Project selections and matching:

- **Project descriptions intentionally are kept general, as specifics will be refined with the interested students later.**
- **There are more interested students than available spots. Top applicants for a position will go through an interview.**
- **Once agreement is reached between student and faculty advisor, the office of admissions will send an offer letter that the student must fill out and return to the admissions by the indicated deadline.**

Biomarker Research

Project #	**Project Title:**	
1	*Do Novo* peptide sequencing from MS/MS data	
Project Description:		
Sequencing peptides by MS/MS is difficult when the expected peptides in a sample are not in a common database. Several groups have developed algorithms to obtain sequence information from the raw peptide MS/MS data files. This project is to evaluate academic and commercial approaches to de novo sequencing from MS/MS data files, install the best options on an appropriate computer and test performance with MS/MS data from a known peptide. ***What kind of student background is required?*** Setting up and installing software operating systems and algorithms on computers, and some experience with data mining large databases ***What will student learn?*** A basic understanding of peptide fragmentation patterns in MS/MS. Critical thinking skills in evaluation of data mining algorithms. Generation and analysis of MS/MS data for de novo sequencing of complex peptides.		

Drug Discovery

Project #	**Project Title:**	
2	Drug discovery against Anthrax, Diphtheria, and Pseudomonas toxins	
Project Description:		
Many bacterial pathogens produce toxins, which are their main pathogenesis factors. Current FDA approved therapies are often directed against bacterial cells and anti-toxin countermeasures are lacking. Therefore, we discover new anti-toxin drugs by screening libraries of chemicals and select those that inhibit Anthrax, Diphtheria, and Pseudomonas toxins for further studies in animals. ***What kind of student background is required?*** Any sub-fields of Biology, Biochemistry, and Chemistry ***What will student learn?*** Mammalian cell culture, microbiology, and drug-discovery		

Project #	**Project Title:**	
3	Safety profile for potential Ebola treatment	
Project Description:		

The Martchenko Lab has been working to identify opportunities to repurpose existing FDA-approved compounds to treat infectious diseases, including the 70+ Class A, B and C pathogens that are the highest priority for NIAID and NIH. It has identified one such small molecule compound that provides in vitro protection against Ebola and a number of other pathogens, and is actively seeking other related compounds.

What kind of student background is required?

We are looking for a student researcher to analyze more than 40 years of published research on this prior compound to prepare a detailed analysis of safety and other clinical data -- including possible interactions or contra-indications -- to help obtain FDA approval for treating Ebola or other Class A pathogens.

Project #	**Project Title:**	
4	Adaptive antibiotic resistance of human pathogens to clinical antibiotics	

Project Description:

Antimicrobial resistance is a growing global concern. As naturally occurring antibiotics used for the treatment of infections become unavailable, more expensive and longer treatments must be used, which greatly increase health-care costs. There are various types of antibiotic resistance, most broadly categorized as inherited and non-inherited. This project specifically focuses on a particular type of non-inherited antibiotic resistance, *i.e.* adaptive antibiotic resistance. Microbial adaptation to lethal doses of clinical antibiotics is a transient phenomenon. There are gaps in current knowledge about antibiotic resistance mechanisms mediated by non-mutated chromosomal genes and about the effects of such mechanisms on pathogen persistence during antimicrobial treatment. The student will identify combinations of clinically relevant antibiotics enabling microbial persistence under normally hostile conditions.

What kind of student background is required?

Microbiology, biochemistry and molecular biology

What will student learn?

Aseptic techniques, designing high throughput screening assays

Project #	**Project Title:**	
5	Structural characterization and in vitro functional testing of potential CNS active analogs	

Project Description:

Identifying and understanding the pharmacological effects of emerging synthetic drugs of abuse is becoming a serious problem with the rapid proliferation of new structures that have never been documented in the scientific literature. We are using combinatorial synthesis to make small quantities of a large number of chemical derivatives based on the core structures of known psychoactive agents. This aspect of the project is to conduct chromatographic and spectral characterization of the compounds in the inventory. Additionally, in vitro functional assays will be run to determine the activity of these chemical compounds at certain CNS receptors.

