

Professor Carla Shatz
Director of Bio-X
James H. Clark Center
318 Campus Drive, W157
cshatz@stanford.edu

Heideh Fattaey, Ph.D.
Executive Director of Operations and Programs
James H. Clark Center
318 Campus Drive, S135
hfattaey@stanford.edu

Gabriella Martelino
Bio-X Education and Fellowship
Coordinator
James H. Clark Center
318 Campus Drive, S131
gfs@stanford.edu

Olgalydia Urbano-Winegar
Bioengineering Student Services Manager
James H. Clark Center
318 Campus Drive, S166
ourbano@stanford.edu



Samir Menon

Joanna Mattis

Carolina Tropini

Kathryn Montgomery



Stanford Bio-X

To learn more about the Bio-X Program at Stanford, please visit the Bio-X website at:

<http://biox.stanford.edu>



Bio-X

Fellowships

2013

The Bio-X Fellowships are made possible by various gifts in order to promote interdisciplinary research by promising scientists who are working on projects that bridge the gap between biology and other fields.

To date, 147 Ph.D. students have received three-year fellowships through Bio-X. After completion of their training, our fellows continue to positively impact the scientific community through their roles as professors, co-founders of start-up companies, and research scientists, among others.

Over 70 Bio-X Fellows have completed their Ph.D. programs, 8 of whom are involved in start-up companies and 7 of whom are holding faculty positions at Duke, Stanford, Caltech, Fuzhou, and Tufts. The remaining fellows are pursuing their postdoctoral training or working for companies such as: L.E.K. Consulting, Intel, Medtronic, Intuit, Abbott, Apple, Oracle, McKinsey & Company, Boston Consulting Group, Goldman Sachs, Twitter, and Amgen.



Bio-X Fellowships

Bio-X Graduate Student Fellowships 2013	Pages 2-7
Bio-X Graduate Student Fellowships 2012	Pages 8-11
Bio-X Graduate Student Fellowships 2011	Pages 12-15
Bio-X Graduate Student Fellowships 2010	Pages 16-17
Bio-X Graduate Student Fellowships 2009	Pages 18-19
Bio-X Graduate Student Fellowships 2008	Page 19
Bio-X Graduate Student Fellowships 2007	Page 20
Bio-X Graduate Student Fellowships 2006	Page 20
Bio-X Graduate Student Fellowships 2005	Page 20
Bio-X Graduate Student Fellowships 2004	Page 20
Bio-X Postdoctoral Fellowships	Page 21

Bio-X Graduate Student Fellowships

2013



Adi de la Zerda
Bio-X Honorary Fellow
Materials Science & Engineering

Profs. Manish Butte (Pediatrics), Sarah Heilshorn (Materials Science & Engineering), and Paul Bollyky (Medicine)

Adi will study how the mechanical stiffness of inflamed tissues can control the activation and function of T cells. She will use materials engineering skills to fabricate artificial bio-matrices and advanced microscopy to study immune cells in inflamed tissue. The goal is to better understand how chronic and acute inflammation can impact immune health at the molecular level.



Sarah Denny
Bio-X Honorary Fellow
Biophysics

Profs. William Greenleaf (Genetics), Rhiju Das (Biochemistry), and Aaron Straight (Biochemistry)

DNA in human cells is tightly compacted into a protein-DNA complex called chromatin. Condensation of chromatin is crucial to gene regulation, but the three-dimensional architecture of DNA within chromatin remains unknown. In her research, Sarah is combining high-throughput DNA sequencing with biophysical structural inference techniques to infer chromatin structure at particular genes and regulatory regions. Sarah aims to answer two fundamental questions: what are the stereotypical chromatin architectures in human cells, and how do these structures correlate with gene expression? This research

will advance our understanding of the complex and nuanced layers of regulation of our genome.



Karen Dubbin
Bio-X Bowes Fellow
Materials Science & Engineering

Profs. Sarah Heilshorn (Materials Science & Engineering), Giles Plant (Neurosurgery), and Andrew Spakowitz (Chemical Engineering)

Following injury to the central nervous system (CNS), the primary trauma is surrounded by a microenvironment that inhibits axonal regeneration. This contrasts with injury to the peripheral nervous system (PNS) where regeneration is possible. One novel approach to spinal cord injury therapy is to mimic the microenvironment of the PNS in the CNS through delivery of pro-regenerative factors or cells known to aid in regeneration in the PNS. We propose engineering an injectable protein hydrogel as a delivery mechanism for spinal cord injury, which is ideal due to its injectability, degradability, cell protective qualities and function as a growth matrix.



Jun Kim (see pg. 3 for research details)

Industry and Donor Sponsored Awards

Student	Award	Department
Jennifer Brady	Skippy Frank Foundation	Microbiology & Immunology
Vincent Chu	Pfizer	Applied Physics
Tiffany Chung	Stanford Faculty funded	Radiology
Adam de la Zerda	Skippy Frank Foundation	Electrical Engineering
Gaurav Krishnamurthy	Medtronic Foundation	Mechanical Engineering
Subhaneil Lahiri	Genentech	Applied Physics
Denitsa Milanova	Medtronic Foundation	Mechanical Engineering
Patricia Ortiz-Tello	Amgen	Genetics
Elena Rykhlevskaia	Lubert Stryer	Psychiatry
Sanaz Saatchi	Amgen	Bioengineering
Shilpa Sambashivan	Genentech	Chemical & Systems Biology
Sergey Solomatin	Stanford Faculty funded	Chemistry
Tristan Ursell	Genentech	Bioengineering



Bio-X Fellows 2010 group photo



Bio-X Fellows 2011 group photo

Student	Department
Jack Wang	Neurobiology
Lucien Weiss	Chemistry
Andrew Weitz	Bioengineering
Anne Ye	Bioengineering
Patrick Ye	Bioengineering
Michael Yip	Bioengineering
Jennifer Yong	Mechanical Engineering
Ryan York	Biology
Noah Young	Bioengineering
Bo Zhang	Chemistry

Bio-X Endowed SIGF Fellows

Student	Department
Namiko Abe	Neurosciences
Shengya Cao	Biochemistry
Elizabeth Chen	Stem Cell Biology & Regenerative Medicine
Jin Chen	Applied Physics
Roshni Cooper	Electrical Engineering
Melinda Cromie	Mechanical Engineering
Remy Durand	Bioengineering
Limor Freifeld	Electrical Engineering
Stephen Fried	Chemistry
Xiaojing Gao	Biology
Viviana Gradinaru	Neurobiology
Jongmin Kim	Chemical & Systems Biology
Daniel Kimmel	Neurosciences, Medicine
Thomas Lampo	Chemical Engineering
Paul Lebel	Applied Physics
Liang Liang	Applied Physics
Ye (Henry) Li	Structural Biology
Mark Longo	Biology
Bertrand Lui	Bioengineering
Li Ma	Statistics
Samir Menon	Computer Science
Kathryn Montgomery	Bioengineering
Daniel Newburger	Biomedical Informatics
Wendy Ni	Electrical Engineering
James Notwell	Computer Science
Peter Olcott	Bioengineering
Shawn Ouyang	Chemical & Systems Biology
William Parsons	Chemistry
Bethany Percha	Biomedical Informatics
Manuel Rausch	Mechanical Engineering
Ruth Sommese	Biochemistry
Carolina Tropini	Biophysics
Aaron Wenger	Computer Science
Patrick Ye	Bioengineering
Jennifer Yong	Mechanical Engineering
Bo Zhang	Chemistry
Xiaoxue Zhou	Chemistry



Gabriela Fragiadakis
Bio-X Bowes Fellow
Microbiology & Immunology

Profs. Garry Nolan (*Microbiology & Immunology*), Martin Angst (*Anesthesia*), Robert Tibshirani (*Biostatistics and Statistics*), and Mark Davis (*Microbiology & Immunology*) Gabriela is interested in integrating high-dimensional single-cell proteomics with algorithms from machine learning to characterize human immune dynamics. Her research currently focuses on the immune response to surgery. Surgery elicits an innate inflammatory response followed by suppression of adaptive mechanisms to ensure host protection. Dysregulation of this immune balance results in adverse clinical outcomes. Gabriela is using single cell mass cytometry to profile the immune response in patients undergoing total hip arthroplasty at Stanford hospital. She will apply variance metrics and predictive modeling to determine common trends in immune cell subsets as well as explore immune signatures that predict recovery.



David Glass
Bio-X Bowes Fellow
Bioengineering

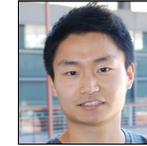
Profs. Ingmar Riedel-Kruse (*Bioengineering*) and KC Huang (*Bioengineering*) Synthetic biology generally focuses on engineering information processing within individual cells with minimal intercellular interaction and, but for very few exceptions, no spatial organization. David plans to expand the capabilities of synthetic biology into the multicellular domain by introducing a system for controllable adhesion, which will specify both strength and specificity of adhesion among individual cells. Additionally, an *in silico* model of cell interactions will support the synthetic platform and broaden an understanding of its connection to natural development. Ultimately, this work will open the door to genetically-encoded spatio-temporal behavior in tissue engineering and deepen knowledge of developmental biology through a build-to-understand methodology.



Fidel Hernandez
Bio-X Honorary Fellow
Mechanical Engineering

Profs. David Camarillo (*Bioengineering*) and Daniel Garza (*Orthopaedic Surgery*) Brain injury is a major health concern, affecting many through vehicular collisions, falls, and sports. Although modern helmets reduce the risk of severe

brain injury and skull fracture, incidence of mild brain injury and concussion has skyrocketed. Studies have connected mild head impacts, even those without immediate symptoms of injury, to long-term neurodegeneration. Fidel is evaluating and developing models that assess a helmet's ability to reduce mild brain injury. His studies found that the 30-year-old football helmet testing standard does not model a player's typical head rotation, the suspected injury mechanism. Fidel plans to develop a new computational model validated with field data and high-speed video.



Jun Woo Kim
Bio-X Bowes Fellow
Bioengineering

Profs. Jennifer Cochran (*Bioengineering*), Alejandro Sweet-Cordero (*Pediatrics*), and Calvin Kuo (*Medicine*) To communicate with their environment, cells use receptors at their surface to detect various biochemical signals. Receptor-mediated dysregulation of signaling pathways can lead to various diseases, including cancer. Protein therapeutics with special targeting activity have become increasingly important to manipulate receptor signaling pathways for effective cancer therapies with lower side effects. The goal of Jun Kim's project is to study the ciliary neurotrophic factor receptor signaling pathway as a novel therapeutic target for cancer. To move beyond proof-of-principle and develop a therapeutic clinical candidate, he will use a protein engineering approach to develop affinity and specificity enhanced therapeutic molecules for clinical application.



RyoSuke Kita
Bio-X Bowes Fellow
Biology, MSTP

Profs. Hunter Fraser (*Biology*) and David Stevens (*Medicine*) Cases of human infection by *S. cerevisiae*, baker's yeast, have been increasingly reported since the 1990s. As an experimentally tractable model organism, *S. cerevisiae* is an ideal system to study the evolution of emerging fungal infectious disease. During the evolution of *S. cerevisiae* from a harmless microbe to a pathogenic state, a number of genetic changes occur. Ryo aims to identify the changes that are important and investigate the evolutionary path to pathogenicity using quantitative genetics and experimental evolution.



Niru Maheswaranathan
Bio-X Honorary Fellow
Neurosciences

Profs. Surya Ganguli (*Applied Physics*) and Stephen Baccus (*Neurobiology*)

Our current understanding of early sensory processing fails to explain neural responses to ethologically relevant stimuli. For example, computational models of the retina (the first stage of visual processing in the brain) perform poorly at predicting responses to natural images. To address this gap, Niru is building nonlinear, adaptive models of retinal function, developing computational methods for fitting and analyzing such models, and utilizing these to unravel how the retina encodes natural stimuli. This will fundamentally advance our knowledge of the relationship between nonlinear, non-stationary sensory processing and non-Gaussian stimuli in the natural world.



