Ultrastructural contributions to bone fragility

Nancy Pleshko
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Engineering
Bioengineering

We are interested in how bone strength and quality are impacted by aging and disease. Understanding the multifactorial nature underlying reduced bone quality is critical for improving clinical assessment and management of fracture risk. The ongoing projects in the lab focus on investigation of bone tissue composition and properties using state of the art spectroscopic imaging and fiber optic approaches combined with mechanical testing, micro CT , microscopy, biochemical analyses, and machine learning. Students involved in these projects will work with pre-clinical models, human tissues, and/or cells, and learn spectroscopic data collection and analysis, including machine learning techniques. Some projects may be data analysis-based only. Students would work closely with senior investigators and graduate students, with the potential to contribute to research presentations and publications.

Location: Main; In-person essential
Student Majors Accepted: Chemistry/(Bio)-Physics/Materials Science/Math/Data Science (Biology or Biochemistry considered)
Class Preferences: Sophomores, Juniors
Important Selection Criteria: The candidate should be motivated, willing to participate actively in the lab in a team environment, as well as capable of being responsible for their own experiments.

Electrochemical Technologies for Wastewater Treatment

Rominder Suri
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Engineering
Civil and Environmental Engineering

Treatment of complex industrial wastewaters via electrooxidation, electrocoagulation, and hybrid electrochemical technologies. Degradation of PFAS and other emerging contaminants.

Location: Main; In-person essential
Student Majors Accepted: Environmental Engineering, Chemical Engineering, Chemistry
Class Preferences: Juniors & Seniors
Important Selection Criteria: Interest in the project/research, critical thinking & problem solving skills.

Screening and detection of antibiotic resistant bacteria and genes from wastewater

Rominder Suri
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Engineering
Civil and Environmental Engineering

The intensive and widespread use of antibiotics, presence of partially metabolized residues and inadequate removal through the wastewater treatment plants (WWTPs) is leading to a severe and growing human health threat worldwide. Presence of residuals in the effluents induces selective pressure on bacterial population for the proliferation of antimicrobial resistance (AMR) through the antibiotic-resistant bacteria (ARBs) and antibiotic resistance genes (ARGs).These are being considered as emerging contaminants of concern which reduces therapeutic effectiveness of the antibiotics against the pathogens. This project will involve screening and analytical method development, involving gaining skills in environmental microbiology, water quality, molecular biology and wastewater treatment methods.

Location: Main; In-person essential
Student Majors Accepted: Environmental/Bioengineering/biology
Class Preferences: Sophomores, Juniors, Seniors
Important Selection Criteria: Some theoretical /practical background on the topics will be helpful. Training will be provided

Regulation of the PP2A tumor suppressor in normal and cancer cells

Xavier Grana
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FELS
Cancer and Cell Biology

There are various projects available that deal with the characterization of the substrate specificity of the B55Î±/PP2A holoenzyme, its regulation in normal cells and its deregulation in cancer. (1) B55Î±/PP2A holoenzyme substrate specificity. This project focuses on determining the determinants of substrate specificity of B55Î±/PP2A holoenzymes using various unrelated substrates of this holoenzyme. We have and extensive collection of B55Î± and substrate mutants and more to be made to be tested for binding using transient co-transfections made in human cells grown in culture. The project involves cell culture, transfections, immunoprecipitation, western blot analysis and generation and maintenance of plasmids. (2) To identify the motifs in substrates recognized by B55/PP2A protein phosphatases. This project is centered on determining the amino acid residues that mediate the interaction of various substrates with the PP2A. We have an extensive collection of GST-mutants to characterize these interactions. More mutants will be generated based on bioinformatics docking analysis and the results of binding assays. The project involves cell culture, GST pull-down assays, western blot analysis and generation and maintenance of plasmids. (3) Role of B55alpha/PP2A holoenzymes in prostate cancer. The project involves cell culture, organoid growth, transfections, immunoprecipitations, western blot analysis and generation and maintenance of plasmids. It may also involve confocal microscopy. (4) Immortalization of primary prostate cells and establishment of primary cancer cells. The project involves cell culture, organoid growth, transfections, immunoprecipitations, western blot analysis and generation and maintenance of plasmids. It may also involve confocal microscopy. (5) Role of B55alpha/PP2A holoenzymes in prostate cancer. The project involves cell culture, organoid growth, transfections, immunoprecipitations, western blot analysis and generation and maintenance of plasmids. It may also involve confocal microscopy.

Location: HSC; In-person essential
Student Majors Accepted: Biochemistry, Biology, Bioinformatics - Genetics and/or Biochemistry and/or Cell Biology
Class Preferences: Freshmen, Sophomores & Juniors
Important Selection Criteria: Motivation for Science and Research. Background knowledge: Previous lab experience is NOT required.