What kind of student background is required?

Some experience with analytical instrumentation. Careful measuring and pipetting skills. Experience with Microsoft Excel for performing calculations. Background check required.

What will student learn?

The student will learn to prepare samples for analysis using careful analytical technique, operate analytical instrumentation (e.g., GC/MS) and analyze results, and run in vitro functional assays on cell lines containing cloned human CNS receptors. The student will also learn to produce publishable results and EC_{50} values for drugs.

Project #	Project Title:	
6	Drug Discovery and Development through computer aided drug design	

Project Description:

Overall aim of our projects is to design and develop lead molecules for various biological targets using *in-silico* molecular modeling as well as find out how these drugs interact at their target sites. We are currently working on the viral targets such as HIV integrase (treatment of AIDS, HPV (Human Papilloma virus) [treatment of cervical cancer).

A model research strategy is as follows:

1. Drug databases (e-Drug-3D) will be screened using molecular docking to predict their binding strength with the target.
2. The identified lead molecules will be tested *in vitro*
3. The "hits" obtained from *in intro* biological experiments will be used for generating pharmacophore models and/or substructure search and screening them against commercially available large drug like molecule databases (e.g., Chembridge database, CoCoCo database)
4. Further optimization and screening will be done by docking and biological screening.
   Student will have an opportunity to work with various molecular modeling software including docking software e.g., GOLD (Genetic Optimization for Ligand Design), Visualization software e.g., Pymol and Discovery Studio as well as Chem Draw for structure drawing and minimization. Apart from this, student will also experience how to obtain and prepare proteins and small molecules for molecular modeling.

What kind of student background is required?

Students will be asked to perform *in silico* Drug design. Chemistry background is preferred with knowledge on computer aided drug design.

What will student learn?

Students will have an overall idea about computer aided drug design; learn to use various molecular modeling software mentioned above.

Project #	Project Title:	
7	Development of *Pichia pastoris* strain for production of an animal feed enzyme	

Project Description:

Several US and European companies use KGI expertise for the development of *Pichia pastoris* strains used for manufacturing animal feed enzymes. A number of such *P. pastoris* strains have been created in our lab.

Target genes encoding enzymes of interest will be inserted into plasmids under control of strong promoters and then transformed into competent cells of *P. pastoris*. Selected transformants will be analyzed for expression of the target gene and activity for the encoded enzyme using activity and protein detection assays. The best strains will be further evaluated and manipulated to further increase the productivity of the strains by introducing additional copies of the target gene-promoter cassette or by introduction of a chaperone. The expressed proteins will be analyzed by activity assays and SDS PAGE. Samples of the recombinant enzymes will be generated using lab scale production and purification methods.

What kind of student background is required?

Experience in DNA and protein manipulations including restriction enzyme digestion, cloning, and PCR of DNAs, protein analytical methods, and standard microbiology techniques.

What will student learn?

What *P. pastoris* specific tools (strains, plasmids) and manipulations are currently available and how a *P. pastoris*-made protein production strain is developed from scratch, analyzed and improved.

Project #	Project Title:	
8	Development of a novel vector for the *Pichia pastoris* expression platform	

Project Description:

Pichia pastoris expression is a powerful platform for the synthesis of pharmaceutics, enzymes for biofuels, animal feed and other commercially useful proteins. Currently, there are several vectors and host strains available. However, there is significant room for improvement of both. A novel vector with improved capability for manipulation and introduction into *P. pastoris* host genome will be designed and constructed. This vector with a test gene of interest will be transformed into *P. pastoris* cells and the fate of the inserted DNA molecule will be analyzed.

What kind of student background is required?

Experience in DNA manipulations, including restriction enzyme digestion, cloning, and PCR analysis. Experience with standard microbiology techniques.

What will student learn?

What *P. pastoris* specific tools (strains, plasmids) and manipulations are currently available and how they can be applied for creation of a *P. pastoris* protein production strain is and what gene-engineering approaches can be used to improve both the strain development technique and the properties of the strains.