Allister McGuire
Bio-X Bowes Fellow
Chemistry

Profs. Bianxiao Cui (*Chemistry*), Yi Cui (*Materials Science & Engineering*), Zhenan Bao (*Chemical Engineering*), and Philip Wong (*Electrical Engineering*)

Information travels through the brain by a three-dimensional highway of neurons in both electrical and chemical vehicles. The electrical signals that carry this information are difficult to measure without causing permanent damage to the neurons. Allister is developing nanoscale electrode devices of various materials and geometries (e.g. platinum “nanopillars”) to measure the electrical behavior of neurons with minimal invasiveness and maximal sensitivity. Such development is borne out with both processes borrowed from the semiconductor industry and material synthesis methods. The project aims to enhance understanding of information transfer in the brain.



Amanda Miguel
Bio-X Honorary Fellow
Bioengineering

Profs. Russ Altman (*Bioengineering*) and KC Huang (*Bioengineering*)

The recent increase in antibiotic resistance in disease-causing bacteria calls for new approaches to drug target selection and drug development. FtsZ, a bacterial cytoskeletal protein critical in cell division, is a powerful target for potential inhibition. Recently crystallized structures of FtsZ bound to a weak inhibi-

tor provide an opportunity for using structure-based computational tools to design new FtsZ inhibitors. By analyzing FtsZ across various bacterial species and across time, we can better understand the molecular basis of FtsZ interaction with inhibitors. We can then develop and apply computational tools for drug repurposing or fragment-based drug design to later pursue with experimental studies.



Herbert Silva
Bio-X Bowes Fellow
Mechanical Engineering

Profs. Drew Nelson (*Mechanical Engineering*), Oscar Abilez (*Medicine*), and Christopher Zarins (*Surgery*) Residual stresses and strains (RSS) play an important role in vascular mechanics. RSS exist without forces being applied. They can develop, for example, from growth and remodeling. The method used for determining RSS in arteries was developed in the 1980s but is now known to have very serious deficiencies. This research represents an opportunity to adapt modern approaches developed in mechanical engineering to improve the measurement of RSS in arteries. Three new approaches will be investigated. The approaches should provide much more accurate data for use in interpreting experiments and as input to computational models. The approaches should also be applicable to other biological structures and offer a significant new capability for researchers.



Michael Yip
Bio-X Bowes Fellow
Bioengineering

Profs. David Camarillo (*Bioengineering*), Paul Wang (*Medicine*), and Kenneth Salisbury (*Computer Science, Surgery*)

Atrial fibrillation is a chronic heart condition that afflicts more than 2.5 million in the US and is a significant risk factor for stroke. Tissue ablation using catheters is the standard procedure for treating AF, but this is encumbered by difficult and non-intuitive catheter manipulation and poor visual feedback. Michael is investigating robotic control methods that integrate real-time imaging and tracking technologies to autonomously perform ablation tasks. He aims to reduce the complexity of the procedure, the training needed to perform the operation, and the amount of x-ray radiation to the patient, thereby making the procedure safer, more widely available, and cost-effective.

Current Bio-X Bowes Fellows

Student	Department
Ron Alfa	Neurosciences
Daniel Bechstein	Mechanical Engineering
Craig Buckley	Chemical Engineering
Shengya Cao	Biochemistry
Elizabeth Chen	Stem Cell Biology & Regenerative Medicine
Jin Chen	Applied Physics
Fang-Chieh Chou	Biochemistry
Roshni Cooper	Electrical Engineering
Jing-yu Cui	Electrical Engineering
Adi de la Zerda	Materials Science & Engineering
Sarah Denny	Biophysics
Karen Dubbin	Materials Science & Engineering
Christopher Emig	Bioengineering
Gabriela Fragiadakis	Microbiology & Immunology
Stephen Fried	Chemistry
Xiaojing Gao	Biology
David Glass	Bioengineering
Fidel Hernandez	Mechanical Engineering
Jongmin Kim	Chemical & Systems Biology
Jun Woo Kim	Bioengineering
Ryosuke Kita	Biology
Thomas Lampo	Chemical Engineering
Paul Lebel	Applied Physics
Soah Lee	Materials Science & Engineering
Austin Lee-Richerson	Bioengineering
Steven Leung	Bioengineering
Ye (Henry) Li	Structural Biology
Sungwon Lim	Bioengineering
Mark Longo	Biology
Niru Maheswaranathan	Neurosciences
Trevor Martin	Biology
Allister McGuire	Chemistry
Samir Menon	Computer Science
Amanda Miguel	Bioengineering
Denitsa Milanova	Mechanical Engineering
Kathryn Montgomery	Bioengineering
Daniel Newburger	Biomedical Informatics
Wendy Ni	Electrical Engineering
James Notwell	Computer Science
Carmichael Ong	Bioengineering
Patricia Ortiz-Tello	Genetics
Sung Jin Park	Bioengineering
Bethany Percha	Biomedical Informatics
Steven J. Petsche	Mechanical Engineering
Jeffrey Quinn	Bioengineering
Joel Sadler	Mechanical Engineering
Pankaj Sharma	Electrical Engineering
Herbert Silva	Mechanical Engineering
Ruth Sommese	Biochemistry
Ryan Squire	Neurosciences
Carolina Tropini	Biophysics
Mathias Voges	Bioengineering

Completed Bio-X Graduate Fellowships

Student	Department	Yr completed
Jaimie Adelson	Neurosciences	2013
Rebecca DiMarco	Bioengineering	2012
Graham Dow	Biology	2012
Alex Grant	Bioengineering	2013
Haisam Islam	Bioengineering	2013
Mihalis Kariolis	Bioengineering	2011
Jonathan Leong	Neurosciences, MSTP	2013
Liang Liang	Applied Physics	2012
Melina Mathur	Bioengineering	2012
Christine McLeavey	Neurosciences	2010
William Noderer	Chemical Engineering	2012
Joo Yong Sim	Mechanical Engineering	2013
Ton Subsoontorn	Bioengineering	2011
Jong Min Sung	Applied Physics	2012
Grace Tang	Bioengineering	2011
Yen-Hsiang Wang	Bioengineering	2012
Remus Wong	Bioengineering	2013
Nan Xiao	Bioengineering	2010
Xiaoxue Zhou	Chemistry	2013



Bio-X Fellows 2008 group photo



Bio-X Fellows 2009 group photo



Ryan York
Bio-X Bowes Fellow
Biology

Profs. Hunter Fraser (Biology) and Russell Fernald (Biology)

Why do some animals get to have sex when others don't? Why do some starve while others feast? Understanding how behaviors vary and evolve is one of the grand challenges in biology. In order to address aspects of these questions, Ryan is studying the mating behaviors of African cichlid fish. He is combining his background in neuroscience with the fields of genomics and ethology in order to unveil the complex interplay between genome and the brain in animal behavior. If successful, this project could, for the first time, identify specific genes controlling complex social behavior in a vertebrate.



Shengya Cao
Bio-X SIGF Fellow
Biochemistry

Profs. Aaron Straight (Biochemistry) and Andrew Spakowitz (Chemical Engineering)

When cells divide, DNA condenses to form mitotic chromosomes. Proper mitotic chromosome condensation is essential for genome stability; however, how it occurs is still a mystery. This is largely due to technological limitations that prevent the direct visualization of substructures of the mitotic chromosome. Shengya is developing a novel method to examine these substructures in living cells by marking known locations in DNA using fluorescent proteins. Combined with predictions from chromatin polymer models, this approach will allow for the study of condensation and the mechanisms of proteins involved in condensation in living cells.



Elizabeth Chen
Bio-X SIGF Fellow
Stem Cell Biology and Regenerative Medicine

Profs. Michael Clarke (Medicine) and Stephen Quake (Bioengineering and Applied Physics)

Stem cells are chameleons that can interconvert between distinct populations in response to injury or physiological stimulus. Liz hopes to test how stem cells can "switch" between a phenotype characteristic of metastasizing cancer cells and a phenotype displayed by cancers with better prognosis. To do this, she hopes to develop novel microfluidic screens for gene expression and epigenetic differences between the two stem cell populations to identify mechanisms that regulate this conversion. This research will com-

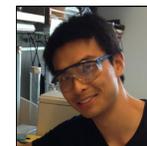
bine methods in stem cell biology, bioengineering, and bioinformatics to drive the conversion of aggressively metastasizing cancer cells into a more treatable state.



Thomas Lampo
Bio-X SIGF Fellow
Chemical Engineering

Profs. Andrew Spakowitz (Chemical Engineering) and Aaron Straight (Biochemistry)

Inside living cells, genomic DNA is densely packed into a space roughly a thousand times smaller than its unconstrained length. At the same time, the information stored in the DNA sequence must be well-organized and accessible for the cell to grow and carry out its functions. Tom is interested in developing physical models that describe the motion and organization of DNA in this highly compact environment. His goal is to use these models to better understand fundamental biophysical processes such as how distant regions of DNA are able to find one another during recombination events.



Ye (Henry) Li
Bio-X SIGF Fellow
Structural Biology

Profs. Wing Wong (Statistics, Biostatistics), Michael Levitt (Structural Biology), and Garry Nolan (Microbiology & Immunology)

Life is sustained by the complex interplays between many genes. The interaction structure can be reconstructed using gene expression measurements because gene regulatory systems have a defined ordering of pathways that assemble into networks. One hallmark of network dynamics is stability, which allows for cells to maintain their cell types. Henry is studying the gene network stability of human embryonic stem cells by carrying out experiments and developing statistical methods for inferring network structure from experimental data. Ultimately, Henry hopes to build a network that can predict stem cell states to understand self-renewal and pluripotency at the systems level.



Gabriela Fragiadakis (see pg. 3 for research details)



James Notwell
Bio-X SIGF Fellow
Computer Science

Profs. Gill Bejerano (*Developmental Biology and Computer Science*), Susan McConnell (*Biology*), and Philippe Mourrain (*Psychiatry & Behavioral Sciences*)

The outer layer of the brain, or neocortex, encompasses many of the features that make us human. Consisting of six layered sheets of neurons, it plays a critical role in cognition, emotion, and perception. The neocortex is formed during embryonic development, and a carefully orchestrated genetic program specifies the roles of its different neurons. Decades of studies have revealed some of the key players in this process, but the upstream and downstream logic remains largely unknown. Jim hopes to expand on the understanding of this highly specific genetic program using whole-genome measurements of the developing neocortex.



Bethany Percha
Bio-X SIGF Fellow
Biomedical Informatics

Profs. Russ Altman (*Bioengineering*), Chris Potts (*Linguistics*), and Daniel Rubin (*Radiology*)

Unstructured, text-based resources such as the scientific and patent literatures and electronic medical records provide a wealth of valuable biomedical data that we have barely begun to tap. Bethany's research goal is to apply modern natural language processing (NLP) and text mining methods to important biomedical problems. Specifically, she is using a combination of NLP and crowdsourcing to extract structured relationships among drugs, genes, and phenotypes (such as diseases and side effects) from unstructured text. Networks of these structured "facts" can help us better understand important biomedical phenomena like drug-drug interactions and patient-level variation in drug response.



Patrick Ye
Bio-X SIGF Fellow
Bioengineering

Profs. Kim Pauly (*Radiology*), William Newsome (*Neurobiology*), and Pierre Khuri-Yakub (*Electrical Engineering*)

Ultrasound neuromodulation is a non-invasive method shown to be safe and effective for stimulating and inhibiting neural activity *in vivo*. While several neuromodulatory and physiological effects have been demonstrated with ultrasound neuromodulation *in vivo*, the underlying mechanism remains unclear. Pat-

rick proposes to examine whether cavitation, thermal and acoustic radiation force bioeffects are causal of ultrasound neuromodulation using a combination of *in vivo*, imaging, and computational simulation techniques. Equipped with greater understanding of the underlying mechanism, he aims to develop ultrasound neuromodulation as a potential method to inhibit seizure activity and perhaps lead to the development of novel therapies for other neurological disorders.