Role of STIM-dependent calcium signals in T cell differentiation

Jonathan Soboloff
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FELS
Cancer and Cellular Biology

T cells are critical players in adaptive immunity. T cells are made in the thymus and then released into peripheral blood where they seek out foreign agents. One of the first events that occurs in T cells when activated is a change in cytosolic calcium concentration. These calcium responses drive their differentiation into multiple differentiated T cell subsets that control the immune response in a manner dependent on both the duration and intensity of the calcium signal. We utilize a combination of cell lines and mouse models to understand the molecular events in control of calcium signal generation and T cell differentiation. This project would involve working closely with senior investigators in my lab, with the potential to learn multiple research approaches. Some prior students have earned publications.

Location: HSC; In-person essential
Student Majors Accepted: Biology, Biochemistry
Class Preferences: Sophomores, Juniors & Seniors
Important Selection Criteria: Student must be enthusiastic with a genuine interest in learning research. Prior lab experience would be highly desirable but not required. Project involves cell culture, Western blots, cloning and fluorescence microscopy.

Genetics and Epigenetics of sex-specific expression patterns in early embryogenesis

Nora Engel
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FELS
Cancer Biology - Fels Institute

We are investigating differences between male and female mouse embryonic stem cells and mouse embryos, and identifying the mechanisms by which these early differences are established. We integrate gene expression, DNA methylation and chromatin conformation analyses with bioinformatics to establish how sex biases affect cellular phenotypes in health and disease.

Location: HSC; In-person essential
Student Majors Accepted: Biology
Class Preferences: Juniors & Seniors
Important Selection Criteria: Basic laboratory skills, such as pipetting, running gels, PCR and making solutions required.

Epigenetic Factors and the Microbiome in Disparities in Colon Cancer Outcomes

Carmen Sapienza
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LKSOM
Cancer and Cellular Biology/Fels Cancer Institute for Personalized Medicine

Racial disparities in colorectal cancer provide one indication that biology-based factors may be at play. Colorectal cancer mortality rates for African American men and African American women are higher than for Caucasian men and women. African American colorectal cancer patients also appear less likely to develop microsatellite instable cancers (a form of colorectal cancer with improved outcome, resulting from mutation or epigenetic silencing of genes involved in DNA mismatch repair) as their Caucasian counterparts. Moreover, African American patients who are asymptomatic are more likely to have large pre-cancerous adenomatous polyps present on colonoscopy screening than their Caucasian counterparts. These observations suggest that genetic and/or environmental factors that differ between African Americans and Caucasians are influencing both the initiation of colorectal cancer, as well as patient outcomes.

Location: HSC; In-person essential
Student Majors Accepted: All Majors
Class Preferences: Freshmen, Sophomores, Juniors & Seniors
Important Selection Criteria:

The role of extracellular vesicles in vascular disease

Victor Rizzo
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LKSOM
Cardiovascular Research Center

Atherosclerosis, hypertension and aneurysms are the major causes of cardiovascular disease (CVD) including heart attack and stroke. Despite recent advances in clinical therapies, CVD remains the leading cause of morbidity and mortality world-wide. Thus, there is a need to discover the underlying mechanisms that lead to CVD. Inter-cellular communication is essential for maintenance of blood vessel homeostasis and disease development. Our laboratory is interested in a new mechanism of cell-cell communication which involves extracellular vesicles (EV). These vesicles carry unique cargo (lipids, proteins, miRNAs and DNA) which can be transmitted to target cells as well as serve as biomarkers which indicate the heath status of the vasculature. Specific projects focus on 1) characterization of EVs in vascular health and disease 2) functional effects of EVs in the vasculature and 3) the potential for EVs to act as therapeutic agents to treat CVD.

Location: HSC; In-person essential
Student Majors Accepted: Biology, Biochemistry, Chemistry or Bioengineering
Class Preferences: Freshmen, Sophomores, Juniors & Seniors
Important Selection Criteria: Seeking motivated students who desire to gain hands-on experience in basic biomedical research.

Investigation of vascular inflammatory disease

Michael Autieri
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LKSOM
Cardiovascular Sciences

Vascular disease is epidemic in our society and is getting worse. Our lab studies the molecular mechanisms of atherosclerosis, restenosis, and angiogenesis. We have several mouse models of vascular disease, and we would teach the URP student how to dissect various tissues from these mice, and then process them for histology and immunohistochemistry. Possibility for more molecular techniques if time/situation permits.

Location: HSC; In-person essential
Student Majors Accepted: Biology, Chemistry, Pre-med
Class Preferences: Juniors, Seniors
Important Selection Criteria: Biology is required. Molecular or cell biology, anatomy and physiology would be helpful, but not required. Prior lab experience would also be helpful. Willingness to work with mice.