Molecular Basis of Human Disease

Project #	Project Title:	
9	Single cell analysis of cell cycle progression	

Project Description:

We are looking for a student(s) interested in any of the following: cell cycle, cancer or microscopy.
This project will consist of culturing cells that express unique fluorescent and genetically encoded cell cycle reporters that we have developed (Zambon AC, Cytometry, 2010, Use of the Ki67 promoter to label cell cycle entry in living cells). Once proficiency is attained students will then move on to conduct video microscopy over the course of several days to quantify the heterogeneous nature of cell cycle progression and further validate improved reporter function. The student will also work on testing software developed from a collaborator on analyze videos of cells produced with the goal of quantifying kinetics of cell cycle at the single cell level.

What kind of student background is required?

Cell culture experience (preferred not required), basic pipette usage and familiarity with spreadsheet software, some experience with Matlab would also be helpful but not required. Good note taking and willingness to work occasionally on weekends is also required.

What will student learn?

Student will learn how to develop properly controlled experiments, learn about microscopy and learn how to visualize and analyze kinetic data extracted from videos. The student will also be able to expand what is learned if the student is self-motivated and efficient.

Project #	Project Title:	
10	Mitochondrial Bioenergetics in cancer	

Project Description:

In the 1920's, Otto Warburg made the observation that human cancer cells seem to produce more lactate than normal cells (Bensinger et al., 2012). In particular, Warburg and his colleagues observed this phenomenon in multiple human carcinomas even in the presence of oxygen (Bensinger et al., 2012). This occurrence, which has become known as the "Warburg effect", suggests that cancer cells eschew metabolism oxidative phosphorylation in favor of glycolysis and lactic acid fermentation. Although oxidative phosphorylation is more efficient in producing ATP from glucose, the ATP yield of glycolysis may exceed that of oxidative phosphorylation if glycolytic flux is high (DeBerardinis et al., 2008). Some have suggested that this shift in metabolic reprogramming is due to anaerobic conditions found in tumor hypoxic states (Vander Heiden et al., 2009). However, multiple

studies have found that cancer cells utilize this form of glycolytic metabolism prior to hypoxic conditions (Vander Heiden et al., 2009). Nonetheless, there appears to be mitochondrial metabolic reprogramming that occurs when cells become tumorigenic. Indeed, cells from multicellular organisms have been found to exhibit proliferative metabolic phenotypes in the presence of abundant nutrients and growth signals (Vander Heiden et al., 2009).

What will student learn?

My lab is interested in investigating the Warburg effect in breast cancer cells. Utilizing techniques such as Western blotting, mitochondrial respiration, and cell microscopy, we are investigating the mitochondrial bioenergetic changes that occur in breast cancer cells.

Project #	**Project Title:**	
11	Characterizing CREB target genes in T cells.	

Project Description:

The CREB/CRTC2 pathway has emerged as an important regulator of immune function. We have shown that the CREB/CRTC2 pathway modulates autoimmune disease by promoting differentiation of the pro-inflammatory T cell, Th17. Although Th17 cells protect us against specific pathogens, Th17 cells have been found to cause destruction of tissue in patients with autoimmune diseases. Using a novel technique called RNAseq, we have identified several genes that may be regulated by CREB in Th17 cells. The student will characterize the role of these genes in T cells to help us better understand Th17 cell development and function. The long term goal is to be able to manipulate these Th17 cells with drugs to treat patients with autoimmune disease and other inflammatory diseases.

What kind of student background is required?

Basic laboratory skills. Cell culture experience is preferred but not required. Motivated and a willingness to learn. Knowledge in immunology is a plus.

What will student learn?

T cell biology, mammalian cell culture, molecular biology and biochemistry. Some of the techniques student may learn include retroviral induction, flow cytometry, quantitative PCR, and Western blot.