Bo Zhang
Bio-X SIGF Fellow
Chemistry

Profs. Hongjie Dai (*Chemistry*), Brian Feldman (*Pediatrics*), Paul Utz (*Medicine*), and Samuel Strober (*Medicine*)

Diagnosing type 1 diabetes is costly and time consuming; however, a delayed or missed diagnosis can result in severe illness or death. Bo is working on solving this diagnostic challenge from a physical chemistry perspective. Through incorporating a protein microarray on nano-engineered plasmonic film, detection of a small amount of diabetes-specific autoantibodies with significantly improved sensitivity becomes possible as the nano-engineered substrate amplifies fluorescent tags on detection antibodies. This protein chip allows for multiplexed quantification of more than one diabetes autoantibody from single patient sample in less than 1 hour. The simplicity of the approach could lead to broad adoption by scientists and clinicians in many fields for better proteomic analysis and diagnosis.

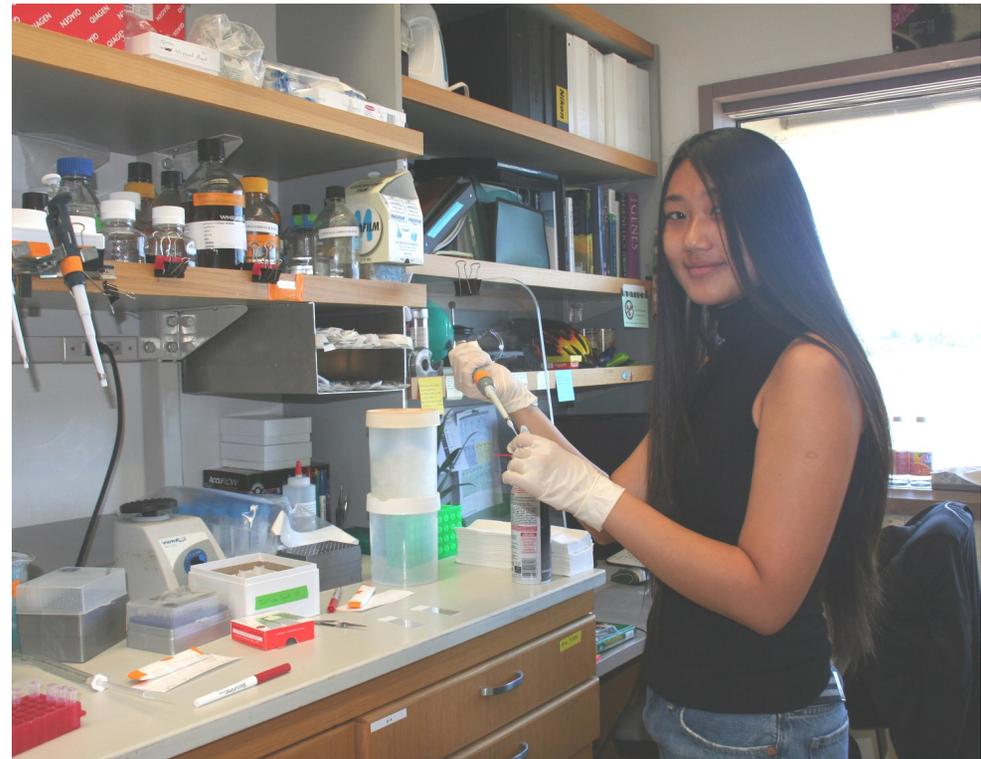


Steven Leung
Bio-X Bioengineering Fellow
(currently in rotation)

Biomedical imaging is a powerful research field that is unhindered by language barriers and conveys more information than words can. The use of imaging to develop minimally invasive therapies and to improve disease diagnostics will certainly become a crucial area in the coming decades. Steven is interested in a number of topics ranging from the development of new image processing algorithms to the creation of multimodal systems. He hopes to research methods for improving sensitivity and specificity of diagnosis and treatment of diseases and to translate these research advances into point-of-care technologies that will provide patients with immediate and cost-effective clinical decisions.

Student	Department	Degree Year
Manuel Rausch	Mechanical Engineering	2013
Andreas Rauschecker	Neurosciences	2011
Sanaz Saatchi	Bioengineering	2011
Jayodita Sanghvi	Bioengineering	2013
Alia Schoen	Materials Science & Engineering	2013
Mark Sellmyer	Chemical & Systems Biology	2010
Min-Sun Son	Bioengineering	2013
Noureddine Tayebi	Electrical Engineering	2011
Rebecca Taylor	Mechanical Engineering	2013
Jules VanDersarl	Materials Science & Engineering	2011
Aaron Wang	Bioengineering	2009
Larry Wang	Materials Science & Engineering	2008
Aaron Wenger	Computer Science	2012
Kitchener Wilson	Bioengineering	2010
Brian Wilt	Applied Physics	2011
Angela Wu	Bioengineering	2012
Yufeng Yang	Neurosciences	2009
Peggy Yao	Biomedical Informatics	2011
Sara Zhao	Mechanical Engineering	2005

*Student will be graduating by the end of 2013.



Shengya Cao (see pg. 5 for research details)

Graduated Bio-X Fellows

Student	Department	Degree Year
Namiko Abe	Neurosciences	2007
Afsheen Afshar	Electrical Engineering	2008
Edith Arnold	Mechanical Engineering	2012
Georgios Asimenos	Computer Science	2009
Aakash Basu	Applied Physics	2013*
Elsa Birch	Chemical Engineering	2013*
Jennifer Blundo	Mechanical Engineering	2010
Jennifer Brady	Microbiology & Immunology	2013
Relly Brandman	Chemical & Systems Biology	2009
David Camarillo	Mechanical Engineering	2008
Mindy Chang	Bioengineering	2011
Ian Chen	Bioengineering	2008
Vincent Chu	Applied Physics	2009
Virginia Chu	Bioengineering	2009
Kelsey Clark	Neurosciences	2012
Melinda Cromie	Mechanical Engineering	2012
Sanjay Dastoor	Mechanical Engineering	2012
Adam de la Zerda	Electrical Engineering	2011
Mario Diaz de la Rosa	Chemical Engineering	2012
Sheng Ding	Bioengineering	2011
Remy Durand	Bioengineering	2011
Limor Freifeld	Electrical Engineering	2013
Viviana Gradinaru	Neurosciences	2010
Adam Grossman	Bioengineering	2010
Lisa Gunaydin	Neurosciences	2012
Jennifer Hicks	Mechanical Engineering	2010
Tyler Hillman	Genetics, Medicine	2010
Jacob Hughey	Bioengineering	2013*
Rachel Kalmar	Neurosciences	2010
Kathryn Keenan	Mechanical Engineering	2012
Samuel Kim	Chemistry	2009
Daniel Kimmel	Neurosciences, Medicine	2013
Gaurav Krishnamurthy	Mechanical Engineering	2011
Frances Lau	Electrical Engineering	2013
Andrew Lee	Chemical & Systems Biology	2013*
Stephen Lee	Bioengineering	2010
Prasheel Lillaney	Bioengineering	2012
Andreas Loening	Bioengineering	2006
Bertrand Lui	Bioengineering	2011
Li Ma	Statistics	2011
Amanda Malone	Bioengineering	2007
Ian Marshall	Civil & Environmental Engineering	2012
Joanna Mattis	Neurosciences	2013*
Cory McLean	Computer Science	2010
Leslie Meltzer	Neurobiology	2008
Murtaza Mogri	Bioengineering	2011
Sergio Moreno	Physics	2012
David Myung	Chemical Engineering	2008
Peter Olcott	Bioengineering	2013*
Shawn Ouyang	Chemical & Systems Biology	2013
William Parsons	Chemistry	2013
Guillem Pratz	Electrical Engineering	2010

*Student will be graduating by the end of 2013.



Mathias Voges
Bio-X Bioengineering Fellow
(currently in rotation)

The future of energy and food security largely depends on technological innovations that help us understand and re-engineer biological systems. Mathias anticipates that these innovations will emerge from the nexus of synthetic biology and green biology. His goal is to develop a framework that supports plug-and-play biological functions within photosynthetic organisms. Such frameworks can be used to engineer crops that harbor different combinations of novel traits. He hopes that his research will produce effective tools to support fundamental research in plant biology and to promote the overall sustainability of agriculture.



Sung Jin Park
Bio-X Bioengineering Fellow
(currently in rotation)

Sung Jin is interested in combining concepts from biology, medicine, and engineering to advance creative new therapeutic technologies. More specifically, he hopes to work on the development of therapies that could help patients living in poverty throughout the world. One of his key research interests involves the development of virus-like particles for therapeutics. Using cell-free protein synthesis and non-natural amino acid incorporation, biomolecules such as therapeutic chemicals or immunogens can be directly conjugated to the viral coat protein surface. The functionalization of virus-like particles in this manner can have wide therapeutic applications such as targeted drug delivery and improved vaccination.



Adi de la Zerda (see pg. 2 for research details)



Daniel Bechstein
Bio-X Bowes Fellow
Mechanical Engineering

Profs. *Shan Wang (Materials Science & Engineering, Electrical Engineering)* and *Juan Santiago (Mechanical Engineering)*

2.5 million vaccine-preventable childhood deaths occur annually. While these vaccines are very affordable, ensuring a full immunization is a bottleneck in vaccination programs. Daniel is developing a novel point-of-care diagnostic device combining advantages of microfluidic sample processing, biomarker-based immunoassays, and integrated circuit-based magnetic sensing to test the immunization status. Magnetic sensor technology, originally developed for computer hard drive read heads, is used to quantify analyte concentrations in biological samples. This allows multiple orders of magnitude lower limits of detection than the current gold standard technology. The point-of-care platform can be expanded to detect cancer and other diseases.



Fang-Chieh Chou
Honorary Fellow
Biochemistry

Profs. *Rhiju Das (Biochemistry)* and *William J. Greenleaf (Genetics)*

RNA controls gene expression and regulation and is known to be associated with various genetic disease when aberrant. Understanding the atomic structures of RNAs is important for obtaining accurate pictures of their functions in cells. Fang-Chieh's research in the Das lab focused on modeling and predicting RNA 3D structures *in silico*. Fang-Chieh has previously developed an automatic tool to help experimentalists in modeling and refining RNA crystal structures with less time and higher accuracy. His current research aims to understand the energetic rules underlying the RNA folding process and to develop an accurate computational method for modeling RNA-protein interface.



Soah Lee
Bio-X Bowes Fellow
Materials Science & Engineering

Profs. *Fan Yang (Bioengineering)* and *Renee Pera (Obstetrics & Gynecology)*

Pluripotent stem cells are promising cell sources for tissue engineering and regenerative medicine; however, due to the lack of understanding of complex,

multifunctional cell surroundings, it is difficult to direct the stem cell differentiation into functional, mature cell types. Working at the interface of biology, materials science & engineering, and medicine, Soah's goal is to develop novel systems that allow her to rapidly test a variety of combinations of the surrounding signals using high-throughput strategies. The system will help to understand how the complex interplay of the signals influences stem cell fate in 3D and to optimize stem cell surroundings for stem cell differentiation into the cell types needed.



Trevor Martin
Bio-X Bowes Fellow
Biology

Professor *Hunter Fraser (Biology)*

A core concern of genomics is the connection of genotypic variation, at the level of DNA sequence, with phenotypic variation, such as disease status. Many studies have shown that connecting these two levels of variation directly can be difficult and that a useful intermediary is variation at the level of gene expression. Trevor's research focuses on developing novel statistical methods to understand how gene expression variation has evolved that allow for new ways of studying the intersection between genetics and disease.



Jeffrey Quinn
Bio-X Bowes Fellow
Bioengineering

Profs. *Howard Chang (Dermatology)* and *Asifa Akhtar (Epigenetics, Max Planck Institute)*

RNAs not only encode the blueprint for making proteins – they also fold into complex structures, regulate gene expression, sense biomolecules, catalyze reactions, and direct important biological processes. One class of these regulatory RNAs is long noncoding RNAs (lncRNAs). The past decade of genomic research has revealed the pervasiveness of lncRNAs in higher organisms; however, very few have been characterized. What are their cellular roles? How do they participate in biological functions? Jeffrey's work aims to answer these questions, focusing on fruitflies' roX lncRNAs in particular. By bridging biochemical, structural, genetic, and next-generation sequencing tools together, he plans to build a mechanistic map of how roX and other lncRNAs function.