Heart Failure with Preserved Ejection Fraction

Steven Houser
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LKSOM
Cardiovascular Sciences

Heart Failure with Preserved Ejection Fraction (HFpEF) is a major health problem and accounts for half of the heart failure deaths. We have developed an animal model that develops HFpEF. We are using this model to define major cellular and molecular mechanisms that underlie HFpEF. We are also testing novel therapies that could reduce the HFpEF phenotype. Students would need to work in a team to contribute to this translational science.

Location: HSC; In-person essential
Student Majors Accepted: Biology/Pre Med/Pre Science
Class Preferences: Sophomores, Juniors, Seniors
Important Selection Criteria: Hard working. Team oriented

Angiogenic effect of Carom KO in murine models

Hong Wang
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LKSOM
Cardiovascular Sciences

Carom is a novel homocysteine (Hcy) response protein. Hyperhomocysteinemia (HHcy), a syndrome displayed by high concentration of Hcy in plasma has been demonstrated as a significant risk factor for cardiovascular disease and inhibition of blood vessel growth (angiogenesis). We have shown in vitro that Carom can inhibit EC function and it's knockout can rescue Hcy inhibited EC functions. This project will demonstrate Carom's effect in vivo. We have produced several murine Carom knockout trains and study several angiogenic assays in these strains. The student will receive hands on experience in DNA technology and histology.

Location: HSC; In-person essential
Student Majors Accepted: Biology, Biochemistry, Bioinformatics
Class Preferences: Sophomores, Juniors
Important Selection Criteria: Highly motivated and responsible

HHcy suppresses microglial Aβ phagocytosis in Alzheimer's disease

Hong Wang
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LKSOM
Cardiovascular Sciences

Alzheimer's disease (AD) is a neurodegenerative disorder characterized by initial memory impairment and cognitive decline. AD development can be caused by complex interactions among multiple factors including age, genetics, lifestyle, and coexisting medical disorders. The pathological features of AD are extra-neuronal accumulation of amyloid β (Aβ) protein and intra-neuronal deposition of neurofibrillary tangles composed of hyperphosphorylated tau protein. Hyperhomocysteinemia (HHcy) is an established independent risk factor for AD. However, the role of HHcy on microglia (MG) function and Aβ phagocytosis in AD development is unknown. In this project, we will determine effect of HHcy in microglial Aβ phagocytosis, and AD pathology in HHcy mice and cultured MG.

Location: HSC; In-person essential
Student Majors Accepted: Highly motivated and responsible
Class Preferences: Sophomores, Juniors
Important Selection Criteria: Highly motivated and responsible

Liver cytotoxic effects in metabolic disorders

Hong Wang
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Cardiovascular Sciences

We study liver cytotoxic effects in metabolic disorders mice and experimental conditions. We generated transgenic mice deficient with genes encoding key enzymes in amino acid metabolic and identified significant liver pathology in these mice. We will characterize lipid glucose and amino acid metabolism and examine mechanisms determining liver cytotoxic effects in metabolic disorders.

Location: HSC; In-person essential
Student Majors Accepted: Biology, Biochemistry, Bioinformatics
Class Preferences: Sophomores, Juniors
Important Selection Criteria: Highly motivated and responsible

Organ Specific Endothelial Cell Heterogeneity

Hong Wang
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LKSOM
Cardiovascular Sciences

Endothelial Cell (EC) formed vascular network to support organ blood supply, and contribute to organ development and function. Organ specific endothelial cell heterogeneity is not well understood. We are characterizing gene expression profile in endothelial cells isolated from different mouse organ and will study their functional implication in different organ. We will also analyze gene expression changes in different vascular beds in metabolic disease models and identify organ-specific molecular targets in metabolic disease.

Location: HSC; In-person essential
Student Majors Accepted: Biology, Biochemistry, Bioinformatics
Class Preferences: Sophomores, Juniors
Important Selection Criteria: Highly motivated and responsible

Vascular energy metabolism (bioenergetics)

Hong Wang
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LKSOM
Cardiovascular Sciences

Hyperhomocysteinemia (HHcy) is an independent risk factor for cardiovascular disease (CVD). We will study metabolic cross talk between homocysteine (Hcy) metabolism and glucose metabolism, and analyses glycolysis & mitochondrial respiration in vascular cells. We will use genetic, biology and biochemical tools to characterize the molecular pathway underlying HHcy–altered vascular energy metabolism and its role in CVD.