Project #	**Project Title:**	
12	The effect of hyperglycemia on T cell development and function	

Project Description:

Obesity is associated with several metabolic dysfunctions such as insulin resistance, hyperglycemia, and high blood pressure, all of which are risk factors for cardiovascular disease and type 2 diabetes. Recent evidence implicates the pathological involvement of the immune system in type 2 diabetes. Excessive levels of nutrients such as glucose and free fatty acids will result in stress in pancreatic islet, adipose tissue, liver, and muscle. The stress results in the local production and secretion of pro-inflammatory cytokines and chemokines. Interestingly, clinical trials using anti-inflammatory drugs have shown to lower blood glucose levels in patients with type 2 diabetes. Although T cells have been found in insulin sensitive tissues, it is unclear what their function is in these tissues. In this study, we would like to determine the effect of high glucose levels on T cell development and function. The student will culture T cells in high glucose concentrations and study T cell survival, cell cycle, and secretion of cytokines.

What kind of student background is required?

Basic laboratory skills. Cell culture experience is preferred but not required. Motivated and a willingness to learn. Knowledge in immunology is a plus

What will student learn?

T cell biology, mammalian cell culture, molecular biology and biochemistry. Some of the techniques student may learn include retroviral induction, flow cytometry, quantitative PCR, and Western blot.

Project #	Project Title:	
13	Targeted genetic modifier screen mapping the role of the retromer in regulating autophagosome formation in Drosophila	

Project Description:

Thanks to the high degree of genetic conservation and an unparalleled arsenal of genetic tools, Drosophila is commonly employed in delineating complex cellular pathways. Macroautophagy plays a fundamental role in maintaining cellular homeostasis and cell survival by forming autophagosomes to sequester and subsequently clear unnecessary or damaged proteins and organelles, and invading microorganisms. Despite a considerable scientific interest, the precise mechanism of autophagosome formation and its regulation remain unclear. The retromer complex and retromer-dependent protein trafficking has been implicated in the process. The goal of this project is to employ a range of transgenic flies in a targeted genetic modifier screen to determine how exactly retromer regulates autophagosome formation.

What will student learn?

In addition to general lab techniques, the students working on this project will learn the basics of Drosophila genetics and maintenance; will become familiar with stereomicroscopy and basics of confocal microscopy; will learn how to utilize online databases and other resources for fly genetics; will participate in designing and setting up the genetic crosses; will become proficient in genotyping and sorting the flies; and will be able to compare, analyze and photo document the Drosophila eye phenotypes and other phenotypes.

Project #	Project Title:	
14	Protein-protein interactions between the leucine-rich repeat kinase 2 (LRRK2) and key players in macroautophagy	

Project Description:

Leucine-rich repeat kinase 2 (LRRK2) is a large multi-domain protein that is plays a key role in macroautophagy through a mechanism that has yet to be elucidated. In Drosophila, we have identified several genetic interactors of LRRK2 within the macroautophagy pathway. The goal of this project is to first validate our data in mammalian cells, and to determine if LRRK2 is part of the same molecular complex with the proteins encoded by these genetic interactors.

What will student learn?

Students will become familiar with basic molecular biology techniques and tools, such as the proper aseptic technique, cell culturing, cell survival assay, fluorescence microscopy, bacterial transformation, plasmid DNA purification, analysis of plasmid DNA concentration and purity, gene transfection, cell harvesting and cell lysis, protein quantification, co- immunoprecipitation, SDS-PAGE, western blot and image analysis by infrared fluorescence detection.

Engineering, Medical Diagnostics and Devices

Project #	Project Title:	
15	Optimizing Devices for Point of Care TB diagnosis	

Project Description:

Tuberculosis (TB) is still a global health threat, with over 8 million new cases and over 1 million deaths each year. Our overall goal of is to enable diagnosis of pulmonary tuberculosis at the point of care in low resource high burden countries by developing a portable, easy to use, integrated nucleic acid testing device that executes sample preparation, isothermal DNA amplification and lateral flow based detection without user intervention. We have designed and are currently testing a functional prototype of this system, consisting of an integrated cartridge and a compact instrument. This project focuses on further characterizing and optimizing the hardware components and process execution.

What kind of student background is required?

We are looking for students with an engineering background, or with strong aptitude for science, who are creative, able to think outside the box, and who have good manual skills.

What will student learn?

