USC Graduate School

JumpStart

SUMMER RESEARCH PROGRAM OVERVIEW

USC's JumpStart Program aims to provide a pathway to PhD programs for undergraduate students.

JumpStart works with USC programs to invite diverse candidates from outside institutions to apply for 10-week in-person summer research opportunities in various PhD disciplines.

Available opportunities range from lab-based research to mentored participation in other types of faculty projects. The JumpStart program requires a full-time commitment.

JumpStart students present their research at the end of the 10-week program.

*All admitted applicants must complete a second process related to stipend eligibility before starting the program. Stipend may be subject to taxation.

PROGRAM BENEFITS

- $5,000 Stipend*
- Campus housing
- PhD Mentor
- Health insurance
- Parking passes
- PhD application fee waiver to USC
- Professional development sessions

ELIGIBILITY

- Interested in pursuing a Ph.D.
- Sophomores, juniors, and seniors enrolled in a 4-year college (and continuing as an undergraduate in Fall 2025)

OR

- Community college students with at least 30 completed transferrable units (in-state applicants only)

APPLY NOW

USC Graduate School

JumpStart

APPLICATION REQUIREMENTS

- Personal statement about research interests
- Short statement about academic and professional goals
- Current Transcripts (official or unofficial)
- Resume or CV
- One (1) letter of recommendation from faculty

PROGRAM DATES

- Application opens: January 2025
- Deadline to apply: **February 28, 2025**
- Program Starts: June 2, 2025
- Program Ends: August 4, 2025

PROGRAM STRUCTURE

- Full-time commitment
- Research (approx. 30-35 hours in lab)
- Professional development sessions
- Meetings with PhD mentor
- Check-ins with staff
- Program dinners
- Community outings
- Poster Symposium at the end of the program

*Unable to accommodate summer class or outside work obligation

Please direct questions to the program coordinator at GradDIA@usc.edu.

APPLY NOW

OPPORTUNITIES BY MAJOR

A color-coded guide to find opportunities by major. This list is meant to be a guide only, please review each opportunity thoroughly.

STEM

- Aerospace Engineering
- Applied Mathematics
- Biochemistry
- Bioinformatics
- Biology
- Biomedical Engineering
- Cell Biology
- Chemistry
- Cognitive Science
- Computational Biology
- Computer Engineering
- Computer Science
- Craniofacial Biology
- Data Science
- Developmental Biology
- Electrical Engineering
- Engineering
- Genetics
- Kinesiology
- Mathematics
- Mechanical Engineering
- Medicinal Chemistry
- Microbiology
- Molecular Biology
- Neurobiology
- Neuroscience
- Occupational Therapy
- Operation Research
- Pharmacology
- Physics
- Pre-Health Sciences
- Pre-Med
- Pre-Physical Therapy
- Statistics

SOCIAL SCIENCES

- Child Development
- Developmental Psychology
- Education
- Geography
- Human Development
- Journalism
- Linguistics
- Psychology
- Public Policy
- Social Sciences
- Social Work
- Urban Planning
- Urban Studies

HUMANITIES + ARTS

- Animation
- Cinema
- History

LEGEND

Orange circle = Humanities

Blue circle = STEM

Pink circle = Social Sciences

MEDIA ARTS + PRACTICE/
BRIDGE INSTITUTE

ALEXANDER MCDOWELL, R.D.I.

World Building Media Lab

1) Art science research for a new visual language for Molecular Biology, in association with the Dornsife Bridge Institute; 2) research into world building practice in association with multiple international schools in the global Junk Consortium.

The World Building Institute is an extension of the lab and is connected to several other schools globally through the Junk Consortium. There are opportunities to interact with and use any of these schools as a resource in the research. The Junk program is an additional element of world building research at the lab.

For more information, please visit:
https://worldbuilding.usc.edu/

STUDENT LEARNING OUTCOMES

The student will be immersed in a cross-platform practice of world building, at multiple scales, in collaboration with different academic institutions, with broad application for multiple disciplines. They will engage media from mixed reality primarily VR and AR, film-making in virtual space, AI / machine learning tools, the application of storytelling and narrative design in complex systems.

PREFERRED MAJORS

Animation, Cinema, Sciences, Journalism

OPEN TO

Community college students, 4-year college students

CAMPUS

University Park Campus

CRANIOFACIAL MOLECULAR BIOLOGY

DR. AMY MERRILL-BRUGGER

Disorders of the temporomandibular joint (TMJ) - Investigations of the craniofacial skeleton

Disorders of the temporomandibular joint (TMJ) of the jaw are a common source of chronic jaw joint or chewing muscles pain, or pain that spreads to the face, neck, shoulders, or back. TMJ disorders can also cause clicking and popping when opening or closing the mouth in addition to jaw locks, headaches and migraines, earaches, teeth grinding or clenching, dizziness, numbness or changes in how the upper and lower teeth fit together.

Our research uses complementary zebrafish and mouse models to investigate the role of LGRs, which potentiate Wnt signaling, in maintaining and controlling differentiation of stem cells that give rise to diverse jaw joint connective tissues. Knowledge gained will inform future studies aimed at repairing and restoring damaged connective tissues in TMJ disease. This comprehensive and forward-thinking investigation of the craniofacial skeleton as a multi-tissue system addresses critical gaps in our understanding of craniofacial connective tissue development and maintenance.

Dr. Merrill-Brugger is Department Chair of Biomedical Sciences for HOSD, and Associate Professor. She holds a joint appointment in the Keck School of Medicine. In 2022, Dr. Merrill-Brugger received USC's prestigious Faculty Mentoring Award for her success in mentoring graduate students. For more information about her research, lab news, and team of experts and experts in training, please visit: https://merrill.usc.edu/ https://ccmb.usc.edu/ https://www.researchgate.net/profile/Amy-Merrill

CAMPUS

Health Sciences Campus

STUDENT LEARNING OUTCOMES

- Collaborate with graduate students in the lab and complete a research project by the end of the summer. Present findings to colleagues and faculty with a poster presentation.
- Gain an understanding of the causes of congenital skeletal disorders and TMJ, and in the process, acquire deeper insights into skeletal development.
- Engage with cutting edge research, and technology and develop advanced problem-solving skills.
- Experience with the inner workings of NIH grant R01 level study in a research setting.
- Learn laboratory techniques and the principals behind them.

PREFERRED MAJORS

Biology, Biochemistry or any of the Biological Sciences including Developmental, Molecular, and/or Cellular Biology.

OPEN TO

Community college students, 4-year college students

DATA SCIENCES AND OPERATIONS

DR. ANGELA ZHOU

Robustly combining LLMs with experts: Street Outreach Data for Homelessness

Large text databases in computational social science are a valuable source of insights, but difficult to manually annotate. (We are working with a nonprofit partner that conducts street outreach for homelessness and has thousands of notes). We want to leverage LLMs to extract useful insights, but also leverage data science to robustly combine this information.

STUDENT LEARNING OUTCOMES

Student wills develop skills working with new LLM technologies in Python and other tools for text annotation, processing text data, and methods for causal inference.

Students will understand how to develop evaluation frameworks for text tasks and design them to assess quantitative and qualitative behaviors of text-based tools.

Students will learn about advanced statistical methodology for robustly combining information.

PREFERRED MAJORS

Computer science, Math, Operations Research, Statistics, Data science, quantitative social sciences (quantitative political science/sociology)

CAMPUS

University Park Campus

OPEN TO

4-year college students

KECK SCHOOL OF MEDICINE

DR. BEIYUN ZHOU

The role of CHOP in regulating the CS-induced/exacerbated aging phenotype and lung fibrosis

The goal of this project is to elucidate the pivotal role of C/EBP homologous protein (CHOP) in cigarette smoke (CS)-induced/accelerated alveolar epithelial cell (AEC) aging phenotype and fibrosis using alveolar epithelial type II (AT2) cells and lungs from Grp78 KO mice as well as from healthy donors and IPF patients who are both smokers and non-smokers. Three-dimensional organoids culture of AT2 cells and precision-cut lung slices (PCLS) ex vivo culture will be applied.

STUDENT LEARNING OUTCOMES

- To investigate the role of ER stress signaling in cigarette smoke-induced injury to alveolar type II (AT2) cells.
- To gain a comprehensive understanding of 3D culture and lung slice ex vivo culture techniques, including theoretical knowledge and hands-on experience.
- To develop proficiency in laboratory techniques such as western blotting and immunostaining.

PREFERRED MAJORS

Biology

CAMPUS

Health Sciences Campus

OPEN TO

Community college students, 4-year college students

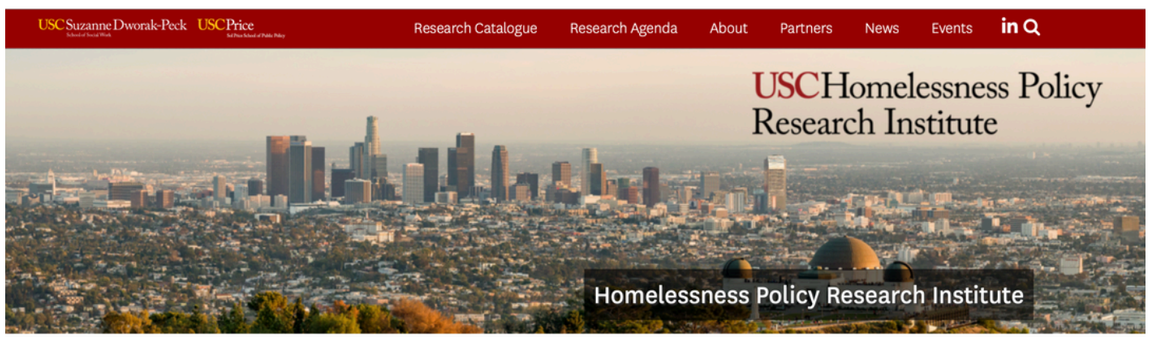
SCHOOL OF SOCIAL WORK AND PUBLIC POLICY

DR. BENJAMIN HENWOOD

Homelessness Policy Research Institute (HPRI)

HPRI is a collaborative of over one hundred researchers, policymakers, service providers, and experts with lived experience of homelessness that accelerate equitable and culturally informed solutions to homelessness in Los Angeles County by advancing knowledge and fostering transformational partnerships between research, policy and practice. Interns will help advance HPRI's mission.