Location: HSC; In-person essential
Student Majors Accepted: Biology, Biochemistry, Bioinformatics
Class Preferences: Sophomores, Juniors
Important Selection Criteria: Highly motivated and responsible

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Molecular control of atherosclerotic plaque stability

Jun Yu
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LKSOM
Cardiovascular Sciences/CMDR

Cardiovascular diseases are still a leading cause of death worldwide. Unstable atherosclerotic rupture, rather than narrowing of the blood vessel, is the major cause of myocardial infarction. Using novel small animal models and state-of-the-art technologies, this project is aimed at uncovering molecular control of this deadly pathological processes, and provide proof-of-concept for developing new drug target to treat coronary artery disease.

Location: HSC; In-person essential
Student Majors Accepted: Biology, Biochemistry, pharmacology, or Biostatistics
Class Preferences: Juniors, Seniors
Important Selection Criteria: Highly motivated and responsible. Basic cell and molecular biology techniques and understanding of human physiology are a plus.

Molecular control of vascular remodeling and lymphangiogenesis

Jun Yu
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LKSOM
Cardiovascular Sciences/CMDR

The focus of the project is to identify novel signaling pathways that regulate vascular angiogenesis and lymphangiogenesis, one of the major cardiovascular problems. Reticulon family proteins (RTN) are mainly localized to endoplasmic reticulon (ER) and regulate mitochondria associated ER membrane (MAM). In this project we are using genetic modified animal models, cellular and molecular techniques to uncover how Nogo-B, the only RTN-4 family protein expressed in vessel wall, regulate MAM remodeling in endothelial cells, and vascular and lymphatic angiogenesis in diabetes.

Location: HSC; In-person essential
Student Majors Accepted: Biology, Biochemistry, or Pharmacology
Class Preferences: Sophomores, Juniors & Seniors
Important Selection Criteria: Highly motivated and responsible. Basic cell and molecular biology techniques and understanding of human physiology are a plus.

The mechanisms of lung injury

Beata Kosmider
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LKSOM
Center for Inflammation and Lung Research

Multiple factors can induce lung injury leading to pulmonary diseases such as emphysema or fibrosis. Our goal is to determine the mechanisms of lung injury using cells lines and samples obtained from patients with these diseases. We use various laboratory methods in our projects.

Location: HSC; In-person essential
Student Majors Accepted: N/A
Class Preferences: Freshmen, Sophomores, Juniors & Seniors
Important Selection Criteria: N/A

Studying offspring metabolic and reproduction associated with PCOS mom

Sheng Wu
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LKSOM
Center for Metabolic Disease Research

Pregnant mice which have increased testosterone will be mated with normal male mice for 3 months, their offspring will be examined for insulin signaling, glucose homeostasis, puberty and fertility

Location: HSC; In-person essential
Student Majors Accepted: Biology and/or science orientated majors
Class Preferences: Sophomores, Juniors, Seniors
Important Selection Criteria: responsible and self-motivated students who are interested in studying human diseases associated with sex hormones using mouse model.

Studying sex hormones effects on liver, central nervous system and ovary

Sheng Wu
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LKSOM
Center for Metabolic Disease Research/ Cardiovascular Sciences

Our lab is using genetic modified mouse models, cellular and molecular techniques to identify how steroid hormones affect metabolic function (such as insulin signaling pathway and glucose homeostasis); Especially investigate the molecular mechanisms of testosterone sexual dimorphic effects on liver function, focus on the link between type 2 diabetes and polycystic ovary syndrome

Location: HSC; In-person essential
Student Majors Accepted: Biology, Biochemistry, or pharmacology
Class Preferences: Sophomores, Juniors, Seniors
Important Selection Criteria: Interested in metabolic diseases. Highly motivated and responsible.

Causal pathways of overuse injury

Mary Barbe
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LKSOM
Center for Translational Medicine

To determine in young adult rats, using our operant model of overuse injuries: (a) causal pathways in overuse MSKIs, focusing on roles of poor sleep, inflammation and fibrosis; (b) whether sleep has a role in moderating pain intensity/persistence; and (c) whether undisturbed sleep or whole body exercise, and reduced fibrosis using a novel antibody against a fibrogenic molecule (anti-CCN2), or a combination, effectively reduces pain and improves function.