Working with our team of engineers, students will learn how to use computer-assisted design (CAD) software such as SolidWorks, and how to fabricate device components e.g. via machining, molding, or rapid prototyping. Students will learn how to execute system assembly and testing, with a focus on thermal and fluidic control.

Project #	**Project Title:**	
16	Optimizing Isothermal Nucleic Acid Amplification Assays for Point of Care TB diagnosis	

Project Description:

As described in the previous project, we have developed a device to enable diagnosis of pulmonary tuberculosis at the point of care in low resource high burden countries, which uses isothermal DNA amplification through Loop Mediated Amplification (LAMP) or Cross Priming Amplification (CPA), each coupled to lateral flow based detection. This project focuses on (1) further optimizing the sensitivity (i.e. limit of detection) of these assays as implemented in our device, (2) characterizing the specificity, i.e. lack of cross-reactivity with other pathogens, and (3) optimizing dry reagent formulations to enable storage of sensitive master-mix reagents at elevated temperatures, which is a critical requirement in the intended use settings.

What kind of student background is required?

We are looking for students with a background in biology (ideally molecular biology), who have meticulous laboratory skills, and ideally prior experience with running PCR.

What will student learn?

Students will learn how to execute various isothermal amplification methods for pathogen detection, and what is involved in assay optimization and validation for clinical diagnostic applications.

Project #	**Project Title:**	
17	Optimizing Devices for Point of Care Diagnosis of Dengue Virus Infections via Nucleic Acid Testing	

Project Description:

The incidence of Dengue virus is increasing globally, particularly in India, Southeast Asia and South America. Secondary infections with a different serotype of the virus that result in Dengue hemorrhagic fever or Dengue shock syndrome are often fatal. Our overall goal of is to enable rapid, serotype-specific detection of acute Dengue virus infections at the point of care in low resource high burden countries through nucleic acid testing. We have already developed a device that executes sample preparation, isothermal DNA amplification and lateral flow based detection without user intervention, for diagnosis of pulmonary TB from sputum. This project focuses on adapting our existing system to enable Dengue virus detection from a drop of whole blood obtained via a finger prick.

What kind of student background is required?

We are looking for students with an engineering background, or with strong aptitude for science, who are creative, able to think outside the box, and who have good manual skills.

What will student learn?

Working with our team of engineers, students will learn how to use computer-assisted design (CAD) software such as SolidWorks, and how to fabricate device components e.g. via machining, molding, or rapid prototyping. Students will learn how to build and test subsystems, and how to integrate these into a larger device.

Project #	**Project Title:**	
18	Optimizing Isothermal Nucleic Acid Amplification for Point of Care Diagnosis of Dengue Virus Infections	

Project Description:

As described in the previous project, we are modifying an existing device to enable diagnosis of acute Dengue virus infections at the point of care in low resource high burden countries. For this test, we will use isothermal amplification of the viral RNA through Reverse Transcription, followed by Loop Mediated Amplification (RT-LAMP). This project focuses on (1) optimizing the sensitivity (i.e. limit of detection) of this assays as implemented in our device, (2) demonstrating the ability to differentiate each of the four viral serotypes, and (3) coupling the assay with suitable multiplexed end point detection.

What kind of student background is required?

We are looking for students with a background in biology (ideally molecular biology), who have meticulous laboratory skills, and ideally prior experience with running PCR, and/or students with background in analytical chemistry, in particular related to biosensors.

What will student learn?

Students will learn how to execute RT-LAMP for pathogen detection, and what is involved in assay optimization and validation for clinical diagnostic applications. Students further will work with different types of biosensors.

Project #	**Project Title:**	
19	Experimental Characterization of Biohydrogel Electrostatics	

Project Description:

Mucosal Biophysics: The mucosal glycocalyx gel controls transport of nutrients, biomolecules, and therapeutics to and across the mucosal surface and also controls interaction with pathogens, commensals, and immune responses. Study of the glycocalyx sits at the intersection of glycomics, polymer physics, and ion-exchange biophysics. Bioengineering of the glycocalyx represents a fundamentally new opportunity to improve human health. With improved understanding of mucosal biophysics, efforts are underway to design an entirely new class of drugs that will better protect the body from infection, prevent heart disease, pulmonary disease, and GI disease. Diagnosis of mucosal health can also be performed through characterization of the mucosal biopolymers in different body fluids, gels, or tissues. This project focuses on the experimental characterization of biohydrogels.