For more information, please visit: https://hpri.usc.edu/



Established with support from the Conrad N. Hilton Foundation and the Home For Good Funders Collaborative, the Homelessness Policy Research Institute (HPRI) is a collaborative of over one hundred researchers, policymakers, service providers, and experts with lived experience of homelessness that accelerate equitable and culturally informed solutions to homelessness in Los Angeles County by advancing knowledge and fostering transformational partnerships between research, policy and practice.

STUDENT LEARNING OUTCOMES

Students will support HPRI to convene stakeholders to discuss data driven policies on homelessness.

PREFERRED MAJORS

Social sciences

CAMPUS

University Park Campus & USC Tower at South Park Center

OPEN TO

Community college students, 4-year college students

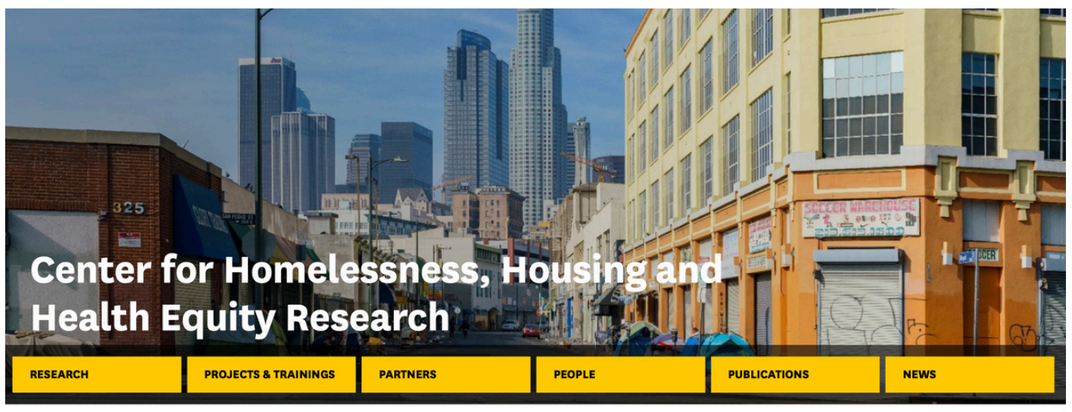
SCHOOL OF SOCIAL WORK AND PUBLIC POLICY

DR. BENJAMIN HENWOOD

Center for Homelessness, Housing, and Health Equity Research (H3E)

H3E has multiple ongoing research projects including an evaluation of field medicine programs in LAC and a randomized controlled trial of a supported employment intervention for formerly homeless adults. We have multiple projects so would assign tasks based on student interest.

For more information, please visit: https://dworakpeck.usc.edu/research/centers/homelessness-housing-health-equity



STUDENT LEARNING OUTCOMES

Students will learn fundamentals of research including human subjects protections, recruitment, and data collection with vulnerable populations.

PREFERRED MAJORS

Social sciences

CAMPUS

University Park Campus & USC Tower at South Park Center

OPEN TO

Community college students, 4-year college students

PEDIATRICS (CHLA)

DR. BETH SMITH

Neural correlates of hand preference and reaching

Experience-dependent plasticity of the nervous system underlies infant and child learning and development. We are studying neural function related to hand preference and reaching skills across development in infants and toddlers. This work is critical to support early identification of and intervention for atypical development.

STUDENT LEARNING OUTCOMES

The student will become reliable in video coding different infant and child motor behaviors and assist with data analysis.

PREFERRED MAJORS

Kinesiology, Neuroscience, Pre-health Sciences, Engineering, Computer Science, Developmental Psychology, or related majors

CAMPUS

Children's Hospital of Los Angeles (CHLA)

OPEN TO

Community college students, 4-year college students

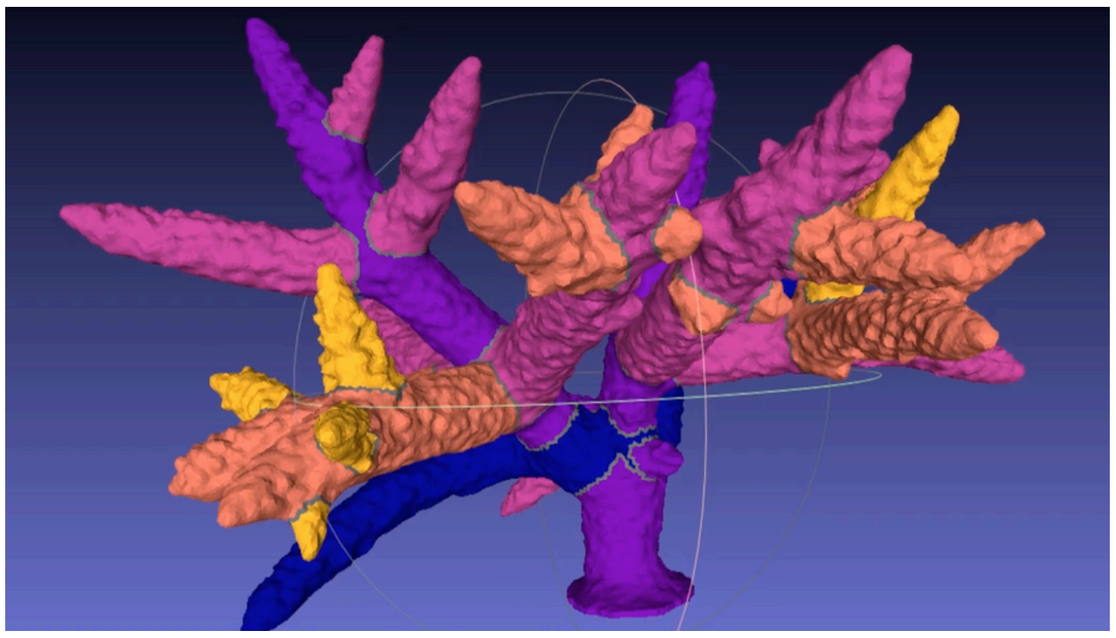
BIOLOGICAL SCIENCES - MARINE & ENVIRONMENTAL BIOLOGY

DR. CARLY KENKEL

Mechanisms underpinning branching in reef-building coral

Branching coral create essential reef habitat. This complex growth formation is the foundation of reef ecosystems and the services they provide, yet we do not understand how branching occurs. We will use single-polyp transcriptomics in combination with time series 3D models to capture polyp differentiation–the transition from lateral polyp to nascent branch. This aquaria-based experiment will held at USC will allow us to untether the molecular drivers of a developmental transition essential to individual coral and reef health.

Learn more about the CEE lab here: https://dornsife.usc.edu/carlslab/



STUDENT LEARNING OUTCOMES

Students will learn basic wet lab methods in coral mariculture, coral ecophysiology and molecular biology including general aquarium care and maintenance, photogrammetry, and DNA/RNA extractions. By the end of this program they will also have an understanding of general coral biology and the current state of the field.

PREFERRED MAJORS

Biology

CAMPUS

University Park Campus

OPEN TO

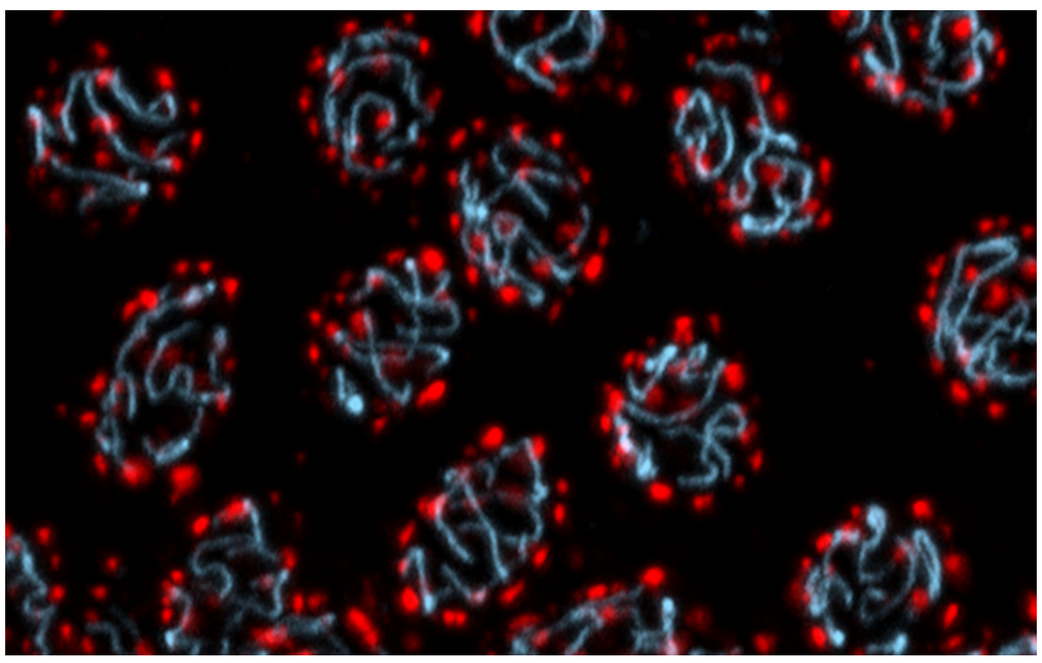
Community college students, 4-year college students

BIOLOGICAL SCIENCES

DR. CAROLYN PHILLIPS

Investigating How Small RNAs Regulate Gene Expression To Promote Fertility

Tiny RNAs have the capacity to alter gene expression by disrupting the stability or function of larger messenger RNAs. They can also protect an organism from harmful nucleic acids such as RNA viruses. The Phillips lab studies how these small RNAs work – the proteins they interact with and the mechanisms by which they carry out their silencing activity. We carry out our studies using the nematode C. elegans. We use methods such as fluorescence microscopy to look at RNAs and proteins inside cells, and CRISPR to generate deletions of proteins in the pathway. Ultimately, we seek to understand how disruption of the small RNA pathways alters gene expression and ultimately affects fertility and fitness of the animal.