Location: HSC; In-person essential
Student Majors Accepted: Biology, or health science related degree
Class Preferences: Juniors & Seniors
Important Selection Criteria: Western blot/electrophysiology or microscopy skills (or desire to learn)

Cardiac Fibrosis in Heart Failure

John Elrod
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LKSOM
Center for Translational Medicine

Approximately six million adults in the US suffering from heart failure (HF), representing a significant health care burden for the nation. A common feature of HF is excessive extracellular matrix deposition by a specialized and differentiated fibroblast population, known as myofibroblasts, in response to injury of the heart. While myofibroblasts help maintain the structure of the injured heart and prevent heart wall rupture, persistence of myofibroblasts results in excessive fibrosis and cardiac dysfunction. Therefore, identifying molecular mechanisms of myofibroblast differentiation in cardiac fibrosis could yield novel clinical targets to delay or reverse the development of HF. Our lab is studying the mechanisms by which metabolism controls the epigenetic reprogramming of myofibroblasts. These projects have identified enzymes that produce acetyl-CoA as crucial regulators of myofibroblast differentiation and as players in the epigenetic reprogramming of cardiac fibrosis. We hypothesize that stress and injury alter the metabolism of cardiac fibroblasts and affect how acetyl-CoA bioavailability mediates changes in histone acetylation and chromatin structure to activate the myofibroblast gene program.

Location: HSC; In-person essential
Student Majors Accepted: Biology, Chemistry, Biochemistry, Neuroscience
Class Preferences: Sophomores, Juniors
Important Selection Criteria: Priority placed on previous molecular biology laboratory experience. Self-motivated, hard-working individuals with a desire to learn are a must.

Mitochondrial Calcium Exchange in Alzheimer's Disease

John Elrod
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LKSOM
Center for Translational Medicine

Alzheimer's disease (AD) is a progressive neurodegenerative disease characterized by memory loss, neuronal death, and rapid cognitive decline. The "amyloid hypothesis" of AD posits that accumulation of amyloid beta (Aß) plaques in the brain parenchyma is a primary mechanism of neuronal death and AD pathogenesis. Unfortunately, the amyloid pathway has proven to be an ineffective therapeutic target through multiple clinical trials and effective treatments for AD remain elusive. Our lab has previously demonstrated that mitochondrial calcium (mCa2+) overload promotes AD pathology. mCa2+ overload causes excessive production of reactive oxygen species (ROS), metabolic derangement, and cell death, all hallmark features of AD. Our lab has shown significant alterations in expression of mCa2+-handling machinery in human brains from sporadic AD patients and established these changes to be causal of AD pathology and cognitive decline using mouse models of AD. We are currently working to understand how alterations of mCa2+ regulatory proteins affect disease course. Students will develop strong foundations in basic cell and molecular biology techniques (mouse handling, genotyping, cell culture, cloning, fluorescence microscopy etc.) as well as be exposed to more advanced and specialized techniques such as behavioral phenotyping. We seek driven, dependable, and articulate individuals for this project.

Location: HSC; In-person essential
Student Majors Accepted: Any
Class Preferences: Sophomores, Juniors
Important Selection Criteria: Priority placed on previous molecular biology laboratory experience. Self-motivated, hard-working individuals with a desire to learn are a must.

Mitochondrial Calcium Exchange in Heart Disease

John Elrod
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LKSOM
Center for Translational Medicine

Mitochondrial calcium exchange plays a critical role in regulating cellular bioenergetics, but also contributes to cell death. The overall goal of this project is to understand how alterations in mitochondrial calcium exchange contribute to cardiac injury and heart failure. Our lab has generated numerous genetic mouse models to knock out or overexpress the genes facilitating mitochondrial calcium uptake and efflux in the heart, and we are currently using surgical models of heart failure to assess how perturbation of these pathways protects or predisposes to heart disease. We are also taking in vivo and in vitro approaches to understand the molecular mechanisms that regulate the activity of these calcium handling proteins in order to understand how they could be targeted therapeutically. Students will gain experience in standard cell and molecular biology techniques as well as mouse handling, genotyping, and cardiovascular phenotyping. We seek driven, dependable individuals for this project.

Location: HSC; In-person essential
Student Majors Accepted: Biology, Chemistry, Biochemistry, Neuroscience
Class Preferences: Sophomores, Juniors
Important Selection Criteria: Priority placed on previous molecular biology laboratory experience. Self-motivated, hard-working individuals with a desire to learn are a must.

Myeloid cell responsiveness to cardiac injury

Douglas Tilley
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LKSOM
Center for Translational Medicine

We are investigating the impact of altered receptor expression/signaling in myeloid cells on their responsiveness to cardiac injury. The URP student will be involved in assessing markers of cardiac injury and remodeling via immunohistochemical and biochemical/molecular biology assays.

Location: HSC; In-person essential
Student Majors Accepted: Biology and Chemistry
Class Preferences: Sophomores, Juniors & Seniors
Important Selection Criteria: Previous research lab experience a plus

The role of ADGRs in the heart

Douglas Tilley
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LKSOM
Center for Translational Medicine

We are investigating the impact of a new class of receptors, adhesion G protein-coupled receptors, on cardiac function and remodeling during heart failure. The URP student will be involved in analyzing echocardiography data for function and immunohistochemical and molecular biology readouts will be used to assess remodeling parameters. Some in vitro work to assess receptor activity/responsiveness may also be pursued.