Postdoctoral Fellows:

Tiffany Chung is a chemist for the Hong Kong government.

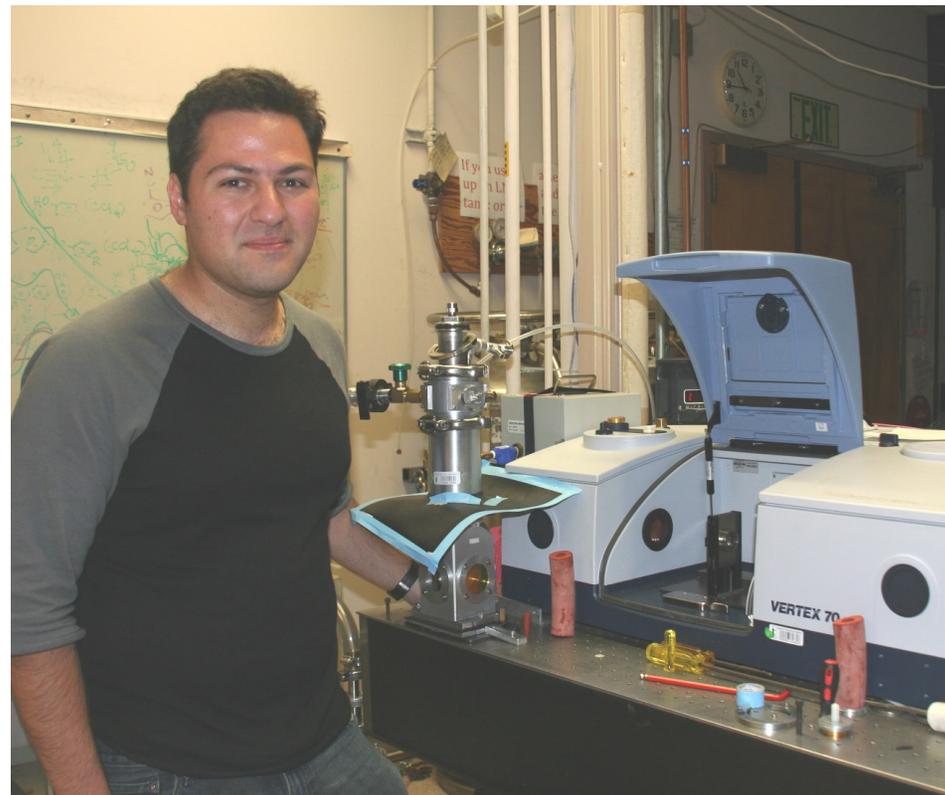
Yu-Shan Lin has a faculty position in the Chemistry department at Tufts University.

Elena Rykhlevskaia is a Sr. Manager in the Marketing Analytics and Data Infrastructure division of The Walt Disney Company.

Shilpa Sambashivan is a Sr. Scientist at Amgen, Inc.

Sergey Solomatin currently works as a scientist in Maraxi, Inc., a recent start-up founded by Stanford Biochemistry professor, Pat Brown. The company's goal is to revolutionize the food industry and to roll back the adverse effects that factory farming of animals has on the environment and on us.

Tristan Ursell is a postdoctoral scholar in KC Huang's group, working on cyanobacterial community structure, single cell bacterial growth physiology, and computational image processing algorithms.



Stephen Fried (see pg. 9 for research details)

After finishing his MD and PhD in neuroscience this June, **Daniel Kimmel (2013)** will enter a research track position in the psychiatry residency training program at Columbia University where he aims to combine his interest in the neural basis of decision-making with the treatment of maladaptive behavior seen in psychiatric disease.

Murtaza Mogri (2011) focuses on strategy projects in the medical device and broader healthcare sector as a consultant in the Minneapolis office of Boston Consulting Group (BCG).

Angela Wu (2012) has returned to Stanford as a post-doctoral fellow and is developing new DNA sequencing methods to study cancer genomics. At the same time, she is also a lab manager, writing grant proposals and managing day-to-day lab operations and funds.

Afsheen Afshar (2008) is working at the Goldman Sachs Group, leading multiple teams that centralize, analyze, and present large financial data sets in order to reduce cost, mitigate risk, improve client service, and maximize profitability.

Georgios Asimenos (2009) is Director of Science and Engineering at DNAnexus, a startup company founded by two Stanford faculty members (Serafim Batzoglou and Arend Sidow) and a former student of Serafim Batzoglou's, Andreas Sundquist.

Rachel Kalmar (2010) is a data scientist at Misfit Wearables, a company that is developing highly wearable sensor products and services for wellness and medical applications.

David Myung (2008) co-founded Biomimedita, a biomaterials-focused orthopaedic startup company after finishing his Stanford Bio-X fellowship and is doing his ophthalmology residency at the Byers Eye Institute at Stanford.

Jules Vandersarl (2011) is a postdoctoral scholar at École Polytechnique Fédérale de Lausanne in Switzerland.

Yufeng Yang (2009) is a professor/investigator in the Institute of Life Sciences at Fuzhou University.

Vincent Chu (2009) is a Technical Lead, API at Twitter, Inc. in San Francisco.

Mindy Chang (2011) is working at Intel in the Perceptual Computing Group.

Virginia Chu (2009) is a postdoctoral fellow at the Rehabilitation Institute of Chicago working with Dr. Brian Schmit and Dr. George Hornby. She is completing a degree in occupational therapy. She was awarded a 2-year postdoctoral fellowship grant from the American Heart Association to study loading perception during walking in stroke survivors.

Stephen Lee (2010) will be graduating with his MBA from Stanford by the end of 2013.

Prasheel Lillaney (2012) is a postdoctoral fellow at the University of California-San Francisco's department of Radiology, Interventional Radiology Lab China Basin.

Relly Brandman (2009) works for Coursera, an education company that partners with the top universities and organizations in the world to offer courses online for anyone to take, for free.

David Camarillo (2008) is an Assistant Professor of Bioengineering at Stanford University.

Samuel Kim (2009) is a postdoctoral scholar at Stanford/IBS.

Andreas Loening (2006) is finishing his Radiology residency this summer and will be a Body MRI Fellow at Stanford for the 2013-2014 academic year.

Leslie Meltzer (2008) is the Associate Director of US Neurology Medical Affairs at Biogen Idec in Cambridge, Massachusetts.

Sergio Moreno (2012) is working in Professor Levitt's lab as he is in the process of interviewing.

Adam Grossman (2010) is co-founder and Metainformation Scientist at Praedicat, Inc., a company dedicated to improving the underwriting and management of liability catastrophe risk.

Amanda Malone (2007) is the VP COO at Auritec Pharmaceuticals.



Joel Sadler
Bio-X Bowes Fellow
Mechanical Engineering

Profs. Sakti Srivastava (Surgery), Larry Leifer (Mechanical Engineering), and Kenneth Salisbury (Computer Science and Surgery)

Joel's research explores how to enhance creativity by prototyping "Smart Wearable Medical Devices" with embedded sensing and actuation. In particular, his work focuses on how to allow technical novices to express their medical device ideas more fluidly with modular electronic and software building blocks. His research combines clinical need-finding with human-computer interaction (HCI) and mechatronics to understand how we can more rapidly prototype functional smart devices worn on the body and create data driven software to solve clinical needs. He is a fan of the Six-million Dollar Man.



Lucien Weiss
Bio-X Bowes Fellow
Chemistry

Profs. W. E. Moerner (Chemistry) and Matthew Scott (Developmental Biology)
Sonic Hedgehog (SHH) signaling plays an important role in human development, particularly in determining the fate of stem cells and regulating cell division in some tissues. Defects in the signaling pathway can lead to serious birth defects and cancer. Despite its importance, the mechanism is not well understood. In this project, Lucien is using single-molecule imaging to characterize the motion and interactions of key proteins in the signaling pathway on the surface of live cells. This work will contribute to the understanding of how the SHH signal is received, transduced, and interpreted.



Jin Chen
Bio-X SIGF
Lubert Stryer Interdisciplinary Fellow
Applied Physics

Profs. Joseph Puglisi (Structural Biology) and Michael Levitt (Structural Biology)

Ribosome translation is one of the most fundamental processes in organisms, converting the genetic code stored in RNA to proteins. Translation is an important regulatory and control point for gene expression, and links to misregulation of protein translation are being identified in an increasing number of diseases. Thus, understanding how ribosomes synthesize protein and how other protein factors interact with the ribosome during the process is crucial. The goal of Jin's project is to use a combination of fluores-

cence, nanophotonic, and computational techniques to study the dynamics of single ribosomes in real-time as they synthesize proteins. Through a multiplexed detection technique, thousands of "single" ribosomes can be observed simultaneously. The single-molecule approach allows the study of the intrinsic dynamics of translation and the detection of rare translational events that may be linked to diseases.



Roshni Cooper
Bio-X SIGF
Morgridge Family SIGF Fellow
Electrical Engineering

Profs. Kang Shen (Biology) and Mark Horowitz (Electrical Engineering)

With today's advanced microscopes, biologists image neurons in unprecedented detail. These images allow us to discern the causes of neuronal diseases and eventually discover treatments and cures for them. Today, analyzing biological pictures is largely a manual process involving tedious tasks like counting hundreds of connections between neurons, which is prone to human error and is incredibly slow. Roshni is invoking techniques from EE to process biological images much faster and more consistently, yielding far more data than previously possible. Using information on this scale, we will be able to draw more precise and unambiguous conclusions about the nervous system.



Stephen Fried
Bio-X SIGF
Chemistry

Profs. Steven Boxer (Chemistry) and Vijay Pande (Chemistry)

We frequently invoke anthropomorphic terms to describe the functions of proteins. For instance, we speak of hemoglobin knowing when it's time to pick up or let go of oxygen; however, proteins cannot think, so a longstanding question in biophysics has been to understand how proteins' "intelligence" emerges from the laws of motion that govern molecular matter. Stephen's research seeks to address this by piecing together spectroscopic techniques that spy on proteins at work with molecular dynamics simulations that model molecular movements that are too subtle to actually detect. By creating a dialogue between experimental and computational approaches, his research aims to build a more rigorous understanding of protein function, which will allow us someday to engineer proteins with new functions altogether.



Xiaojing Gao
Bio-X SIGF
Enlight Foundation Interdisciplinary
Graduate Fellow
Biology

Profs. Liqun Luo (Biology) and Thomas Clandinin (Neurobiology)

We intuitively sense pleasant or noxious smells, and olfactory attraction or aversion prevails in many organisms. How does the brain make this binary decision about an odor? Almost nothing is known about the neural circuit for this computation. Xiaojing is using fruit flies as a model to address this question. To reveal the roles of specific neurons in olfactory behavior, he non-invasively manipulates their activity with state-of-the-art genetic tools and quantitatively analyzes the change in the animal's response to odors. His work may advance our general knowledge regarding how sensation leads to action and help pest control.



Kathryn Montgomery
Bio-X SIGF
William and Lynda Steere Fellow
Bioengineering

Profs. Scott Delp (Bioengineering, Mechanical Engineering) and Karl Deisseroth (Bioengineering, Psychiatry)

Kate is developing methods to control muscle and pain by using optical stimulation to specifically activate and inhibit motor and pain neurons. This project combines the fields of electrical engineering, material science, neuroscience, and molecular biology. Research in this field will improve the tools available to study the complex fields of motor control and pain and may someday improve the available therapies for people with paralysis, movement disorders, and intractable pain conditions.