STUDENT LEARNING OUTCOMES

This project will give the student a hands-on experience using many different molecular, biochemical, and microscopy-based techniques. These techniques will include genetic crosses, genotyping, RNAi screens, western blotting, immunoprecipitation, and both widefield and confocal microscopy. Additionally, the project will focus on the fundamentals of lab-based research, with an emphasis on how to design and execute an experiment and think critically about expected and observed results. In combination with the skills learned inside the lab, the student will participate in a lab journal club to learn how to read and understand primary scientific articles and how to interpret results. To conclude the training, the student will present their findings to the lab and receive feedback on how to improve on giving a scientific presentation.

PREFERRED MAJORS

Biology, Molecular Biology, Genetics, Biochemistry

CAMPUS

University Park Campus

OPEN TO

4-year college students

CHEMISTRY REU PROGRAM/ CHEMISTRY DEPARTMENT

CHEMISTRY FACULTY

Snapshots of Chemistry: Visualization at the Molecular Level

Spend 10 weeks conducting research in residence in our Chemistry Department. We use the term “Snapshots of Chemistry” to emphasize our focus on gaining insights on key chemical features of molecular processes via visual images. We offer broad selection of research groups in alternative energy, chemical physics, chemical biology, drug discovery, inorganic, materials/polymers, nanoscience, organic, physical, and theoretical chemistry. We integrate student research activities with weekly meetings that feature professional development courses, showcase student research presentations, and highlight the breadth of chemistry across traditional and interdisciplinary areas. Included will also be tours of local research facilities such as the NASA's Jet Propulsion Laboratory, the Loker Hydrocarbon Research Institute and other team building activities. The summer will culminate with a poster session, where you will display your summer research and discuss it with Chemistry faculty and graduate students.

Applicants should visit the Chemistry faculty website (https://dornsife.usc.edu/chemistry/faculty/) and indicate three potential advisors in their research statement.

STUDENT LEARNING OUTCOMES

We provide comprehensive research opportunities and long-term mentoring, professionalization, and social activities. This approach aims to build skills and confidence needed for each participant to pursue STEM degrees and chemistry-related careers. We believe that having access to research opportunities and long-term mentoring empowers students with knowledge and opportunities needed for professional success in many careers. Research topics conducted in our department deal with significant and critical issues in our society and participants learn both chemistry perspective and the significant role of chemical research in solving the current societal and environmental issues.

PREFERRED MAJORS

Chemistry/Biochemistry

CAMPUS

University Park Campus

OPEN TO

Community college students, 4-year college students

BIOLOGICAL SCIENCES/
BRIDGE INSTITUTE

DR. CORNELIUS GATI

Decoding opioid receptor pharmacology

Our work focuses on opioid receptor pharmacology, with an emphasis on structure determination (cryoEM), single molecule microscopy and pharmacological assay development. Prior wetlab experience is recommended, but not required.

STUDENT LEARNING OUTCOMES

The student has the possibility to fully emerge in a research program over the summer, and focus on either 'wetlab' - molecular biology, biochemistry, protein production and purification, cellular assays, or 'drylab' - electron microscopy, TIRF microscopy, and data analysis thereof.

PREFERRED MAJORS

Biochemistry

CAMPUS

University Park Campus

OPEN TO

Community college students, 4-year college students

COMPUTER SCIENCE

DR. DANIEL SEITA

Generative AI for Robot Manipulation

In standard robot planning, it is assumed that robots should avoid making any contact with obstacles. This project, however, considers when it is acceptable to make some contact. Humans frequently make incidental contact with obstacles, such as when reaching into backpacks to retrieve an item buried in it while making contact with other things in the bag. The student will combine classical planning algorithms (such as RRT) with generative AI models (such as GPT-4) to enable robots to make some types of contact when necessary. The student will test in simulation and, if time permits, on a physical robot.

See the lab website for more: https://slurm-lab-usc.github.io/

STUDENT LEARNING OUTCOMES

The student will learn how to do robot manipulation (i.e., robot affects its environment) in the age of foundation models. They will also learn how a robotics research lab operates. See this for more about the lab: https://slurm-lab-usc.github.io/.

PREFERRED MAJORS

Computer Science, Electrical Engineering

CAMPUS

University Park Campus

OPEN TO

Community college students, 4-year college students

PHARMACOLOGY AND PHARMACEUTICAL SCIENCES

DR. DILLON COGAN

Reverse Engineering Molecular Machines in Bacteria for Human Health

Bacteria have evolved over billions of years to become extremely adept producers and surveyors of biologically important materials. Our research explores bacterial mechanisms of chemical synthesis and molecular detection that can serve human medical and environmental needs. We are focused on two prominent types of bacterial protein machinery to this end: (I) multienzyme systems known as polyketide synthases (PKSs) that generate complex medicinal compounds and (II) two-component signal transduction systems (TCSs) responsible for regulating cellular behaviors in response to environmental cues. We employ a variety of techniques to understand molecular mechanisms of PKS/TCS operation that can enable their genetic reprogramming for sustainable biosynthesis, biosensing, and cellular therapeutics. Interested applicants should

email dcogan@usc.edu

CAMPUS

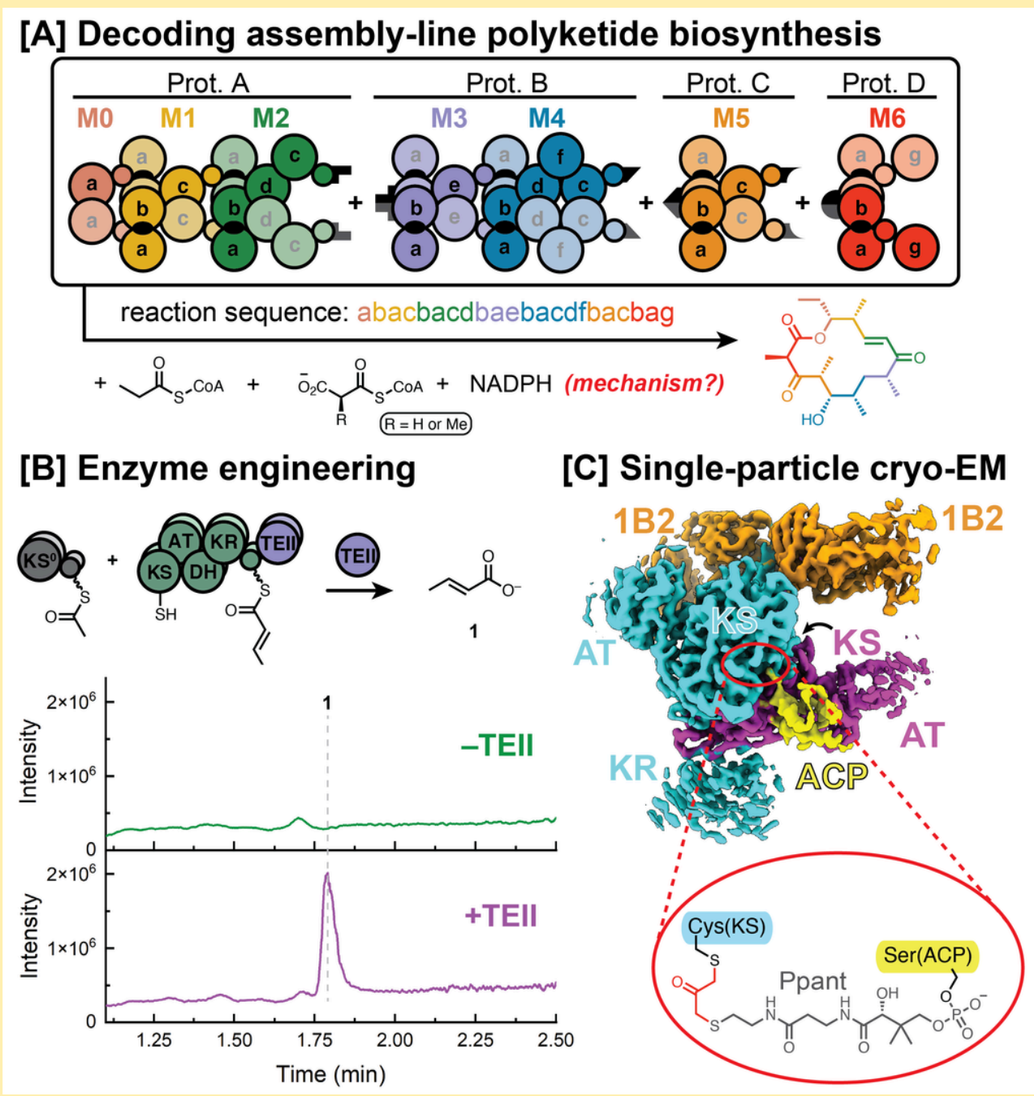
Health Sciences Campus

OPEN TO

Community college students, 4-year college students

STUDENT LEARNING OUTCOMES

The selected student(s) will gain exposure to a variety of experimental techniques, including in molecular biology, biochemistry, structural biology, analytical chemistry, and microbiology. There will be additional opportunities to learn bioinformatic and other computational techniques commonly used in protein structure-function research .



