog Hotline: Investigating Candidates of Hedgehog-Dependent Proliferation and Primary Cilia"**

Anais Tsai<sup>1</sup>, Emily Kolenbrar<sup>2</sup>, Garrison Buss<sup>3</sup>, Tim Stearns<sup>1</sup>  
Departments of Biology<sup>1</sup>, Developmental Biology<sup>2</sup>, Molecular & Cellular Physiology<sup>3</sup>, Stanford University

**"GABAAR Signaling-Mediated Neuroimmune Interactions Contribute to *Gabrb3*-Associated Neurodevelopmental Risk"**

Jacob E. Umans<sup>1,2</sup>, Hyang Mi Moon<sup>1,2</sup>, Alyssa Bormann<sup>1,2</sup>, Vidya Saravanapandian<sup>1,2</sup>, Jennifer Su<sup>1,2</sup>, Megan Louise Chin<sup>1,2</sup>, Brooke A. Babineau<sup>1,2</sup>, Aditi Narayan<sup>1,2</sup>, Michelle Kielhold<sup>1,2</sup>, Theo D. Palmer<sup>1,2</sup>  
Department of Neurosurgery<sup>1</sup> and Institute for Stem Cell Biology & Regenerative Medicine<sup>2</sup>, Stanford University



**“Orthogonal dCas9 Platform for Targeted Epigenetic and Transcriptional Gene Activation”**

Amanda Urke<sup>1</sup>, Antonia Dominguez<sup>1</sup>, Lei Stanley Qi<sup>1,2,3</sup>

Department of Bioengineering<sup>1</sup>, Department of Chemical & Systems Biology<sup>2</sup>, ChEM-H<sup>3</sup>, Stanford University

**“Utricular Hair Cell Loss and Regeneration via Transdifferentiation in an NF2 Murine Model of Vestibular Schwannoma”**

Panayiotis Vandrís<sup>1</sup>, Tian Wang<sup>1</sup>, Davood K. Hosseini<sup>1</sup>, Alan G. Cheng<sup>1</sup>

Department of Otolaryngology (Head & Neck Surgery)<sup>1</sup>, Stanford University

**“Outgroup Machine Learning Approach Identifies Single Nucleotide Variants in Noncoding DNA Associated with Autism Spectrum Disorder”**

Maya Varma<sup>1</sup>, Kelley Marie Paskov<sup>2</sup>, Jae-Yoon Jung<sup>2</sup>, Brianna Sierra Chrisman<sup>2</sup>, Nate Tyler Stockham<sup>2</sup>, Peter Yigitcan Washington<sup>2</sup>, Dennis Paul Wall<sup>2</sup>

Departments of Computer Science<sup>1</sup>, Pediatrics<sup>2</sup>, and Biomedical Data Science<sup>2</sup>, Stanford University

**“Recombinant Protein Hydrogels for Cell Transplantation Therapies”**

Alice Wang<sup>1</sup>, Laura Marquardt<sup>1</sup>, Vanessa Doulames<sup>2</sup>, Giles Plant<sup>2</sup>, Sarah Heilshorn<sup>1</sup>

Departments of Materials Science & Engineering<sup>1</sup> and Neurosurgery<sup>2</sup>, Stanford University

**“The Role of the Paraventricular Thalamus in Depression”**

Vickie Wang<sup>1</sup>, Piper Keyes<sup>2</sup>, Xiaoke Chen<sup>3</sup>

Departments of Psychology<sup>1</sup> and Biology<sup>3</sup> and Neurosciences Ph.D. Program<sup>2</sup>, Stanford University

**“Characterizing the Roles of Landmark Sensory Cues and Self-Motion Information in Neural Encoding of Space”**

Dhara Yu<sup>1</sup>, Malcolm Campbell<sup>1</sup>, Isabel Low<sup>1</sup>, Lisa Giocomo<sup>1</sup>

Department of Neurobiology<sup>1</sup>, Stanford University



# Stanford Bio-X Undergraduate Summer Research Program



*2017 Stanford Bio-X Undergraduate Summer Research Program (USRP) Participants*

**Professor Carla Shatz**

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