Wendy Ni
Bio-X SIGF
Bruce and Elizabeth Dunlevie Fellow
Electrical Engineering

Profs. Greg Zaharchuk (Radiology), Dwight Nishimura (Electrical Engineering), and Michael Moseley (Radiology)

Many pathological conditions change oxygen metabolism (oxygenation) in brain tissues. However, there is currently no fast and reliable way to acquire high-resolution whole-brain oxygenation maps. In particular, existing MRI methods suffer from inadequate signal models and rely on potentially toxic contrast agents for the vital measurement of cerebral blood volume (CBV). Wendy's research aims to design and implement two novel numerical modeling approaches for clinical MRI and to develop a novel CBV measure-

ment technique that does not require contrast agents. Ultimately, these methods will be optimized for improved assessment of the condition and progress of stroke patients.



Pankaj Sharma
Bio-X Bowes Fellow
Electrical Engineering

Profs. Sakti Srivastava (Surgery), Krishna Shenoy (Electrical Engineering), and Kenneth Salisbury (Computer Science, Surgery)

Pankaj is designing and developing an interactive tool for the objective assessment of manual dexterity with an emphasis on surgical tasks. His approach involves breaking a complex task into fundamental surgical manipulations and performing a task analysis using optical and electronic motion capture techniques. This project combines the fields of surgery, electrical engineering, computer science, robotics, and neuroscience. This research will help surgeons to efficiently and effectively learn surgical skills. It will have an impact in the field of rehabilitation and will also help significantly in developing highly functional upper limb prostheses.



Jennifer Yong
Bio-X SIGF
Morgridge Family SIGF Fellow
Mechanical Engineering

Profs. Scott Delp (Bioengineering, Mechanical Engineering) and Michael Fredericson (Orthopaedic Surgery)

Running is a popular recreational activity with notoriously high injury rates. Though running injuries are often attributed to overtraining, the specific causes of injury remain unknown. Barefoot or minimalist running has recently experienced a resurgence, being touted as a more natural running pattern that can reduce injuries. Barefoot runners often run with a different foot strike pattern, landing on their forefoot rather than heel striking, and have reported fewer injury rates associated with skeletal loading such as lower limb stress fractures. The goal of this project is to investigate potential injury mechanisms in rear foot striking runners compared to forefoot striking runners in order to reduce running injuries.



James H. Clark Center, Stanford University

Mark Sellmyer (2010) has graduated from the Stanford MD/PhD program and has begun a research track residency in radiology at the University of Pennsylvania.

Adam de la Zerda (2011) is an assistant professor of Structural Biology at Stanford University.

Gaurav Krishnamurthy (2011) is a Senior R&D Engineer at Abbott Vascular, Structural Heart, Menlo Park, CA.

Melinda Cromie (2012) has a postdoctoral position in the Neurology department at Stanford and the VA in Palo Alto with Professor Thomas Rando. She is working on tissue engineering of human skeletal muscle to repair large wounds that result in loss of significant amounts of muscle tissue.

Viviana Gradinaru (2010) is an assistant professor of Biology at California Institute of Technology (Caltech).

Kelsey Clark (2012) will begin a yet-to-be-determined position at Montana State University in September 2013.

Jennifer Hicks (2010) currently serves as the associate director of the National Center for Simulation in Rehabilitation Research, an NIH-funded center at Stanford that brings state-of-the-art engineering tools to rehabilitation scientists. She oversees the center's Visiting Scholar Program, Pilot Projects, workshops, webinars, and online resources, and is the Research and Development Manager for the OpenSim software platform.

Frances Lau (2013) is an engineer at Apple.

Cory McLean (2010) is a computational biologist at 23andMe, working on exome- and whole-genome sequencing analysis.

Rebecca Taylor (2013) is a Biochemistry postdoctoral fellow in the Spudich lab at Stanford University.

Kitchener Wilson (2010) is a Molecular Pathology fellow at Stanford. He is training to be a physician-scientist and plans to one day direct a clinical genome sequencing laboratory. He also continues his basic research on stem cells and regenerative medicine, with a particular focus on iPSC cell models of human biology.

Sheng Ding (2011) works for Amunix, a biotech start-up company, as a research scientist focusing on developing protein therapeutic drugs with extended half-life.

Jacob Hughey (2013) will have his thesis defense in August 2013 and is currently interviewing for postdoctoral positions at Stanford and University of California-San Francisco.

Jayodita Sanghvi (2013) is a postdoctoral fellow at the University of California-Berkeley, working in David Schaffer and Adam Arkin's labs, studying the mechanism of HIV infection using a combination of experimental and computational approaches.

Min-Sun Son (2013) is working for Exponent, an engineering and scientific consulting company.

Edith Arnold (2012) is working at St. Jude Medical as a staff scientist doing research in the Implantable Electronic Systems Division.

Ian Chen (2008) is a cardiology fellow at Stanford University.

Sanjay Dastoor (2012) is co-founder of Boosted, which designs and builds the world's lightest electric vehicles.

Katy Keenan (2011) has an NRC postdoctoral scholar position at the National Institute of Standards and Technology (NIST) in Boulder, Colorado.

Guillem Pratx (2010) is an assistant professor in Radiation Oncology at Stanford University. His research focus is on biomedical imaging for radiotherapy.

Aaron Wang (2009) is at Johns Hopkins University for his residency in ophthalmology.

Peggy Yao (2011) is working on supply chain management optimization for Oracle.

Namiko Abe (2007) is a postdoctoral scholar at Columbia University in the Biochemistry and Molecular Biophysics department.

Bertrand Lui (2011) is an Engagement Manager at McKinsey & Company, a global management consulting firm.

Where are they now?

Manuel Rausch (2013) joined MicroInterventionalDevices, a start-up on the East Coast, developing minimally invasive technologies for the treatment of structural heart disease.

Andrew Lee (2013) will be returning to the Stanford MD program after defending his thesis in early fall of 2013.

Joanna Mattis (2013) will have her thesis defense in July 2013 before going to clinics to complete her MD/PhD.

Jennifer Brady (2013) started a postdoctoral position at Stanford University with Monte Winslow (Genetics). She is working on mechanisms of tumor progression to metastasis using mouse models of lung cancer.

Remy Durand (2011) works for L.E.K. Consulting as a business strategy consultant for companies in the life sciences space.

Limor Freifeld (2013) will be joining Prof. Mehmet Fatih Yanik's High-Throughput Neurotechnology group, which is a part of the Research Laboratory of Electronics at MIT, as a postdoctoral associate in August 2013.

William Parsons (2013) is a postdoctoral fellow at the Scripps Research Institute, working in the lab of Dr. Benjamin Cravatt.

Aaron Wenger (2012) is head of technology at Survata, a market research startup company that he co-founded.

Aakash Basu (2013) will be graduating in September 2013 upon which he will begin his postdoctoral position in James Hudspeth's lab at Rockefeller University.

Elsa Birch (2013) will be graduating in Fall 2013. She has accepted a position at Exponent in Menlo Park where she will be doing technical consulting.

Alia Schoen (2013) accepted a California Science and Technology Policy Fellowship from the California Council on Science and Technology (CCST) and will be beginning her one-year appointment in the California State Legislature in November 2013.

Noureddine Tayebi (2011) is a research scientist within the Integrated Biosystems Laboratory, Intel Research Labs, Intel Inc., Santa Clara, CA.

Sanaz Saatchi (2011) is a Principal R&D Engineer in the CardioVascular group at Medtronic. After conducting a global research effort and opportunity assessment to identify new areas for cardiovascular medical device innovation, she is now the technical lead on a cross-functional team driving these product concepts through the product development process towards commercialization.

Li Ma (2011) is an assistant professor in the department of statistical science at Duke University.

Peter Olcott (2013) will be graduating in Fall 2013 and is currently looking for a position in the medical device industry.

Shawn Ouyang (2013) has a short-term postdoctoral position with James Chen at Stanford University.

Mario Diaz de la Rosa (2012) is in the process of interviewing.

Lisa Gunaydin (2012) is currently a postdoctoral fellow in the Gladstone Institute of Neurological Disease at UCSF.

Tyler Hillman (2010) is a resident in Ob/Gyn at University of California-San Diego and plans to eventually pursue specialty training in maternal-fetal medicine.

Ian Marshall (2012) is a postdoctoral fellow in the Center for Geomicrobiology at Aarhus University in Denmark.

Andreas Rauschecker (2011) is graduating from medical school in June 2013 and will be starting his residency in radiology at the University of Pennsylvania.

Brian Wilt (2011) is a data scientist for Intuit in Mountain View. He works on the Data Sciences and Analytics New Business Initiative team, where he is building a commercial graph of Intuit's data to drive new products.



Andrew Weitz
Bio-X Bioengineering Fellow

Prof. Jin Hyung Lee (Neurology, Bioengineering)
Andrew works at the interface of neuroscience, engineering, and imaging to better understand how the brain works in health and disease. He currently uses optical, electrophysiological, and functional imaging techniques to identify large-scale networks in the brain and their functional significance in diseases such as epilepsy. Research in this area will help elucidate the mechanisms of current "black box" therapies, such as deep brain stimulation, as well as drive the development of novel, more targeted, and effective treatments.



Anne Ye
Bio-X Bioengineering Fellow

Prof. Jennifer Cochran (Bioengineering)
Angiogenesis plays a crucial role in health and disease. While the formation of new vasculature is often an essential component of desirable processes such as tissue regeneration, aberrant angiogenesis is implicated in numerous diseases, including cancer and age-related macular degeneration. Anne is interesting in taking a structure- and mechanism-based approach toward engineering variants of vascular endothelial growth factor (VEGF), one of the primary signaling ligands that mediates angiogenesis, to serve as modulators of this process. These VEGF-derived agonists and antagonists comprise a molecular toolbox that will be useful for probing the complex signaling networks that control angiogenesis, as well as for therapeutic and diagnostic applications, such as cancer imaging and wound healing.



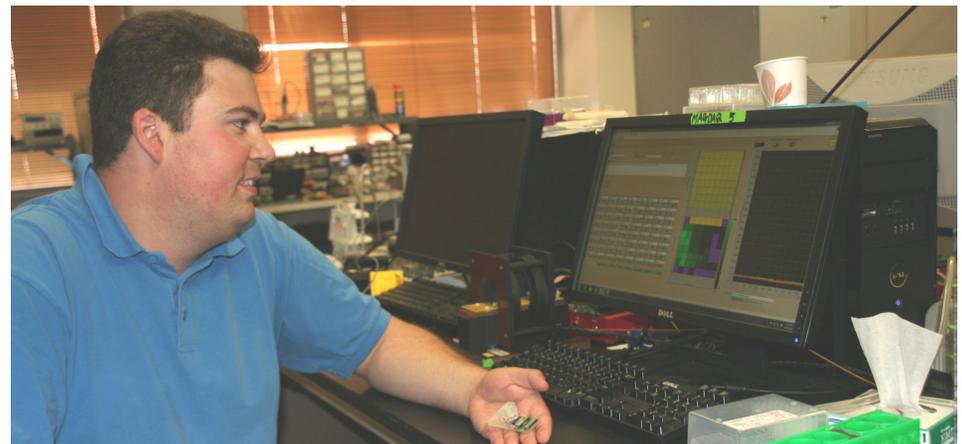
Noah Young
Bio-X Bioengineering Fellow

Prof. Karl Deisseroth (Bioengineering, Psychiatry)
When the human heart is damaged, valves, pace-making cells, or even the entire heart can be replaced or augmented with artificial components. When the brain becomes damaged, there is no artificial cerebellum or other synthetic part to repair the harm. As a preliminary step to designing neural implants that can restore function to the brain, Noah plans to use optical stimulation and optical imaging techniques to study how ever-larger networks of neurons interact, compute, and adapt. Standing at the intersection of neuroscience, electrical engineering, and bioengineering, this research may also lead to energy-efficient electronics, better prostheses, and more intelligent machines.

The following student fellows from 2012 are graduating in 2013:
Manuel Rausch (Bio-X SIGF Fellow)

For more details, see page 22.