PREFERRED MAJORS

Chemistry, Biochemistry, Biology, Physics, Molecular Biology, Pharmacology, Medicinal Chemistry, Structural Biology, and related fields

PHYSICS AND ASTRONOMY

DR. ELENA PIERPAOLI

Galaxy clusters and cosmology

We will explore techniques to detect galaxy clusters in surveys targeting the cosmic microwave background radiation. We will then explore how these clusters can be used to extract cosmological information.

STUDENT LEARNING OUTCOMES

Acquired knowledge on the large scale structure of the Universe, as well as on the astrophysics of galaxy clusters. The student will also learn how to master some essential codes for the data analysis of cosmological data.

PREFERRED MAJORS

Physics

CAMPUS

University Park Campus

OPEN TO

4-year college students

COMPUTER SCIENCE

DR. ERDEM BIYIK

Uncertainty modeling and active querying for RLHF

The current implementations of reinforcement learning from human feedback (RLHF) follows the learned policy to generate new queries for the human. Recent works in statistical learning showed that it is possible to form Bayesian distributions over neural networks using linear algebraic methods in an efficient way. The goal of this project is to investigate whether these distributions (over reward models in RLHF) can be used for uncertainty modeling and active querying for RLHF. The applications include tabletop manipulation and simulated dynamical environments where RLHF has been proven successful.

STUDENT LEARNING OUTCOMES

Students will learn about and develop skills in:

- Dynamical systems
- Reinforcement learning
- Preference-based reward learning
- Bayesian inference
- Bayesian neural networks

Depending on the progress in the project, the students will have the chance to get involved in writing an academic paper and presenting it as an oral presentation and/or poster.

PREFERRED MAJORS

Computer Science, Electrical Engineering, Computer Engineering

CAMPUS

University Park Campus

OPEN TO

4-year college students

COMPUTER SCIENCE

DR. EVI MICHA

Fair and Efficient Collective Decision Making

Over the past decade, algorithms have had a profound impact on human lives. As a result, it has become more crucial than ever to design decision-making algorithms that treat people fairly, make efficient use of limited resources, and promote social good. These goals lie at the core of our lab's research. Interns will have the opportunity to contribute to projects across this spectrum, with a particular focus on AI alignment challenges involving diverse human values. Specifically, while current methods for aligning large language models (LLMs) with human values often assume a shared societal consensus, this assumption frequently does not hold in practice. Our work focuses on addressing this gap by leveraging the mathematical foundations of computational social choice to design reward functions that account for heterogeneous preferences and effectively capture diverse perspectives.

STUDENT LEARNING OUTCOMES

The students are expected to have a strong theoretical background as they will contribute to the theoretical aspects of the project, such as designing algorithms and conducting worst-case analyses to evaluate their performance. Additionally, they will design and implement experiments to complement and validate the theoretical findings.

PREFERRED MAJORS

Computer Science, Operation Research, Mathematics

CAMPUS

University Park Campus

OPEN TO

4-year college students

KSOM/MOLECULAR MICROBIOLOGY AND IMMUNOLOGY

DR. HYUNGJIN EOH

To study metabolic topology of bacterial pathogens required to achieve drug resistance

This project examines the metabolic and biochemical strategies employed by notorious bacterial pathogens to obtain the antibiotic tolerance and antibiotic resistance. We are interested in metabolic networks altered during enhancing the levels of antibiotic tolerance. We are also interested in examining how the metabolic remodeling is associated with emerging the permanent antibiotic resistance. To answer these questions, my lab uses cutting edged liquid-chromatography mass spectrometry metabolomics technology. Bioinformatics and big-data mining will help us pinpoint the metabolic pathways essential for the antibiotic tolerance and resistance. Also, the metabolic pathways will be validated as a rich source of conceptually novel antibiotic targets by conducting the multidisciplinary national and international collaboration including medicinal chemistry, structural biology, and enzymology.

CAMPUS

Health Sciences Campus

STUDENT LEARNING OUTCOMES

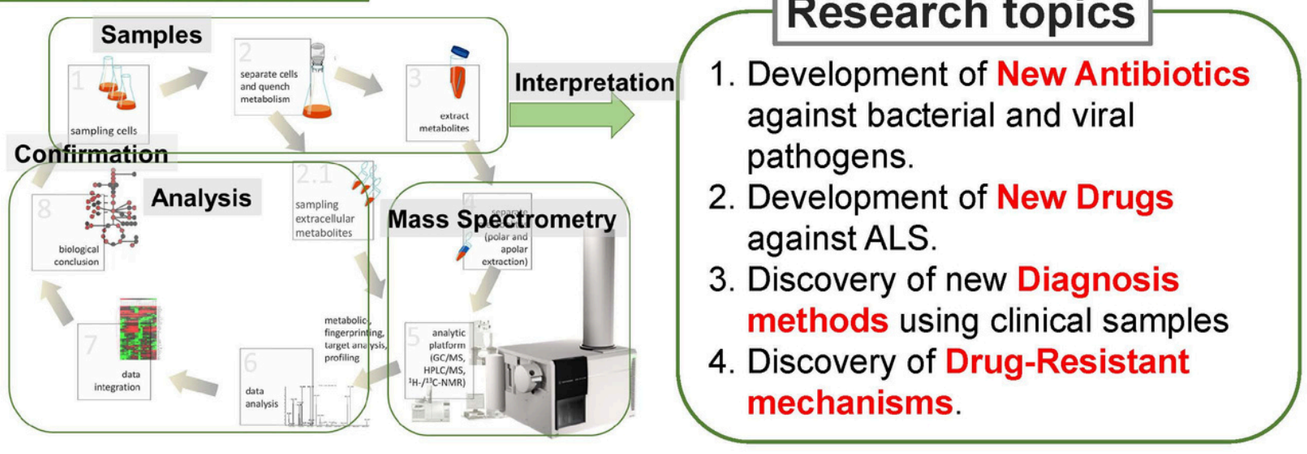
Students are expected to work on a team comprising graduate students and postdoctoral research scientists to help collect the metabolome and mRNA samples from pathogenic bacteria after treatment with sublethal doses of antibiotics. Students will learn how to analyze the bacterial adaptive strategies used to evade antibiotic effects to elucidate the mechanistic bases underlying development of antibiotic resistance. Students will experience the basic platform discovering new antibiotic targets and agents.

PREFERRED MAJORS

Microbiology; Biochemistry

OPEN TO

4-year college students



CLINICAL SCIENCE/PSYCHOLOGY

DR. IONY EZAWA

Investigating Mental Health Care Barriers in LA's Marginalized Communities

The USC Depression Treatment (dTx) Lab launched a project investigating sociocultural barriers impacting the access of mental health care in Los Angeles County among Hispanic/Latinx and Black communities. As a part of this study, we conducted qualitative interviews with a sample of individuals from marginalized communities and mental health care providers who work with marginalized communities in Los Angeles County. The interviews are almost completed, and we will begin coding/analyzing the qualitative data soon. Learn more about our study and lab here: https://sites.usc.edu/depressiontxlab/access/

STUDENT LEARNING OUTCOMES

JumpStart students will undergo training from graduate students in our lab to code qualitative data. Students will gain experience with qualitative data analysis and collaborating with a research team. Students will also have the opportunity to join lab meetings and engage in professional development.

PREFERRED MAJORS

Psychology, Cognitive Science, Social Work, Pre-Med

CAMPUS

University Park Campus

OPEN TO

4-year college students

NORRIS COMPREHENSIVE CANCER CENTER/DEPT SURGERY

DR. ITE OFFRINGA

Molecular Lung Cancer Research

Lung cancer is the cancer that kills the most men and women in the USA. There are different kinds of lung cancer, depending on which type of lung cell became cancerous. Lung adenocarcinoma, the most common kind, arises from air sac cells. The air sac cells of one adult form a surface the size of half a tennis court, and are very susceptible to damage from cigarette smoke and other chemicals. We study how normal air sac cells become cancerous due to environmental exposures. Small cell lung cancer (SCLC) is the most aggressive type of lung cancer. It arises in rare cells called pulmonary neuroendocrine cells. We are studying how SCLC develops and spreads in the body, and are trying to develop and immunotherapy to treat it.

The Jumpstart student would be mentored by Dr. Offringa in collaboration with a PhD student working on the lung adenocarcinoma or SCLC projects. The Offringa lab is passionate about improving lung cancer diagnosis and treatment and we are thrilled to host JumpStart students in our lab.