Location: HSC; In-person essential
Student Majors Accepted: Biology and Chemistry
Class Preferences: Sophomores, Juniors & Seniors
Important Selection Criteria: Previous research lab experience a plus.

Stem cell therapy for cardiac repair

Sadia Mohsin
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LKSOM
DCVS

The project would help in understanding different mechanisms that could be involved in heart repair after stem cell or exosomes transplantation after cardiac injury. Immune response is one of the major events that occur after injury. We would study how stem cells can play a part in modulating immune response after myocardial infarction.

We will also study interaction of stem cells and other heart cell types including fibroblasts and myocytes.

Location: HSC; In-person essential
Student Majors Accepted: All majors
Class Preferences: Sophomores, Juniors & Seniors
Important Selection Criteria: N/A

Optimizing Prehospital Stroke Systems of Care-Reacting to Changing Paradigms (OPUS-REACH)

Derek Isenberg
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LKSOM
Emergency medicine

The Optimizing Prehospital Stroke Systems of Care-Reacting to Changing Paradigms (OPUS-REACH) is a consortium of nine health systems committed to improving stroke care. Approximately, one year ago, nine hospitals formed the OPUS-REACH consortium with the intention of studying the care of LVO stroke patients. With Temple University as the hub, the network developed and implemented a research plan to create a registry of real world LVO stroke patients. The registry includes data from prehospital dispatch to ninety-day functional outcomes.

Students will be responsible for assisting Dr. Isenberg with data collection, data cleaning, and data analysis. Students will learn about the prehospital care of stroke patients and stroke systems of care.

Location: HSC; Virtual or computational research
Student Majors Accepted: Public Health, Nursing, Data Science
Class Preferences: Sophomores, Juniors & Seniors
Important Selection Criteria: Good organization skills, knowledge of working with data sets, basic medical knowledge

Thermosensitive Archaeosomes

Parkson Chong
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LKSOM
Medical Genetics & Molecular Biochemistry

Archaeal bipolar tetraether liposomes (BTL, ~150 nm) are remarkably stable and robust biomaterials, holding great promise for technological applications. The goals of this research are two-fold. First, we plan to use biochemical and biophysical tools to gain a deeper molecular understanding of the structure-activity relationship of BTL liposomes in order to improve their usage as biomaterials and explore their possible new applications. Second, we plan to design and fabricate novel thermosensitive BTL for targeting cancer cells and conducting controlled drug release. BTL will be isolated from the thermoacidophilic archaeon Sulfolobus acidocaldarius. Biochemical assays, archaea growth, tetraether lipid isolation, cell cultures, cell viability assays, optical spectroscopy, cryo-electron microscopy, and liposome technology will be employed.

Location: HSC; In-person essential
Student Majors Accepted: chemistry, biology, biophysics, bioengineering
Class Preferences: Sophomores, Juniors
Important Selection Criteria: having passion in science and willing to devote a significant amount of time to the lab work

Anti-thrombotic Liposomes

Parkson Chong
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LKSOM
Medical Genetics and Molecular Biochemistry

This project is to develop a more potent and safer anti-thrombotic agent that can be utilized clinically to reduce the incidents of strokes and pulmonary embolism, the fifth leading cause of death in the United States accounting for the death of nearly 150,000 individuals in 2019. Recently, we, partnered with Dr. Larry Goldfinger at Jefferson, found that, in mice models, Zn(II)-bis-dipicolylamine-cyanine 3[22,22] (abbreviated DPA-Cy3[22,22])-containing liposomes exhibited an anti-thrombotic activity and did not lead to thrombocytopenia. Our findings led to a new US patent (Number 11,090,309, issued August 17, 2021) entitled “Antithrombotic Agents and Methods of Use Thereof”. In this research project, the specific aims are to (i) characterize how DPA-containing liposomes interact with the activated platelets and (ii) to develop a new DPA-liposome formulation that will optimize the antithrombotic activity. To achieve these aims and to examine the effect of liposome composition and particle size on the binding of DPA-containing liposomes to activated versus un-activated platelets, we will design in vitro experiments (i.e., no animals will be used). We will employ liposome methodology, dynamic light scattering, particle tracking, and fluorescence spectroscopy. The obtained results will shed light on the mechanism underlying the anti-thrombotic effect of DPA-containing liposomes and pave the way for more advanced in vivo studies of DPA-containing liposomes, in hopes of producing a truly new and clinically useful anti-thrombotic agent.