One of the wonderful things about the Bio-X program here at Stanford is its commitment to multi-disciplinary collaborations, bringing teams together to help solve these otherwise unanswerable questions. It gives you the freedom to ask a challenging question, and facilitates the means to pursue it. These collaborations result in a much more diverse educational experience where students can benefit from the mentorship of professors in different fields.
- Jennifer Brady, Ph.D. (Bio-X Skippy Frank Fellow 2010)



Daniel Bechstein (see pg. 8 for research details)



Ron Alfa
Bio-X Bowes Fellow
Neurosciences/MSTP

Prof. Seung Kim (Developmental Biology) and Tom Clandinin (Neurobiology)
Diabetes mellitus is a chronic disease defined clinically by increased blood glucose levels resulting from decreased peripheral insulin sensitivity or impaired insulin secretion by pancreatic beta cells. While diabetes mellitus is historically one of the oldest diseases, the complex genetics underlying the most prevalent form, type-2 diabetes mellitus (T2DM), are only beginning to be elucidated. Ron's work is directed at harnessing the powerful genetics of the fruit fly, *Drosophila melanogaster*, to study the genetics of diabetic states. To this end, he is drawing on approaches from neuroscience and bioengineering to study metabolism and glucose homeostasis in the fly.



Craig Buckley
Bio-X Bowes Fellow
Chemical Engineering

Prof. Alex Dunn (Chemical Engineering) and James Nelson (Molecular & Cellular Physiology)
Mechanical force has increasingly been shown to play an important role in many aspects of biology, such as influencing stem cell differentiation; however, its mechanism of action is still poorly understood in many key protein systems. One critical system is the adherens junction, which mediates adhesion between neighboring cells. Previous attempts to measure the interactions of the core adherens junction components with the actin cytoskeleton have been unsuccessful. Craig is utilizing optical tweezers to directly probe the interaction of these proteins with actin filaments as a function of applied mechanical load, which simulates the nature of these interactions within the cell.



Jing-yu Cui
Bio-X Bowes Fellow
Electrical Engineering

Prof. Craig Levin (Radiology), Dwight Nishimura (Electrical Engineering), Lei Xing (Radiation Oncology), and Guillem Pratx (Radiation Oncology)
Jing-yu is designing algorithms and systems for real-time cardiac Positron Emission Tomography (PET) for non-invasive *in vivo* visualization of molecular signatures of disease and for guidance of surgical interventions. Jing-yu applies the state-of-the-art technologies

in computer graphics, optimization, and computer vision for removing motion artifacts and speeding up the imaging process by hundreds of times to enable real-time visualization of molecular activities in cardiology.



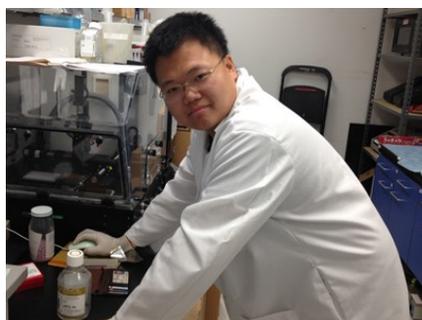
Christopher Emig
Bio-X Bowes Fellow
Bioengineering

Prof. Stephen Quake (Bioengineering, Applied Physics)
Chris is developing devices and methods for high throughput immune repertoire analysis. He is working to better characterize patient responses to influenza vaccination by sequencing heavy and light chain genes from hundreds of thousands of individual B cells and subsequently cloning antibody genes in order to identify cognate antigens. This research should provide insights into the mechanisms of immunization and possibly aid in vaccine development.



Denitsa Milanova
Bio-X Medtronic Fellow
Mechanical Engineering

Prof. Juan Santiago (Mechanical Engineering), Annelise Barron (Bioengineering), and Mark Holodniy (Infectious Diseases)
Denitsa is working on developing a novel assay for physico-chemical extraction and isotachopheresis-based purification and quantification of HIV-1 virus from whole blood. This project combines the fields of mechanical engineering, molecular biology, and infectious diseases. HIV/AIDS is one of the most costly diseases since HIV patients require treatment and need to monitor treatment throughout their lifetime. Development of a rapid, sensitive, and selective diagnostics would help reduce these costs, minimize the spread of the infection, and ensure a timely onset of antiretroviral therapy.



Bo Zhang (see pg. 6 for research details)



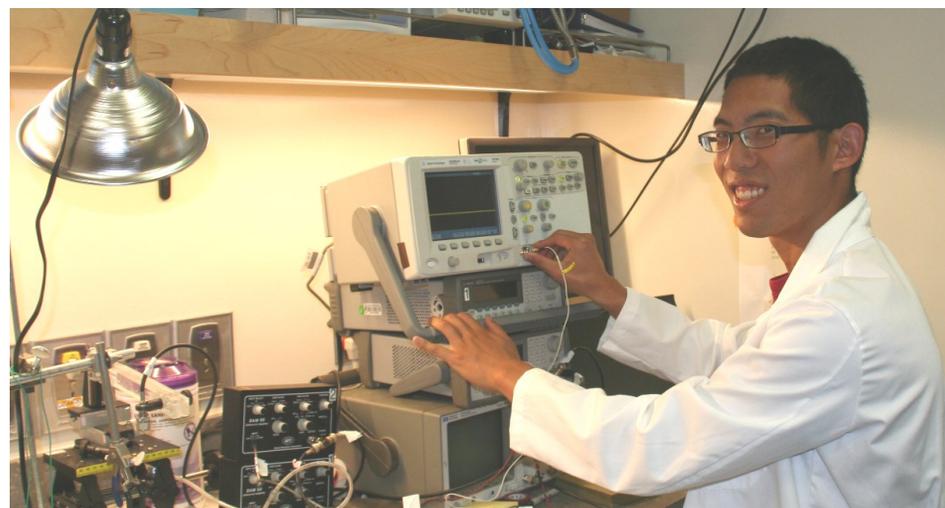
Subhaneil Lahiri
Bio-X Postdoctoral Fellowship 2013
Bio-X Genentech Fellow
Applied Physics

Prof. Surya Ganguli (Applied Physics)
Our brains store long term memories by adjusting the strengths of the synapses that connect neurons. The tendency for new memories to overwrite old ones leads to a trade-off between learning and remembering: if synapses are too plastic older memories will be wiped out too easily, but if they are too rigid, it becomes difficult to learn new memories in the first place. Subhaneil is studying theoretical models of synapses to understand how their internal structure can be used to balance these effects and maximize their memory storage.

The following students have completed their postdoctoral program:
Tiffany Chung
Yu-Shan Lin
Elena Rykhlevskaia
Shilpa Sambashivan
Sergey Solomatn
Tristan Ursell

For more details, see page 25.

"The Bio-X Program and Fellowship allowed me to do riskier research for my Ph.D. because we didn't have outside funding for that [specific] project. I think it directly contributed to the success of that work, specifically in the publication of the work in the Proceedings of the National Academy of Sciences."
Amanda Malone, Ph.D. (Bio-X Bowes Fellow 2004)



Patrick Ye (see pg. 6 for research details)



Bio-X Fellows 2012 group photo

Bio-X Graduate Student Fellowships

2007



Nan Xiao
Bio-X Bioengineering Fellow

Profs. Charles Taylor (Bioengineering, Mechanical Engineering) and Markus Covert (Bioengineering)
Recent advances in modern medical imaging and computing have enabled researchers to build increasingly realistic computer models of the cardiovascular system. Understanding the propagation of pressure and flow waves as a function of arterial stiffness is a crucial factor in unveiling the mechanisms behind diseases such as hypertension. Nan's work involves combining medical image data and other non-invasive clinical measurements with computational mechanics to construct realistic, three-dimensional simulations of blood flow in the large arteries of the human body in order to study the impact of changing arterial stiffness on the wave propagation behavior of arterial blood flow.

The following student fellows from 2007 have graduated:

Kelsey Clark (Bio-X Bowes Fellow)
Jennifer Hicks (Bio-X Bowes Fellow)
Frances Lau (Bio-X Bowes Fellow)
Cory McLean (Bio-X Bowes Fellow)
Rebecca Taylor (Bio-X Bowes Fellow)
Larry Wang (Bio-X Bowes Fellow)
Kitchener Wilson (Bio-X Bowes Fellow)
Sheng Ding (Bio-X Bioengineering Fellow)
Jacob Hughey (Bio-X Bioengineering Fellow)
Jayodita Sanghvi (Bio-X Bioengineering Fellow)
Min-Sun Son (Bio-X Bioengineering Fellow)

For more details, see page 23.

Bio-X Graduate Student Fellowships

2006

The following student fellows from 2006 have graduated:

Edith Arnold (Bio-X Bowes Fellow)
Jennifer Blundo (Bio-X Bowes Fellow)
Ian Chen (Bio-X Bowes Fellow)
Sanjay Dastoor (Bio-X Bowes Fellow)
Katy Keenan (Bio-X Bowes Fellow)
Guillem Pratz (Bio-X Bowes Fellow)
Aaron Wang (Bio-X Bowes Fellow)

Peggy Yao (Bio-X Bowes Fellow)
Namiko Abe (Bio-X SIGF Paul Berg Medical Fellow)
Bertrand Lui (Bio-X SIGF Lubert Stryer Fellow)
Daniel Kimmel (Bio-X SIGF Affymetrix Fellow)
Murtaza Mogri (Bio-X Bioengineering Fellow)
Angela Wu (Bio-X Bioengineering Fellow)

For more details, see pages 23-24.

Bio-X Graduate Student Fellowships

2005

The following student fellows from 2005 have graduated:

Afsheen Afshar (Bio-X Bowes Fellow)
Georgios Asimenos (Bio-X Bowes Fellow)
Rachel Kalmar (Bio-X Bowes Fellow)
David Myung (Bio-X Bowes Fellow)
Jules VanDersarl (Bio-X Bowes Fellow)
Yufeng Yang (Bio-X Bowes Fellow)

Vincent Chu (Bio-X Pfizer Fellow)
Mindy Chang (Bio-X Bioengineering Fellow)
Virginia Chu (Bio-X Bioengineering Fellow)
Stephen Lee (Bio-X Bioengineering Fellow)
Prasheel Lillaney (Bio-X Bioengineering Fellow)

For more details, see page 24.

Bio-X Graduate Student Fellowships

2004

The following student fellows from 2004 have graduated:

Relly Brandman (Bio-X Bowes Fellow)
David Camarillo (Bio-X Bowes Fellow)
Samuel Kim (Bio-X Bowes Fellow)
Andreas Loening (Bio-X Bowes Fellow)
Leslie Meltzer (Bio-X Bowes Fellow)
Sergio Moreno (Bio-X Bowes Fellow)

Sara Zhao (Bio-X Bowes Fellow)
Adam Grossman (Bio-X Bioengineering Fellow)
Amanda Malone (Bio-X Bioengineering Fellow)

For more details, see page 24.



Patricia Ortiz-Tello
Bio-X Bowes and Amgen Fellow
Genetics

Profs. Carlos D. Bustamante (Genetics) and Julie Baker (Genetics)

Preeclampsia, a disorder that complicates 3-8% of pregnancies worldwide and jeopardizes the life of the mother and newborn, occurs at 2-3 fold higher prevalence at higher altitudes – most likely due to the hypoxic environment. Interestingly, the higher prevalence of preeclampsia observed at high altitudes is linked to those individuals with higher European ancestry, leading us to believe that the Amerindian population living at high altitude for over 10,000 years have developed a genetic adaptation protective against preeclampsia. We aim to use whole-genome DNA analysis, local functional expression, and clinical and histopathology data to disentangle the genetic basis of preeclampsia.



Steven J. Petsche
Bio-X Bowes Fellow
Mechanical Engineering

Profs. Peter Pinsky (Mechanical Engineering) and Marc Levenston (Mechanical Engineering)

The unique structure of the human cornea results in a tissue that is mechanically strong yet completely transparent. Advances in imaging and experimentation at small scales have allowed better understanding of the molecular mechanisms that give rise to its mechanical properties. Steven follows a "multi-scale" modeling approach where improved macro-scale mathematical models are directly linked to micro-scale models of these mechanisms. A coordinated approach between modeling and novel experimentation combines areas of biology, chemistry, imaging, and applied mechanics to engineer a computational model of the cornea with direct clinical applications in refractive surgery and the study of corneal pathologies.