STUDENT LEARNING OUTCOMES

- Students will be able to read, understand and critically interpret the scientific literature.
- Students will be able to design, carry out and interpret experiments.
- Students will become adept at experimental techniques relevant for their project, which may include tissue culture, polymerase chain reaction, molecular cloning, gel electrophoresis, CRISPR-based genome engineering, enzyme-linked immunosorbent assay (ELISA), Western blots, etc.
- Students will present their results in lab meetings and as part of the JumpStart program.

PREFERRED MAJORS

Biology, Chemistry, STEM fields

CAMPUS

Health Sciences Campus

OPEN TO

4-year college students

PROGRAMS IN BIOMEDICAL AND BIOLOGICAL SCIENCES (PIBBS)/SURGERY

DR. JULIET EMAMAULLEE

Using 'omics' to understand clinical liver disease

Our lab uses innovative 'omics' platforms, combined with patient specimens, to identify new biomarkers of disease and immunotherapy targets. Our focus is related to transplant patients, mainly liver transplant patients with rejection, children with acute liver failure, and Fontan-associated liver disease.

STUDENT LEARNING OUTCOMES

Learn how to process human samples, learn how to code in R and Python, learn how to work with 'omics' data. Being a beginner is perfectly fine.

Clinical exposure to organ transplant is possible for those who are interested.

PREFERRED MAJORS

Biology, Bioinformatics, Math, Chemistry

CAMPUS

Health Sciences Campus

OPEN TO

4-year college students

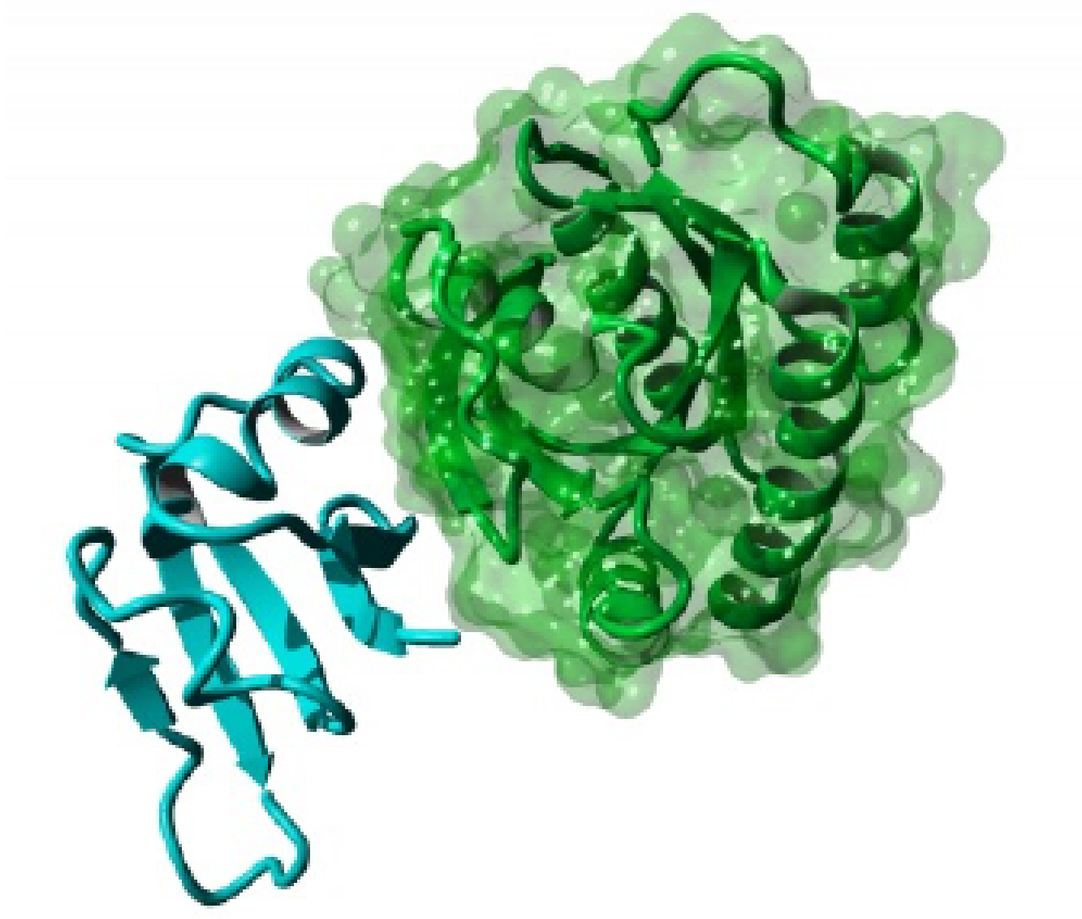
PHARMACEUTICAL SCIENCES PHAMACOLOGY/ NORRIS COMPREHENSIVE CANCER CENTERRICS (CHLA)

DR. JULIO CAMARERO

Development and testing of RAS/RAF inhibitors

The mitogen-activated protein kinase (MAPK) pathway is crucial in controlling cell growth, differentiation, proliferation, and cell death. Disruptions in this pathway often contribute to human cancer development. Specifically, changes in the RAS-RAF-MEK-ERK pathway are associated with about 33% of gastrointestinal cancers, including pancreatic cancer.

This project aims to continue the preclinical trials of our recently developed pan-RAS inhibitor.



STUDENT LEARNING OUTCOMES

Experience gained in a biochemical research lab. This includes to be exposed to techniques like:
Mass spectrometry, HPLC, fluorescence biological assays, cell based assays, participation in animal testing...

PREFERRED MAJORS

Biochemistry, Chemistry

CAMPUS

Health Sciences Campus

OPEN TO

Community college students, 4-year college students

KECK SCHOOL OF MEDICINE/
PHYSIOLOGY & NEUROSCIENCE

DR. KAREN CHANG

Molecular mechanisms regulating brain development and function

The overall goal of this project is to understand the molecular and cellular mechanisms that regulate synapse development, function, and plasticity, as well as how alterations in these processes contribute to neurodevelopmental disorders. Specifically, we are investigating the role of a kinase associated with autism, intellectual disability, and Down syndrome in regulating brain development and synaptic functions, using Drosophila melanogaster as a model organism. Through a multidisciplinary approach, we aim to provide an unprecedented characterization of the kinase's substrates and their functional significance in regulating neuronal processes. We hope that this study will contribute to the development of therapeutic strategies for treating neurological disorders.

STUDENT LEARNING OUTCOMES

Students will gain hands-on laboratory experience in a multidisciplinary research setting, learning techniques in genetics, biochemistry, cell biology, and neuroscience. They will also develop critical thinking and data analysis skills, along with valuable experience in experimental design, troubleshooting, and effective communication of scientific findings.

PREFERRED MAJORS

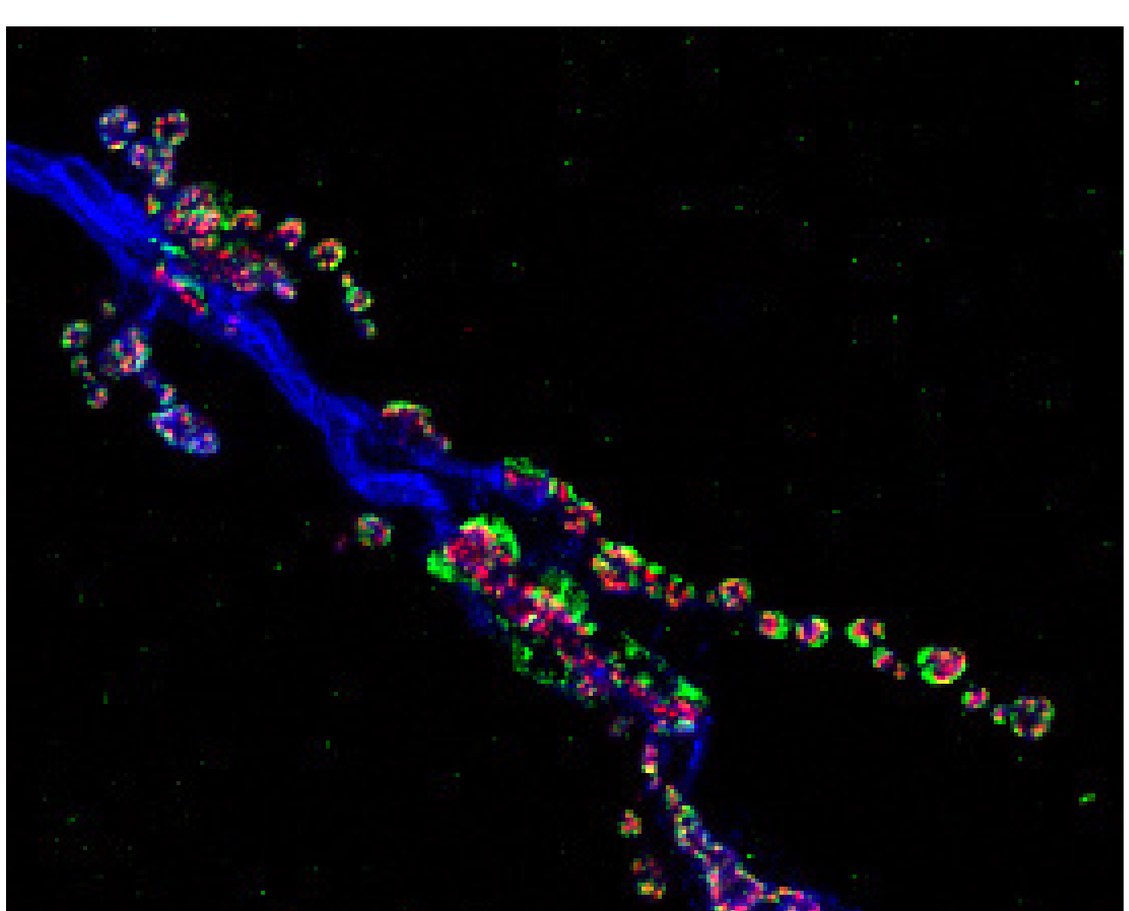
Neurobiology, Biochemistry, Molecular biology, Genetics, Biology

CAMPUS

Health Sciences Campus

OPEN TO

Community college students, 4-year college students



DIVISION OF BIOKINESIOLOGY AND PHYSICAL THERAPY

DR. KARI KRETCH

Development of walking in infants with and without Down syndrome

The mission of the Learning, Development, and Rehabilitation Lab is to advance the science underlying early rehabilitation intervention for infants and children, with a focus on promoting development, participation, and inclusion for children with physical disabilities. Research in the lab aims to develop interventions that promote exploration, learning, and global development in children with neurodevelopmental conditions like cerebral palsy and Down syndrome.