What kind of student background is required?

STEM undergraduate study with lab experience. Engineering background with experience in a biology/chemistry lab is preferred.

What will student learn?

Methods of bioengineering measurement and experimental design including bioanalytical methods, rheology and surface science.

Project #	**Project Title:**	
20	Bioengineering of hydrogels	

Project Description:

The mucosal glycocalyx gel controls transport of nutrients, biomolecules, and therapeutics to and across the mucosal surface and also controls interaction with pathogens, commensals, and immune responses. Study of the glycocalyx sits at the intersection of glycomics, polymer physics, and ion-exchange biophysics. This project focuses on the mathematical modeling of the electrostatics of biohydrogels and the development of complex fits of microfluidic data to ion-partitioning within the gel. This involves developing least-squares fits to experimental data using multi-layer models of Donnan and Zeta potentials in the gel layers.

What kind of student background is required?

STEM undergraduate student with experience in differential equations and data analysis. Proficiency with computer programming and multivariate mathematical modeling of physical systems.

What will student learn?

Bioengineering of hydrogels with a focus on data analysis of microfluidic and biohydrogel experimental data.

Project #	Project Title:	
21	Design and Development of Diagnostics Biosensors	

Project Description (≤ 150 words):

This project focuses on the design, fabrication and testing of lab-on a chip (LOC) biosensors for biomolecule detection. The biosensors utilize functionalized graphene as both their recognition element and the transducer and will be used for the detection of wide range of biomarkers associated with various diseases.

What kind of student background is required?

Basic laboratory skills, Basic biology and chemistry, Knowledge in electronic and Matlab is a plus. Prior experience with 3D modeling software such as Solidworks or Pro-E is preferred.

What will student learn?

Biosensor design and fabrication, Graphene functionalization, Data collection and analysis, Scientific writing

Project #	Project Title:	
22	Microfluidic-based Small Animal Blood Filtration Systems for Identifying the Biomarkers of Aging	

Project Description (≤ 150 words):

Studies on blood exchange between young and old mice have shown reversals in the progression of aging. However, the definitive humoral elements in young mice that advance rejuvenation in old mice and those in old mice that have inhibitory effect on young animals are yet to be identified. The goal of this project is to determine the specific blood component in young or old mice responsible for rejuvenation or aging in mice. This project focuses on designing a microfluidic-based blood exchange device with an immunoaffinity module capable of continuously separating selected blood proteins during blood transfusion between young and old animals to help identify the blood components responsible for rejuvenation.

What kind of student background is required?

Basic laboratory skills, Basic biology and chemistry, flow cytometry experience is preferred. Prior experience with 3D modeling software such as Solidworks or Pro-E is preferred

What will student learn?

Design, fabrication and testing of a microfilter, 3D printing, Western Blotting, Flow Cytometry, Scientific writing.

Project #	Project Title:	
23	Fully Automated Small Animal Blood Exchange Systems for Identifying the Biomarkers of Aging	

Project Description (≤ 150 words):

Studies on blood exchange between young and old mice have shown reversals in the progression of aging. However, the definitive blood elements in young mice that advance rejuvenation in old mice and those in old mice that have inhibitory effect on young animals are yet to be identified. The goal of this project is to determine the specific blood component in young or old mice responsible for rejuvenation or aging in mice. To do so this project will focus on developing a self-contained, fully automated blood exchange system which will be connected to filtration modules developed in the lab to continuously separate different type of blood components during blood exchange to help identify their role on tissue rejuvenation.

What kind of student background is required?

Basic laboratory skills. Prior experience with 3D modeling software such as Solidworks or Pro-E is preferred

What will student learn?