Location: HSC; In-person essential
Student Majors Accepted: Biology, Chemistry, and Biophysics
Class Preferences: Sophomores, Juniors
Important Selection Criteria: with great interests in basic science research

Deciphering the role of STAT2 in colorectal cancer

Ana Gamero
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LKSOM
Medical Genetics and Molecular Biochemistry

Cancer is a very complex disease driven by multiple genetic alterations. The focus of my research is to investigate the mechanism by which the transcription factor STAT2 promotes tumor progression in colorectal cancer. The long-term goal of this project is to determine how STAT2 cooperates with tumor oncogenes to enable tumor progression, conversion of benign lesions to malignant and metastasis. Understanding this process will lead to the development of novel therapeutic interventions to treat colorectal cancer.

Location: HSC; In-person essential
Student Majors Accepted: Biology and Biochemistry
Class Preferences: Sophomores, Juniors & Seniors
Important Selection Criteria: No prior research experience is required. Good communication skills, attention to detail and able to follow directions. Self-motivated, eager to learn.

Genetic studies of brain malformation

Seonhee Kim
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LKSOM
Neural Sciences

To study the pathogenic mechanisms underlying brain malformation, our lab aims to identify the molecular and cellular changes leading to abnormalities in brain morphogenesis. We have collected mouse genetic mutants and systematic detailed phenotypic analyses will be conducted. Histology, immunostaining and imaging analyses will be performed.

Location: HSC; In-person essential
Student Majors Accepted: Biology related
Class Preferences: Sophomores
Important Selection Criteria: Motivated, basic biology courses with good academic standing

Spinal cord injury in MMC

Barbara Krynska
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LKSOM
Neural Sciences

Myelomeningocele (MMC), the most common and severe type of spina bifida, is a devastating congenital neural tube defect. The defect is characterized by protrusion of the spinal cord and meninges through a pathological opening in the overlying vertebrae and skin, leaving the spinal cord exposed to the intrauterine environment. The underlying defect leads to prenatal injury to the exposed spinal cord and a spectrum of associated abnormalities leading to life-long disabilities.

One segment of our research focuses on understanding of pathophysiological alterations associated with the prenatal injury to the exposed MMC spinal cord and exploring the causative factors and possible mechanisms by which these alterations are induced. This work includes examination of mechanisms underlying the formation of astrocytosis, analysis of extracellular matrix imbalance as well as other pathophysiological derangements that parallel the injury. In addition, our research involves analysis of MMC-associated changes in the amniotic fluid components and identification of novel diagnostic biomarkers for MMC.

For these studies, we use rat model of MMC and a variety of in-vitro systems. By elucidating the cellular and molecular mechanisms underlying spinal cord injury in MMC, we aim to develop novel approaches for the prenatal treatment of this defect to lessen the burden of neural injury and to identify potential biomarkers for the diagnostic strategies that can aid in the detection and management of MMC.

Location: HSC; In-person essential
Student Majors Accepted: Biology, neuroscience.
Class Preferences: Sophomores & Juniors
Important Selection Criteria: Biology, biochemistry or neuroscience major courses.

Noncoding RNAs in reward

Stephanie Sillivan
stephanie.sillivan@temple.edu
LKSOM
Neural Sciences

Student will measure expression of noncoding RNA pathways in brain tissue from animals that have undergone a learning task. Student may study the brain circuits involved in regulating the noncoding RNA pathway during reward learning. Student may evaluate behavior of animals during a reward learning task after manipulation of noncoding RNA pathways.

Location: HSC; In-person essential
Student Majors Accepted: biology or neuroscience
Class Preferences: Sophomores, Juniors, Seniors
Important Selection Criteria: Must be willing to work with animals

Analysis of transgenic mice to study Peripheral nerve degeneration, tumorigenesis or regeneration

Young-Jin Son
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LKSOM
Neural Sciences

Student(s) will be involved in immunohistochemical, Western blotting and/or electron microscopic analysis of various transgenic or knockout mice in which expression of Yap/Taz or related factors are removed or increased selectively in Schwann cells. We aim to understand how Yap/Taz contribute to the normal maintenance, tumorigenesis and regeneration of fully functional motor and sensory nerve in adult.

Location: HSC; In-person essential
Student Majors Accepted: Biology, Neuroscience, Chemistry or related
Class Preferences: Juniors & Seniors
Important Selection Criteria: high motivation and serious about learning bench work, excellent organization skills

Prostate Cancer in Renal Transplant recipients

Sunil Karhadkar
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LKSOM
Surgery

An increasing number of older patients are being transplanted and as the longevity of the transplanted patients increases, there is an increase in risk of developing prostate cancer. This project aims to determine risk factors for developing prostate cancer in patients with kidney failure and following kidney transplantation.

Location: HSC; Virtual or computational research
Student Majors Accepted: All majors
Class Preferences: Freshmen, Sophomores, Juniors & Seniors
Important Selection Criteria: Data science skills preferred but not an absolute requirement.