A current focus of the lab is the development of walking, and early interventions to promote walking development, in infants with Down syndrome. Ongoing projects aim to understand: (1) the nature of spontaneous locomotion (crawling, cruising, and walking) in pre-walking and walking infants with and without Down syndrome, measured in a laboratory playroom and in the home environment, and (2) the development of supported stepping in infants with Down syndrome using different forms of gait training (treadmill training and overground training with mobility devices).

STUDENT LEARNING OUTCOMES

Students will work closely with a team of other research assistants with graduate student and/or postdoc supervision, and will participate in weekly meetings with the faculty advisor. A primary learning outcome will be proficiency in the use of Datavyu, a behavioral coding software used to annotate video data. Research assistants will also complete ethics training in human research, assist with data collections, and build skills in experimental design, data analysis, and data visualization (primarily in R). Students will also read and present foundational papers in the field to build a working knowledge of key concepts in developmental psychology and movement science, develop presentation skills, and hone the ability to read and critique research.

PREFERRED MAJORS

Kinesiology/Movement science, Neuroscience, Psychology, Child Development, Pre-med, Pre-physical therapy

CAMPUS

Health Sciences Campus

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Community college students, 4-year college students

USC STEVENS NEUROIMAGING AND INFORMATICS INSTITUTE

DR. KAY JANN

Brain functional complexity

Functional Magnetic Resonance Imaging (fMRI) allows to non-invasively measure changes in brain activity. Using fMRI we can identify brain networks and my lab is specialized in novel analytical approaches to understand the brains function and organization in health and disease. In the JumpStart project the student will apply non-linear mathematical models to estimate the brains complexity, specifically multiscale sample entropy (MSE). MSE is proposed to reflect the brains capacity for information processing and flexibility to adapt to changing demands. We will focus on evaluating the relationship between fMRI-complexity of different brain networks to brain network organization and cognitive function/impairments.

STUDENT LEARNING OUTCOMES

- Familiarity with Functional Magnetic Resonance
- Learn how to calculate brain functional complexity.
- Learn how to calculate dynamic brain network changes.
- Exposer to statistical modeling

PREFERRED MAJORS

CS, EE, Math, Neuroscience, Psychology, Physics

CAMPUS

Health Sciences Campus

OPEN TO

Community college students, 4-year college students

PHYSICS & ASTRONOMY

DR. KRIS PARDO

Looking for gravitational waves with apparent star motions

We are aiming to observe gravitational waves (GWs) from supermassive black hole mergers using apparent star positions. When a GW passes through the Earth, it distorts how light comes to us from stars, and can make them appear to move in a coherent, wobbling pattern. We are currently looking through star position data to try to make this measurement, and are developing algorithms to find this very weak signal in noisy data. We are looking for a student to assist with training machine learning models to identify GW signals.

STUDENT LEARNING OUTCOMES

The student will learn to train a few types of machine learning algorithms, and will learn statistical techniques to assessing the efficacy of these algorithms. The student will also learn about gravitational wave physics, and data science and visualization techniques.

PREFERRED MAJORS

Astronomy, Physics

CAMPUS

University Park Campus

OPEN TO

Community college students, 4-year college students

OCCUPATIONAL SCIENCE & OCCUPATIONAL THERAPY

DR. LISA AZIZ-ZADEH

The neuroscience of interactions with artificial intellegence

We are conducting fMRI and behavioral studies to understand neural regions involved in anthropomorphizing AI and other aspects of human-AI experiences.

STUDENT LEARNING OUTCOMES

Running human research participants, using fMRI scanner, data uploading, data analysis, and data presentation

PREFERRED MAJORS

Psychology, Neuroscience, OT

CAMPUS

University Park Campus

OPEN TO

Community college students, 4-year college students

CENTER FOR CRANIOFACIAL MOLECULAR BIOLOGY

DR. LU WANG

Using stem cell based organoid model to understand neurological disorders

Stem Defects of patterning, neurogenesis, astrogliogenesis, or synaptogenesis in the developing brain can lead to developmental brain disorders, often with structural and cognitive phenotypes, collectively referred to as neurological developmental disorders (NDDs). NDDs account for nearly 25% of pediatric chronic diseases, burdening children, and their families with serious financial and psychological hardship. Thousands of genes are associated with neurodevelopmental disorders (NDDs), yet mechanisms and targeted treatments remain elusive. Our works utilized a stem cell-based brain organoids (hBOs) model in combination with genetic/genomic at single cell to address the pathogenesis NDDs. Simultaneously, we actively develop novel stem cell models to understand astrocytic immune response, adding depth to our understanding of neurodevelopmental disorders. We believe our collective efforts, alongside those of others in the field, will pave the way for groundbreaking interventions in the realm of pediatric neurological disease.

STUDENT LEARNING OUTCOMES

Stem cell and brain organoids, genetic/genomic analysis methods

PREFERRED MAJORS

Neuroscience/Cellular and Molecular Biology

CAMPUS

Health Sciences Campus

OPEN TO

Community college students, 4-year college students

PEDIATRICS (CHLA)

DR. MARK FREY

Cell stress responses in the intestinal lining

Our lab is focused on how cell-cell communication mechanisms maintain a healthy epithelial cell layer lining the intestine. We have identified several candidate molecules that may be important for maintaining the integrity of this cell layer. In this project, students will test the importance of candidate programs related to the cellular response to stress and ask whether they impact cell survival, wound healing, or proliferation.

STUDENT LEARNING OUTCOMES

On a conceptual level, after completing this project students will be able to define central signal transduction pathways promoting epithelial cell survival, wound healing, and proliferation. They will also be able to describe and discuss the fundamental biology of the stem cell niche in the intestine. On a technical level, students will achieve proficiency in cell culture, RNA and protein extraction, qPCR, and western blotting. They will gain exposure to other techniques as well such as immunostaining and organoid culture. For students who have not worked in a lab before, this is also an opportunity to get a sense for the rhythm and culture of lab life.

PREFERRED MAJORS

Biology, Biochemistry, or similar

CAMPUS

Children's Hospital of Los Angeles (CHLA)

OPEN TO

Community college students, 4-year college students

USC LIBRARIES AND SCHOOL OF ARCHITECTURE

DR. MEREDITH DRAKE-REITAN

Building Bunker Hill's Rebel Archive

The Bunker Hill Refrain project aims to digitally recreate a Los Angeles neighborhood demolished through urban renewal in the 1960s. In summer 2025, a small team of undergraduate researchers will conduct genealogical research and interview descendants of Bunker Hill's former residents. JumpStart participants will also work with others to transform their research into visual narratives, such as videos or artwork that will be linked to a public-history website designed to share stories of displaced residents. The Bunker Hill Refrain project's long-term goals include countering historical portrayals of the neighborhood as a blighted slum, fostering intergenerational learning about the impacts of urban renewal, and increasing awareness of housing displacement.

STUDENT LEARNING OUTCOMES

Students will develop skills in historical methods, including how to analyze US Census data and other historical sources. Through this community-engaged project, students will also gain knowledge of urban renewal policies and their impacts. Finally, they will have an opportunity to collaborate across generations, institutions, and communities as part of an interdisciplinary team of historians, librarians and community members.

PREFERRED MAJORS

History, Journalism, Public Policy, Urban Planning, Urban Studies, Geography, and other humanities or social science majors.

CAMPUS

University Park Campus

OPEN TO

Community college students, 4-year college students

DR. PAROMITA DUBEY &

DR. GOURAB MUKHERJEE

Data Science for Online Review Dynamics

This project explores how online reviews evolve over time and how data science can be used to analyze these patterns. Online reviews are vital for consumers and businesses, but changes in sentiment often reflect shifts such as product updates, marketing campaigns, or other external influences. In this project, students will apply machine learning models to perform time-varying sentiment analysis both at the item level and the consumer level. The project will also involve detecting "change points," or significant shifts in sentiment, using data-driven techniques. Students will gain hands-on experience with real-world data analysis tools and methods while uncovering insights into consumer behavior. This project is ideal for students interested in using data science to solve practical problems. It provides an opportunity to work with dynamic, real-world data, helping students develop skills in sentiment analysis, functional data analysis, and expanding their computational toolkit.