Design, fabrication and testing of automated pumps and controller system, programming, 3D printing, Scientific writing

Project #	Project Title:	
24	Engineering medical diagnostics for low-resource settings	

Project Description (≤ 150 words):

In the Schlappi Lab, we develop medical diagnostics and therapeutics that benefit patients in limited-resource settings without access to hospitals or modern healthcare technology. For this project, we are focusing on multiplexed detection of urinary tract infection (UTI) pathogens in a point-of-care device. The goal is to provide pathogen identification in less than one hour without the need for complex instrumentation or trained technicians. Research areas will involve optimizing molecular biology methods for nucleic acid amplification and detection, as well as designing and fabricating microfluidic devices that handle the fluid manipulation steps.

What kind of student background is required?

A student studying the sciences, preferably bioengineering, chemical engineering, microbiology, molecular biology, or chemistry. Previous lab experience and skills are preferred.

What will student learn?

The student will learn basic molecular biology techniques and how to design and fabricate diagnostic devices. The student will also learn how to design and conduct experiments to answer research questions.

Sociology, Innovation & Entrepreneurship

Project #	Project Title:	
25	Universities and the Emergence of Biotechnology Hubs: The UCSF – Mission Bay Biotech Cluster	

Project Description:

Within the biotechnology industry most biotechnology firms agglomerate within regional clusters, usually anchored by a strong research university. That being said, there are very few successful biotechnology clusters across the world, and most major research universities have not been associated with the development of biotechnology clusters. In October 2002, UCSF opened a new medical research campus in the Mission Bay area of San Francisco. In the decade since the campus opened, Mission Bay has rapidly developed one of the most vibrant biotechnology clusters, encompassing both entrepreneurial spin-offs and numerous corporate R&D laboratories of established companies. While the existence of a large biotechnology cluster within the Bay Area certainly helped in the establishing the new biotech hub, little research has been done to explore why such a vibrant center of biotechnology activity developed so quickly.

What will student learn?

This project will use a variety of methodologies, including social network analysis and qualitative research, to develop a history of how the UCSF Mission Bay biotechnology cluster emerged and become sustainable. For the undergraduate research experience project, we will focus primarily on examining bibliometric and patent evidence, though we might also conduct some interview research.

Project #	Project Title:	
26	Measuring the Impact of California's Public Investment in Regenerative Medicine	

Project Description:

In 2006, California citizens in unprecedented numbers voted for a state bond that would assure a three billion dollar investment over a ten year period in Stem Cell Research, research that was promoted and understood to be essential to the treatment of a myriad of health issues of deep concern to the citizens of California; Cancer, MS and Alzheimer's. As this initiative approaches its tenth year of funding, an important question is what sorts of effects has this investment had on the state? This project will explore the extent to which the public investment in stem cell research has led to the creation of a sustainable research infrastructure for regenerative medicine research

in California. This infrastructure consists of both university capacity to conduct research exploring the application of stem cell technology, and commercial activities to exploit such findings within the state.

What will student learn?

The project will draw on a variety of methods, including bibliometric and patent analysis, comparisons of university stem cell grant funding before and after 2006 within the state, and data gathering on commercialization activities.

Project #	**Project Title:**	**Advisor**
27	Value-based Contracts in the Pharmaceutical Industry	Yun Liu

Project Description (≤ 150 words):

As a new attempt to contain drug prices, health insurers and pharmaceutical companies are experimenting with value-based contracts, where drug prices are contingent on the actual effectiveness of the drugs on real patients. The number of such deals has increased recently in both the U.S. and abroad but remained limited in scope. It is unclear in theory whether and to what extend value-based pricing would affect health care costs. There are also practical challenges in implementing such contracts, including the difficulty of obtaining data, high administrative costs and monitoring costs. This project will collect and examine the features of existing value-based contracts, assess the impacts of these deals on drug prices empirically, and develop theoretical economic models to inform future exploration of pricing strategies in the pharmaceutical industry.

What kind of student background is required?

Students should be able to or willing to learn to conduct literature review and to compile primary and secondary data. A background of economics or industry organization is preferred but not required.

What will student learn?

Students will acquire knowledge of pricing strategies and contracting theories, in the context of pharmaceutical industry. Students will develop abilities of gathering, analyzing, and presenting relevant information on a new front in the battle to contain drug prices.