Jack Wang
Bio-X Bowes Fellow
Neurobiology

Profs. Ben Barres (Neurobiology), Tom Claudinin (Neurobiology), Tom Wandless (Chemical & Systems Biology), and Ricardo Dolmetsch (Neurobiology)
Degeneration of the nerve fibers, or axons, is a pivotal event in many neurodegenerative diseases such as glaucoma, Alzheimer's, and stroke; however, the mechanisms that regulate this process remain largely

unclear. How do axons degenerate, and how can we delay or prevent the process from occurring to improve clinical outcome in nerve injuries or diseases? To address these questions, Jack studies a genetic mutation (Wlds) that confers robust axonal protection from various physical injuries and chemical insults. Through a series of genetic, biochemical, and proteomic approaches, he hopes to understand the neuroprotective mechanism of the mutant Wlds protein and the molecular events that orchestrate the process of axonal degeneration and ultimately identify novel therapeutic targets to treat neurological injuries and diseases.



Jongmin Kim
Bio-X SIGF
Bruce and Elizabeth Dunlevie Fellow
Chemical and Systems Biology

Profs. Margaret Fuller (Developmental Biology) and Paul Khavari (Dermatology)

Most of our tissues are constantly replenished by tissue specific adult stem cells. The goal of Jongmin's research is to understand how the switch from proliferation to differentiation in adult stem cell lineages is regulated. He has developed an *in vivo* differentiation system that can trigger proliferating progenitor cells to synchronously differentiate in the male germ line of fruit flies. By employing this differentiation assay, he will identify genes critical for the switch and will determine how those genes are regulated. Understanding this switch will be important in regenerative medicine and cancer therapy.



Paul Lebel
Bio-X SIGF
Applied Physics

Profs. Zev Bryant (Bioengineering) and Hideo Mabuchi (Applied Physics)

Paul's goal is to further our mechanistic understanding of both DNA and molecular motors by capturing the motion of single molecules at unprecedented speed and resolution. He has developed an imaging and data acquisition system to track gold nanoparticles as precise probes of length and twist of single DNA molecules at upwards of 20,000 frames per second. The lab he works in exploits the resolution of this technique as a tool to study various systems. They observe individual torque-generating steps ATP-powered enzymes as they wind up DNA, and they measure the basic physical properties of DNA itself when single bases are unwound with tension and torque.



Mark Longo
Bio-X SIGF
Morgridge Family Fellow
Biology

Profs. Ward Watt (Biology) and Jay McClelland (Psychology)

In the course of Mark's research in evolutionary genetics, he has noticed striking parallels between certain aspects of the cognitive and biological sciences. He intends to explore these similarities further in pursuit of a complex adaptive systems conception of genetics. This work will yield a book-length manuscript with the working title *The Genetic Mind: Genes as Learning Networks*. At issue is the very way we think of evolution and what exactly it means for genes to be "for" things.



Samir Menon
Bio-X SIGF
Colella Family Fellow
Computer Science

Profs. Oussama Khatib (Computer Science) and Kwabena Boahen (Bioengineering)

Understanding how the brain coordinates the same muscles to simultaneously execute multiple motor tasks, like holding a cup with a hand and flipping a switch with the same arm's elbow, is a fundamental issue facing motor control research. Samir is combining robotic control theory and biomechanics to predict musculoskeletal coordination strategies for individuals and is using Functional Magnetic Resonance Imaging to determine how the brain's motor regions could implement them. His work promises to help diagnose motor disorders before physical deficits appear, develop therapies that simultaneously target multiple brain regions and circuits, and improve our ability to decode the brain's motor activity.



Daniel Newburger
Bio-X SIGF
Morgridge Family Fellow
Biomedical Informatics

Profs. Serafim Batzoglou (Computer Science), Arend Sidow (Pathology, Genetics), and Robert West (Pathology)

Characterizing the genomic evolution of cancer cells has proven effective in elucidating mutational mechanisms responsible for cancer progression. However, the genetic landscape of premalignant cancer cells remains largely unexplored due to the difficulty of isolating early neoplasias and obtaining interpretable DNA sequences from these cellular populations. By leveraging phylogenetic relationships among co-occurring breast cancer lesions, Daniel is developing methods for using next generation DNA sequencing

to determine the initial genomic changes responsible for breast cancer development. We hope that this research can identify genetic signatures that distinguish benign lesions from premalignant lesions and ultimately inform the treatment of patients with early breast cancer lesions.



Ruth Sommese
Bio-X SIGF
Paul Berg Fellow
Biochemistry

Profs. James Spudich (Biochemistry) and Euan Ashley (Medicine)

In the United States, cardiovascular disorders are a leading cause of morbidity and mortality. Familial cardiomyopathies are among the most frequently occurring inherited cardiac diseases, and many result from mutations in the fundamental force-generating system of cardiac muscle, myosin, and the thin filament. The interaction between myosin and the thin filament has been fine-tuned in cardiac muscle in terms of power output and the rates of force generation and relaxation. The goal of this project is to characterize how cardiomyopathy mutations affect force-producing capabilities of cardiac muscle at the single molecule, single cell, and whole organ levels.



Carolina Tropini
Bio-X SIGF
Bruce and Elizabeth Dunlevie Fellow
Biophysics

Profs. KC Huang (Bioengineering) and Daniel Fisher (Applied Physics)

Shape matters at all scales, including the cellular one, and the cell-wall determines the bacterial boundaries and shape. Carolina is interested in understanding how the cell-wall is formed from molecular components thousands of times smaller: sugars and amino acids. Just like with a LEGO structure, the simple pieces combine to form complicated and diverse structures; it is how they are assembled that ultimately determines cell shape. Using genetic and biophysical approaches, Carolina modifies cell-wall building blocks and forces; then with microscopy, she observes how bacterial shape changes. The merging of this data with a computational model of cell growth is shedding light on the fundamental question of cellular shape determination.

"One of the many ways Bio-X led me to what I'm doing now is by getting me initially connected to people in the device and venture community, and these connections led to others that helped get the company started and funded."
David Myung, Ph.D. (Bio-X Bowes Fellow 2005)



Yen-Hsiang Wang
Bio-X Bioengineering Fellow

Prof. Christina Smolke (Bioengineering)

Yen-Hsiang is interested in controlling cells with synthetic RNAs. These synthetic RNA controllers are capable of fine-tuning genes and pathways, which gives scientists greater control over intricate cellular networks. He is building an operational amplifier (op-amp), which is a fundamental building block in most electrical circuits like computers. An op-amp is generally composed of three stages – differential stage, amplification stage, and output stage – each of which

has its own key functional features. He is currently working on the first stage: a RNA sensor that is able to detect the difference between two inputs using antisense.

The following student fellows from 2009 have graduated:

Aakash Basu (Bio-X Bowes Fellow)
Elsa Birch (Bio-X Bowes Fellow)
Alia Schoen (Bio-X Bowes Fellow)
Noureddine Tayebi (Bio-X Bowes Fellow)
Sanaz Saatchi (Bio-X Amgen Fellow)
Li Ma (Bio-X SIGF Fellow)
Peter Olcott (Bio-X SIGF Fellow)
Shawn Ouyang (Bio-X SIGF Fellow)

For more details, see page 22.

Bio-X Graduate Student Fellowships

2008



Mihalis Kariolis
Bio-X Bioengineering Fellow

Prof. Jennifer Cochran (Bioengineering)

Directed evolution is a powerful method that can be used to engineer proteins for therapeutic applications. Using this method, Mihalis is engineering proteins to target and inhibit receptors on the cancer cell surface that are crucial for cell growth and survival. The engineered proteins also hold potential to disrupt critical signaling pathways important for disease progression. As such, they have potential value as targeted therapeutics agents as well as diagnostic imaging probes.



Grace Tang
Bio-X Bioengineering Fellow

Prof. Russ Altman (Bioengineering, Genetics)

Fragment-based drug design, a drug discovery approach, takes small chemical compounds that bind to the protein target and expands or combines them into larger compounds with potent effects on the protein target. Crucial to this process is the identification of the starting small compounds (fragments). The increasing availability of 3D protein structures in complex and diverse chemical compounds provides a valuable source of information on the binding preferences of these compounds. Thus, the Altman lab is using unsupervised machine learning algorithms to identify these binding preferences and to apply this knowledge to drug design and drug repurposing.



Ton Subsoontorn
Bio-X Bioengineering Fellow

Profs. Drew Endy (Bioengineering) and Michele Calos (Genetics)

An ability to store modest amounts of information within living systems would enable new approaches to the study and control of biological processes. For example, a simple data storage device functioning as an 8-bit counter which can count and report up to 256 discrete biochemical events (e.g. cell division) is sufficient for tracking and controlling entire cell lineages during the development and aging across most known organisms; however, state-of-the-art genetically encoded data storage devices can reliably handle only a few states. The goal of Ton's project is to develop a platform for using rewritable site-specific recombination to enable combinatorial data storage architectures on DNA which could help expand storage capacity by orders of magnitudes.

The following student fellows from 2008 have graduated:

Mario Diaz de la Rosa (Bio-X Bowes Fellow)
Lisa Gunaydin (Bio-X Bowes Fellow)
Tyler Hillman (Bio-X Bowes Fellow)
Ian Marshall (Bio-X Bowes Fellow)
Andreas Rauschecker (Bio-X Bowes Fellow)
Brian Wilt (Bio-X Bowes Fellow)
Mark Sellmyer (Bio-X Bowes Fellow)
Adam de la Zerda (Bio-X Skippy Frank Fellow)
Gaurav Krishnamurthy (Bio-X Medtronic Fellow)
Melinda Cromie (Bio-X SIGF)
Viviana Gradinaru (Bio-X SIGF)

For more details, see pages 22-23.



Graham Dow
Bio-X Bowes Fellow
Biology

Profs. Dominique Bergmann (Biology) and Joe Berry (Global Ecology, Carnegie Inst. for Science) Plants are dependent on their ability to sense and respond to their surrounding environment in order to successfully grow and reproduce. Stomata are specialized cells on the above ground surface of plants that control the flux of gases, such as CO₂ and H₂O, between internal plant structures and the outside world. Stomatal development and physiology are finely tuned to environmental conditions and ultimately help plants optimize their relationship with the environment. The goal of this project is to elucidate the molecular mechanisms that underlie the relationship between stomata and the environment, particularly with respect to development of stomata and its feedback on physiology.

nervous system. For example, she is interested in how the inhibitory projection neurons in the fly olfactory system act in parallel with excitatory projection neurons to sharpen the selectivity of higher order lateral horn neurons' response to food odors and pheromones. She incorporates fly genetics, two-photon imaging and optogenetic methods to manipulate and record neuronal activity with high spatiotemporal resolution. Her study will help us to better understand the neural coding in the olfactory circuitry.



Kathryn Montgomery
Bio-X Bioengineering Fellow

Profs. Scott Delp (Bioengineering, Mechanical Engineering) and Karl Deisseroth (Bioengineering, Psychiatry) Kate Montgomery was awarded a Bio-X SIGF in 2012. See page 10 for research information.



Rebecca DiMarco
Bio-X Bioengineering Fellow

Profs. Sarah Heilshorn (Materials Science & Engineering) and Calvin Kuo (Hematology) As the cost and duration of clinical trials continue to increase, a rising emphasis is being placed on improving preclinical testing methods for new drug candidate molecules. Despite its prevalence of use, the current standard preclinical absorption model suffers from multiple limitations, including poor reproducibility and marked inaccuracies in predicting drug bioavailability. The goal of Rebecca's work is to create an improved *in vitro* mimic of intestinal tissue, the primary point of absorption for most orally administered drugs, by exploiting the molecular-level precision of protein-engineered scaffold materials to control cellular behavior.