STUDENT LEARNING OUTCOMES

This research project focuses on analyzing the dynamics of online reviews using a variety of data science techniques. The goals include:

- **Data Preprocessing and Sentiment Analysis**: Preprocess online review datasets and apply machine learning models to analyze how review sentiments evolve over time. Use the results to identify trends and patterns in consumer feedback.
- **Visualization and Interpretation**: Create novel visualizations to track the evolution of review sentiment and learn how to interpret the findings effectively.
- **Change-Point Detection:** Apply change-point detection techniques to identify shifts in sentiment, such as those driven by product updates or external events, uncovering key moments that shape consumer perception.

Throughout the project, students will gain exposure to important topics in data science, including reproducible research. Some familiarity with programming is required, and the project code will primarily be written in R or Python. Experience with R or Python is helpful, but not mandatory. Prior exposure to either programming language may also be useful. This project will be co-advised by Prof. Paromita Dubey and Prof. Gourab Mukherjee.

PREFERRED MAJORS

Computer Science, Statistics, Mathematics, Data Science, Engineering

CAMPUS

University Park Campus

OPEN TO

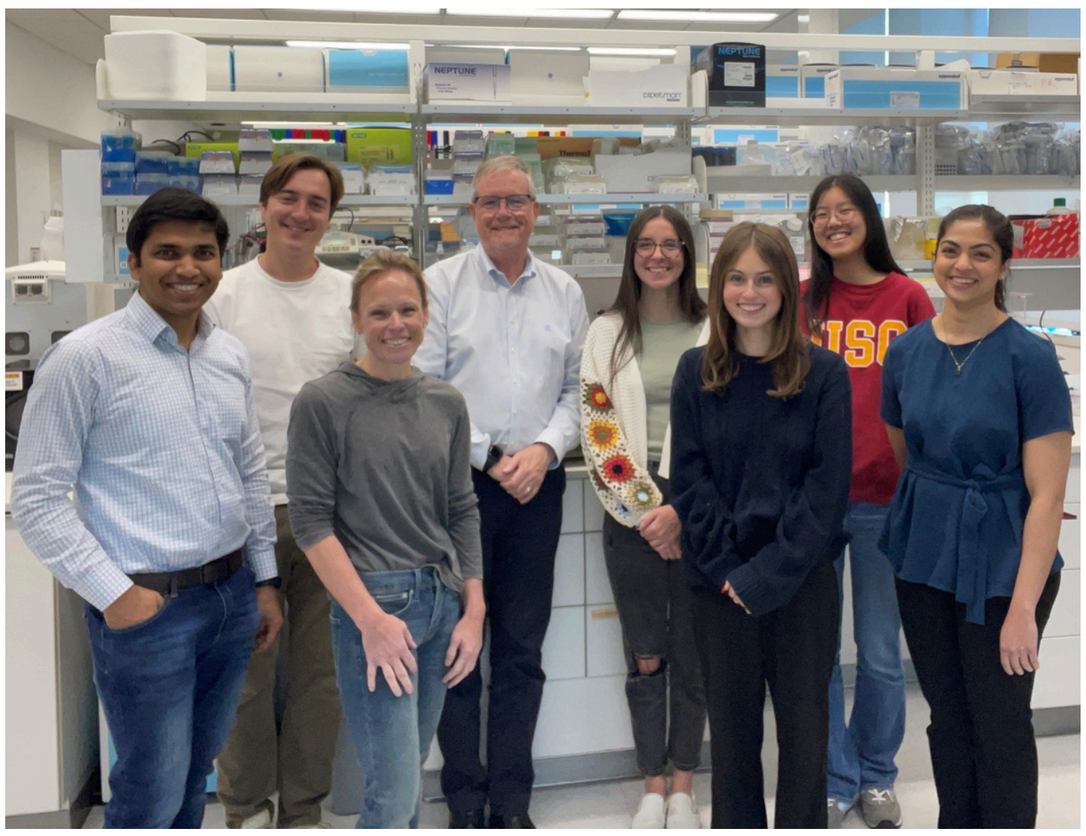
Community college students, 4-year college students

PHYSIOLOGY AND NEUROSCIENCE

DR. PATRICK LYDEN

Treatment to improve outcome for stroke patients

Our lab studies the brain during injury such as stroke or concussion. Part of our work seeks to discover new medicines to treat stroke patients. At a deeper level, we look at how the different cells in the brain, for example neurons and glia, interact during injury. For many decades, neuroscientists thought the glia--which means glue in Greek--did nothing more than hold the brain together. We and others have shown that glia promote the healing response in brain, and provide protection to other cells, especially the neurons. We look at how, exactly, the glia respond to stroke or head injury, and what they do that helps the brain survive and recover. Also, we discovered that some treatment designed to help the brain actually make things worse by interfering with the natural ability of glia to protect neurons. Our studies involve modeling stroke and head injury in rodents.



STUDENT LEARNING OUTCOMES

We hope that our undergraduate rotating students will come to love studying the brain as much as we do. The student participates in all lab meetings, image review and data reveals. The student will prepare and deliver presentations to the lab team as part of learning the neurobiology of stroke and head injury. The student will fully master how to work safely in a lab; how to handle rodents; how to assess the behavior of rodents using maze activities; and how to study brain cells. Depending on the time of year, the student many learn the basics of magnetic resonance scanning. Students will become proficient in basic histology, including tissue sectioning, mounting, and staining, and will learn basic DNA handling and PCR. Most importantly, students will master the fundamentals of scientific methods, especially how to do the most rigorous science. Summer students attend our annual lab BBQ!

PREFERRED MAJORS

Biology, Chemistry other science

CAMPUS

Health Sciences Campus

OPEN TO

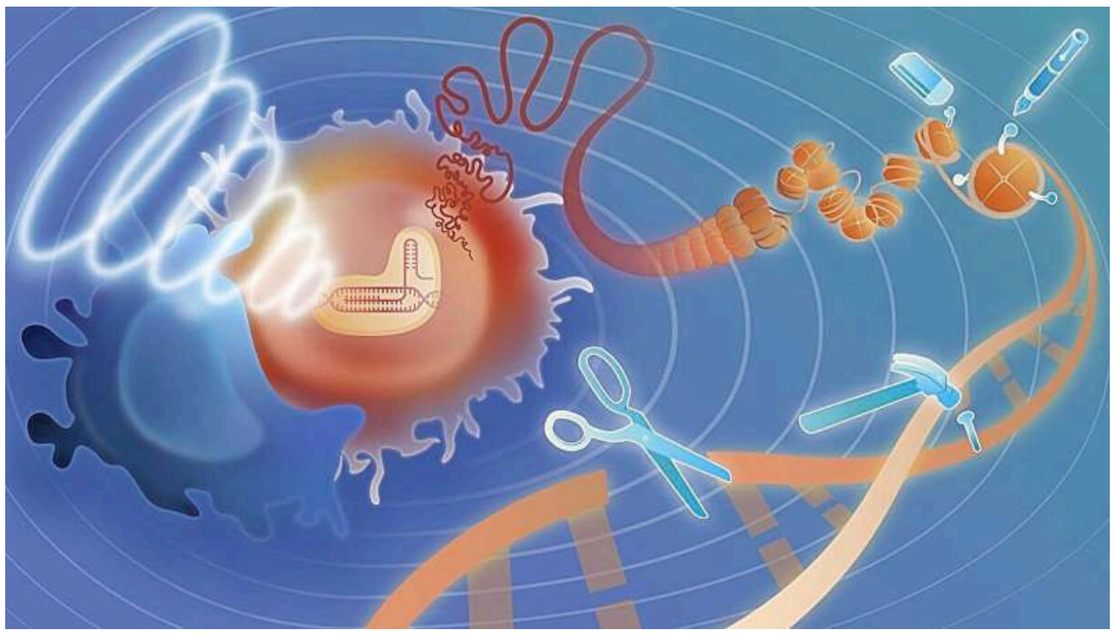
Community college students, 4-year college students

BIOMEDICAL ENGINEERING

DR. PETER YINGXIAO WANG

Genetic Engineering of Ultrasound Controllable Cells for Guided Therapeutics

Our lab focuses on the integration of biotechnologies in cellular and molecular engineering for the development of genetically-encoded biosensors and the application of them to visualize molecular events in live cells and animals. We also develop molecular sensors and transducers for the engineering of immune cells to control genetic and epigenetic activities targeting cancer immunotherapy. For example, we engineer CAR T cells and macrophages so that they can be remotely and non-invasively controlled by ultrasound waves to recognize and eradicate tumors.



STUDENT LEARNING OUTCOMES

Develop exp skills, team work, learn academic environment

PREFERRED MAJORS

Genetics, Biomedical engineering

CAMPUS

University Park Campus

OPEN TO

4-year college students

HEARING AND COMMUNICATIONS NEUROSCIENCE TRAINING PROGRAM/ DEPARTMENT OF OTOLARYNGOLOGY

DR. RADHA KALLURI

Hearing and Communications Neuroscience

The HCN program trains aspiring and newly minted PhD-level scientists to become exceptional, independent researchers and scholars in the field of hearing and communication neuroscience. By exposing undergraduate trainees to relevant aspects of clinical practice in the auditory and communication sciences and involving them in rigorous scientific training and clinical research, we aim to strengthen a pipeline of students interested in advanced study in the field of auditory and communications neuroscience.

For additional information, https://sites.usc.edu/hcn/

STUDENT LEARNING OUTCOMES

Our aim is to encourage trainees to develop a range of experimental, data analysis, and basic research skills necessary for advanced study in graduate or medical school. By integrating students into research laboratories and to a cohort of advanced trainees in graduate school and medical school, we aim to create an immersive experience for undergraduate trainees that capitalizes on the training activities that are already in place for graduate students through the HCN graduate training program.