Renal dysfunction after Lung Transplantation

Sunil Karhadkar
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LKSOM
Surgery

A decline in renal function in the first 6 months after heart or lung transplantation progressively worsens in subsequent years. Furthermore, up to 5% of patients eventually progress to end-stage renal disease (ESRD) requiring permanent renal replacement therapy. The prevalence of renal failure following lung transplant is 26% and 38%, at 1 and 5 years, respectively. However, little is known about the prevalence of RF in the immediate post-operative period following lung transplantation and the long-term consequences of peri-operative RF.
This project seeks to determine the prevalence of RF in lung transplant recipients, to identify pre-operative and intra-operative predictive factors for RF, and to assess the effects of RF on long-term renal function and survival.

Location: HSC; Virtual or computational research
Student Majors Accepted: Biology, Premed
Class Preferences: Freshmen, Sophomores, Juniors & Seniors
Important Selection Criteria: N/A

Structural Organization of Bacterial Biofilms

Bettina Buttaro
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LKSOM
Thrombosis Center

Our multi-disciplinary laboratory works in collaboration with mathematicians (Drs. Klapper and Queisser) and an engineer (Dr. Picone) to understand how structural arrangements of bacterial biofilms influences their biological behavior. We have three major projects. (1) Determining how pheromone responsive plasmids remodel commensal Enterococcus faecalis biofilms to produce heterologous rigid structures in their otherwise viscous biofilms and if these structures increase Enterococcal virulence. (2) Determining if flow around heterologous rigid structures creates unique new environments protecting microbiota from antibiotic killing and organizing bacterial metabolism. Using Gram-positive E. faecalis and Gram-negative E. coli as models (Dr. Tükel), this may lead to a better understanding of the metabolic organization of complex microbiota communities and their ability to survive in the presence of antibiotics. (3) In collaboration with the national park service, we are modeling how bacterial biofilm communities organize themselves to survive on marble monuments.

Location: HSC; In-person essential
Student Majors Accepted: Biology. Chemistry
Class Preferences: Sophomores, Juniors, Seniors
Important Selection Criteria: The laboratory accepts motivated, hard working students with any level of training and experience.

Development of drug delivery systems with enhanced in vivo stability

Marc Ilies
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Pharmacy
Pharmaceutical Sciences

Drug delivery systems can modify the pharmacokinetics of drugs, protect them from decomposition and control their spatial and temporal delivery in the organism. In recent years we were involved in the development of drug delivery systems based on amphiphilic compounds of different molecular weight, from simple surfactants, gemini surfactants, lipids, dendrons and polymers. We are currently seeking talented and highly motivated students to develop the next generation of drug delivery systems with enhanced in vivo stability capable of long circulation time in the human body. Students majoring in chemistry, biochemistry and biology are welcomed. Experience in working with cells and animal models is a plus but it is not required

Location: HSC; In-person essential
Student Majors Accepted: Chemistry, Biochemistry, Biology
Class Preferences: Freshmen, Sophomores, Juniors & Seniors
Important Selection Criteria: General knowledge in chemistry, biochemistry, biology and especially in the interdisciplinary integration of this knowledge is needed.

Synthesis, physicochemical and biological evaluation of novel carbonic anhydrase inhibitors, activators and their pharmaceutical formulations

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Pharmacy
Pharmaceutical Sciences

Carbonic anhydrases (CAs, E. C. 4.2.1.1) are a class of ubiquitous metalloenzymes that catalyze the reversible hydration of carbon dioxide: $CO_2 + H_2O \leftrightarrow HCO_3^- + H^+$. Fourteen isozymes are currently known in humans, with different catalytic activity, subcellular localization and tissue distribution. These isozymes are involved in critical physiologic and pathologic processes including respiration, acid-base regulation, electrolyte secretion, bone resorption/calcification, gluconeogenesis, tumorigenicity and the growth and virulence of various pathogens. Some of them are over-expressed in pathological conditions such as edemas, glaucoma, obesity and cancer. Therefore CA isozymes have become important targets for pharmaceutical research. We are seeking talented and passionate individuals to be involved in the synthesis, physicochemical and biological testing of novel selective CA inhibitors and of their pharmaceutical formulations aiming towards treatment of various forms of cancer via novel drugs and drug delivery systems.

Location: HSC; In-person essential
Student Majors Accepted: Chemistry, Biochemistry, Biology
Class Preferences: Freshmen, Sophomores, Juniors & Seniors
Important Selection Criteria: Previous experience in synthesis, physicochemical and/or biological evaluation of organic compounds and their formulations, as well as towards tissue cell cultures constitutes a plus.