Sarah Denny (see pg. 2 for research details)



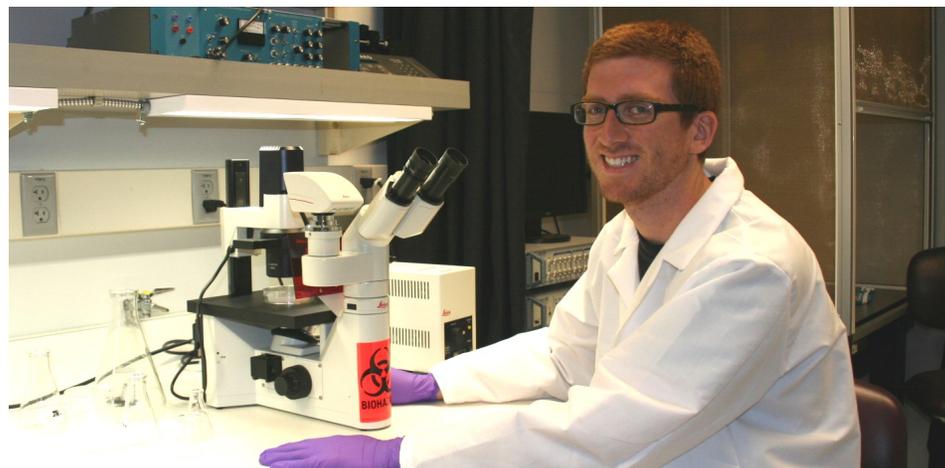
Austin Lee-Richerson
Bio-X Bioengineering Fellow

Prof. Michael Lin (Pediatrics) Controlling protein activity with light has long been a goal of scientists and engineers seeking to study protein interaction networks and develop novel medical therapeutics. Light-responsive proteins have been engineered for specific applications; however, a broadly applicable platform using light to study protein function in general is still needed. The aim of Austin's research is to construct and characterize such a platform using fluorescent proteins, which absorb and emit light. Currently, the project consists of optimizing a light-control system for a specific set of proteins involved with cell movement. The eventual goal is to apply this platform to control many proteins with a variety of functions.



Carmichael Ong
Bio-X Bioengineering Fellow

Prof. Scott Delp (Bioengineering, Mechanical Engineering) Carmichael's research interest is in using engineering concepts to analyze human movement. His project combines tools from mechanical engineering and biology to create simulations of walking and running with heavy load. These simulations allow us to gather information that is impossible to measure experimentally. With this knowledge, we will better understand how to guide training programs and inform device design to reduce injuries, reduce fatigue, and improve human performance, especially for soldiers.



Andrew Weitz (see pg. 11 for research details)



Sungwon Lim
Bio-X Bioengineering Fellow

Prof. Jennifer Cochran (Bioengineering) Regenerating blood vessels (angiogenesis) has been a spotlighted research area for a long time because of its importance as a potential solution to treat chronic cardiovascular disease and other ischemia. Various approaches using genes, proteins, and cells have been made but have failed to induce sufficient amounts of blood vessel formation in clinical studies. Sungwon's project develops molecular therapeutics and delivery systems to achieve a synergistic combination of the different approaches that maximize therapeutic effects for ischemic diseases. Genes and proteins inducing angiogenesis can be engineered and delivered safely and efficiently to the ischemic region with the help of a novel delivery system.

"The diversity of science [in Bio-X and the Clark Center] enables you to become a real generalist—to feel comfortable jumping into a new field. My work in Bio-X, the Neurosciences Program, and at Stanford allowed me to look for something interesting [when ready to graduate], knowing that I had the ability to learn quickly, solve problems, and work with researchers from many different fields."
-Leslie Meltzer, Ph.D. (Bio-X Bowes Fellow 2004)

**BIO-X AT STANFORD
TO EDUCATE...
TO DISCOVER...
TO INVENT....**



Jong Min Sung
Bio-X Bowes Fellow
Applied Physics

Profs. James Spudich (Biochemistry), Alexander Dunn (Chemical Engineering), Euan Ashley (Cardiovascular Medicine), and Sebastian Doniach (Applied Physics) Hypertrophic (HCM) and dilated (DCM) cardiomyopathies are the two most common genetic heart diseases. HCM affects nearly 0.2% of the general population. They often result from single point mutations in sarcomeric proteins especially in β -cardiac myosin heavy chain (β -cMHC), a molecular engine for muscle contraction, yet the molecular mechanism of how the mutations cause the diseases is not clearly understood. The goal of Jongmin's project is to understand the molecular mechanism of the disease at a single molecular level by characterizing the change in function of β -cMHC in the force generation role by using an optical trap.



Liang Liang
Bio-X SIGF
Applied Physics

Profs. Liqun Luo (Biology) and Mark Schnitzer (Biology, Applied Physics) Liang is interested in the organization and information processing principles of neural circuits. She uses the fruit fly olfactory system as a model to study the functional connections and computation in the central



Jaimie Adelson
Honorary Fellow
Neurosciences

Profs. *Carla Shatz (Biology, Neurobiology)* and *Rona Giffard (Anesthesia)*

Our brains have the remarkable ability to change and learn. The cerebral cortex has intrinsic mechanisms that limit or promote plasticity by converting neural activity into lasting structural changes at synapses. Jaimie considers the model that, in neurons, two major histocompatibility complex class I genes, Kb and Db, signaling via the innate immune receptor PirB, act as a brake on cortical plasticity. The goal of her research is to “release the brake” in mutant mice that lack these molecules and to examine if it is possible to not only increase cortical plasticity but also to promote faster recovery following acute cortical injury.



Alex Grant
Bio-X Bowes Fellow
Bioengineering

Profs. *Craig Levin (Radiology)* and *Norbert Pelc (Bioengineering and Radiology)*

Alex is working on novel technology for improving PET (positron emission tomography) system performance. PET allows non-invasive cellular and molecular assays of a subject’s tissues and is widely used for cancer diagnosis and staging. His project involves using optics to process PET signals in order to achieve better system performance while reducing system size and complexity. This work has the potential to increase PET image signal-to-noise ratio, enabling significant improvements in disease visualization and quantification. This will allow better detection and diagnosis of cancer and other diseases and make these procedures more widely available.



Jonathan Leong
Bio-X Bowes Fellow
Neurosciences, MSTP

Profs. *Thomas Clandinin (Neurobiology)* and *Steven Boxer (Chemistry)*

Jonathan is using functional imaging in the fruit fly, *Drosophila melanogaster*, to study sensory neuronal processing, specifically the initial computations that underlie the visual detection of motion. The genetic tractability and relative anatomical simplicity of *Drosophila* present a unique experimental opportunity to probe the functional contribution of individual neuron

types to specific computations instantiated in the brain. Importantly, like humans, *Drosophila* assess the visual periphery in highly sophisticated ways and use vision to guide their behavior, such as locomotion. A functional characterization of the early visual system in *Drosophila* may reveal not only the computational primitives of a highly evolved visual system but also novel interactions, governed by neuronal circuits, between sensory processing and behavior.



William Noderer
Bio-X Bowes Fellow
Chemical Engineering

Profs. *Cliff Wang (Chemical Engineering)*, *Tom Wandless (Chemical & Systems Biology)*, *Laura Attardi (Genetics, Radiation Oncology)*, and *Markus Covert (Bioengineering)*

The protein p53 protects the fidelity of the genome and limits mutations that could lead to cancer. The Wang lab uses γ -irradiation to induce double stranded breaks in the DNA to trigger a p53 response. Under these harsh conditions, p53 levels oscillate with a period of about 8 hours. It is unclear what function the p53 oscillations have. Does oscillatory behavior aid the cells in responding to DNA damage? William has created a synthetic p53 oscillator to decouple the stress signal (DNA damage) from the p53 oscillations. By manipulating the period, amplitude, and duration of oscillations, William can directly show how p53 dynamics affect DNA repair, cell survival, gene expression, and ultimately tumor suppression.



Joo Yong Sim
Bio-X Bowes Fellow
Mechanical Engineering

Profs. *Beth Pruitt (Mechanical Engineering)*, *W. James Nelson (Biology)*, and *Alex Dunn (Chemical Engineering)*

Joo Yong Sim is interested in the research on mechanobiology, studying the interaction of cells and tissues with mechanical forces from micro to macro scale. He has been working in the Pruitt Lab and collaborating with the Nelson lab on the mechanics of cell-cell adhesions. He is developing mechanical stimulation systems to study how cells respond to mechanical loading and find the key proteins to sense the signal and cascade it further to change their functions. His research will focus on revealing the role of the mechanical forces on regulating the cell-cell adhesion and the signaling pathways using the microfabricated devices and advanced microscopy techniques.



Ryan Fox Squire
Bio-X Bowes Fellow
Neurosciences

Profs. *Tirin Moore (Neurobiology)* and *Karl Deisseroth (Bioengineering, Psychiatry)*

The ability to pay attention is a central feature of our day-to-day life that enables us to selectively process some aspects of our sensory world while ignoring others. Identifying the specific brain cells and circuits that bring about attention is essential for understanding both normal and impaired cognition, yet this is currently beyond the reach of established neurobiological techniques. Ryan’s research utilizes new technologies to measure, turn off, and turn on specific brain circuits as primates perform attention-demanding tasks. This research hopes to understand at an unprecedented level of specificity how brain activity underlies cognitive functions such as attention.



Xiaoxue Zhou
Bio-X SIGF
Larry Yung Fellow
Chemistry

Prof. *Julie Theriot (Biochemistry, Microbiology & Immunology)*

Most bacteria surround themselves with a tough cell wall exoskeleton made of peptidoglycan, a cage-like macromolecule that preserves cellular integrity and maintains cell shape. While its essential function is to be robust enough to protect the cell, peptidoglycan is also required to be dynamic (constantly remodeled) to accommodate cell growth and division. Enzymes that hydrolyse peptidoglycan are crucial for these processes, but their activities can be lethal if not tightly controlled. Xiaoxue wants to understand how bacteria coordinate and regulate their peptidoglycan hydrolyses to accomplish cell division while not breaking the integrity of their peptidoglycan exoskeleton.



Melina Mathur
Bio-X Bioengineering Fellow

Prof. *Christina Smolke (Bioengineering)*

Engineered biological systems hold great promise for developing solutions for human health; however, building genetic systems that can integrate with native biological functions is currently limited by the availability of tools to engineer sophisticated behaviors. Alternative splicing is a mechanism used by cells to produce one of several related proteins from a single DNA sequence depending on environmental cues.

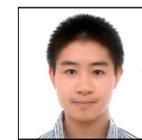
The goal of this project is to engineer precise alternative splicing patterns in human cells to dynamically control cellular fate and function.



Haisam Islam
Bio-X Bioengineering Fellow

Professor *Gary Glover (Radiology)*

Haisam is working on acquiring data from a limited field of view using non-linear gradients in magnetic resonance imaging (MRI). Usually, restricting data acquisition to a limited region within an excited volume results in aliasing of signal from outside the field of view. Thus, the entire volume must be encoded, even if it includes regions that are not of interest. By using non-linear gradients and a spatial-spectral excitation pulse, it is possible to restrict the excited volume to a circular region within a slice. This can reduce the acquisition time or allow for higher resolution imaging for the same acquisition time.



Remus Wong
Bio-X Bioengineering Fellow

Prof. *Christina Smolke (Bioengineering)*

Remus is pursuing research in synthetic biology with specific goals to design, construct, and engineer biological functions in cells using regulatory RNAs. Adoptive T-cell therapy uses genetically engineered T-cells for cancer treatment, and this approach has demonstrated promising results in clinical trials. Remus hopes to further improve this technology by developing RNA-based genetic regulatory systems to control T-cell function and survival in response to pharmaceutical drug inputs.

The following student fellows from 2010 have graduated:

Andrew Lee (Bio-X Bowes Fellow)
Joanna Mattis (Bio-X Bowes Fellow)
Jennifer Brady (Bio-X Skipky Frank Fellow)
Remy Durand (Bio-X SIGF Fellow)
Limor Bursztyn Freifeld (Bio-X SIGF Fellow)
William Parsons (Bio-X SIGF Fellow)
Aaron Wenger (Bio-X SIGF Fellow)

For more details, see page 22.