PREFERRED MAJORS

BME, Biology, Neuroscience, Psychology, Physics

CAMPUS

Health Sciences Campus

OPEN TO

Community college students, 4-year college students

MEDICINE, PEDIATRICS, MOLECULAR MICROBIOLOGY AND IMMUNOLOGY

DR. RONGFU WANG

Cancer immunotherapy in solid cancers

We are working on cancer immunotherapy using Chimeric Antigen Receptor T-cell (CAR-T) and T-cell receptor engineered T cells. Both CAR- and TCR-T cell immunotherapy are cutting-edge cancer therapies that use a patient's own immune cells to fight cancer. The process starts by collecting T-cells, a type of immune cell, from the patient's blood. After engineering of T cells, the CAR-T cells are grown in large numbers and infused back into the patient's body to kill cancer cells. While CAR-T therapy has been highly successful for some blood cancers, it faces challenges, such as cancer cells escaping detection and the short lifespan of the CAR-T cells. Hence, we develop novel TCR-T cell therapy in solid cancers. In our lab, we are working on improving CAR-T therapy for both leukemias and solid tumors like breast, liver, lung, gastric, and pancreatic cancers, making this breakthrough treatment effective for more types of cancer. Furthermore, we are developing therapeutic cancer vaccines using a breakthrough technology developed in my laboratory.

PREFERRED MAJORS

Molecular biology, biochemistry

CAMPUS

Health Sciences Campus

OPEN TO

4-year college students

STUDENT LEARNING OUTCOMES

The following technologies and skills can be learnt from my lab:

1. Cell Culture: Growing and maintaining both primary cells (e.g., T-cells) and cancer cell lines under sterile conditions.
2. Flow Cytometry: Analyzing and sorting cells based on surface markers to evaluate CAR expression and T-cell phenotypes.
3. Gene Editing and Transduction: Using viral vectors (e.g., lentivirus and retrovirus) to introduce CAR genes into T-cells.
4. Molecular Biology and immunology skills:
5. Cytotoxicity Assays: Testing how effectively CAR-T cells kill cancer cells in vitro.
6. Analytical Skills
7. ELISA and Cytokine Analysis: Measuring immune responses like cytokine release.
8. Data Analysis: Interpreting experimental results using software tools (e.g., FlowJo, GraphPad Prism).
9. Critical Thinking: Understanding experimental design and troubleshooting issues.
10. Literature Review: Learning to analyze scientific papers to stay updated on CAR-T advancements.
11. Teamwork: Collaborating with graduate students and postdocs in the lab.

COMPUTER SCIENCE

DR. SAI PRANEETH KARIMIREDDY

AI Readiness Metrics for Healthcare Data

Healthcare data is famously messy and needs massive manual effort to clean it up. Current automated methods often struggle with high-dimensional, complex data and may not capture subtle irregularities. This project proposes using Large Language Models (LLMs) to interpret and model intricate patterns within the data to identify outliers more effectively. By harnessing the nuanced understanding of LLMs, we aim to develop a novel outlier detection approach that works well even when data is privacy-sensitive.

STUDENT LEARNING OUTCOMES

Students will learn to:

- Apply foundational concepts in machine learning and natural language processing to healthcare data.
- Develop skills in using large language models for complex data analysis.
- Understand and address challenges in privacy-sensitive data handling.
- Design, implement, and evaluate outlier detection algorithms.
- Critically analyze the performance of AI models on real-world, messy datasets.

Only candidates with experience in deep learning projects (beyond course projects) will be considered.

PREFERRED MAJORS

Computer Science

CAMPUS

University Park Campus

OPEN TO

4-year college students

PSYCHOLOGY

DR. SANDY LATOURRETTE

Researching How Infants Understand Speech in Unfamiliar Accents

As infants grow, they not only need to learn how to understand their native language, but also the countless variations from speakers all around them. With global immigration having spiked over the last century, infant's environments have become more likely to include speech in a variety of accents. We are interested in how infants and children comprehend speech produced by different speakers or in different contexts. For example, when infants hear a speaker with a different accent, how, and at what age, do they understand this speech? We seek to answer these questions in a study where children are asked to comprehend speech and learn new words from either a familiar or unfamiliar-accented speaker. By analyzing the preferential looking patterns, we seek to uncover how infants adapt to speech in different accents.

STUDENT LEARNING OUTCOMES

Through this project, students will learn to conduct research with young children and gain knowledge on various developmental methodologies and research tools. Students will learn how to design and analyze developmental studies, including using multiple software platforms for creating and running studies with parents and children online. Students will learn how to code videos of the children's behavior to analyze the looking lengths, patterns, and behaviors of child participants. They will also develop skills in statistical analysis and programming, including using R to organize, clean, and analyze child data. Finally, students will have the opportunity to collaborate on other projects in the lab addressing developmental questions centered on linguistic and cognitive development.

PREFERRED MAJORS

Psychology, Cognitive Science, Linguistics, Neuroscience, Education, Human Development, related majors

CAMPUS

University Park Campus

OPEN TO

Community college students, 4-year college students

PSYCHOLOGY

DR. SANTIAGO MORALES

Study of Temperament and Emotion Regulation

This project examines individual differences in the development of emotion and emotion regulation - often conceptualized as temperament. We are interested in temperament because of the impact that these individual differences have on socioemotional development, especially with regards to the development of internalizing and externalizing psychopathology. This project focuses on how young children process social information to help us determine which children at temperamental risk go on to develop socioemotional problems. For this, we will us a combination of behavioral observations, computer-based tasks (eye tracking), and neuroscience measures (EEG).

BEAD Brain, Emotion, & Attention Development LAB

STUDENT LEARNING OUTCOMES

Students are expected to work on a team of graduate students and research assistants to help us collect, clean/process, and analyze these data. Students will learn how to interact with families and young children in a research context, how to utilize sophisticated equipment to collect data (e.g. eye tracker and EEG), and how to analyze and interpret those data.

PREFERRED MAJORS

Psychology, Neuroscience, and Computer Science

CAMPUS

University Park Campus

OPEN TO

Community college students, 4-year college students

COMPUTER SCIENCE

DR. SEO JIN PARK

Flash burst inference

Nowadays, AI models are prevalent for important control applications where both accuracy and latency of inference are important for safety. For example, autonomous driving cars need to make not only highly accurate but also timely decisions. Due to the limitation of computing power of edge devices (cars, robots, drones, etc), there is a significant limit on model sizes for these important applications. In this project, we will explore how to augment these on-edge low-accuracy inferences with on-cloud high-accuracy inferences on the cloud. When there is a sudden need for high-accuracy inferences, our system aims to finish the computationally intensive high-accuracy inference by harnessing hundreds of cloud GPUs in parallel. This project will explore the potential of many parallelization techniques including sequence parallelism via speculative decoding and tensor parallelism.

STUDENT LEARNING OUTCOMES

Students will learn how to distribute DNN models to speed up inference.

PREFERRED MAJORS

Computer Science; Prefer students with prior experience with LLM or VLM models.

CAMPUS

University Park Campus

OPEN TO

4-year college students

BIOCHEMISTRY AND MOLECULAR MEDICINE

DR. SHENG LI

Computational analysis to reveal cell-to-cell communications from spatial transcriptomics

The project will focus on data mining for cell-to-cell communications using spatial transcriptomics and AI models. Analysis of spatial transcriptomics data will lead to cell type identification, neighborhood analysis, co-occurrence analysis, and cell-to-cell communications to reveal the impact of immune microenvironment and stromal cells in impacting how cancer cells response to immunotherapy.

STUDENT LEARNING OUTCOMES

The student will learn to analyze spatial transcriptomics data including cell type annotation and cell-to-cell communications. The student will develop skills in bioinformatics, especially data science in functional genomics and spatial omics.

PREFERRED MAJORS

Computational Biology

CAMPUS

Health Sciences Campus

OPEN TO

4-year college students

DIVISION OF BIOKINESIOLOGY AND PHYSICAL THERAPY/ MOTOR DEVELOPMENT LAB

DR. STACEY DUSING

Quantifying motor and cognitive behaviors in infants with and without disabilities

The Motor Development Lab is the home of 3 clinical trials evaluating how infant motor and cognitive development interact and change in response to physical therapy interventions. This interdisciplinary lab works collaboratively with students from high school through post-doctoral fellows to enhance everyone's learning.

The mission of the Motor Development Lab is to investigate the development of motor control and coordination in infants and young children with and without disabilities as well as the impact of physical therapy treatment on motor and cognitive development. Students may work on numerous projects in the lab involving participants from preterm age to 24 months old who are typically developing, or with developmental delays (e.g. cerebral palsy). Some projects include: comparing the effectiveness of two physical therapy interventions, implementing the early detection guidelines for cerebral palsy into local hospitals standard of care, disseminating early detection educational information to local community families and clinical providers, examining developmental effects of posture on object exploration and social attention, and observing infants' motor and cognitive experiences in their everyday environments.

STUDENT LEARNING OUTCOMES

Student will develop a research question aligning with the goal of the MDL and time line for the internship, code the data, analyze and present a poster.

Learn the ethical and safety considerations needed to participate in research and demonstrate the ability to integrate these values during interactions with participants and their families.

Gain an understanding of the multiple steps and roles of different researchers involved in clinical trials and pediatric research.

Develop their skills in reading and discussing scientific literature.

Demonstrate skills with behavioral video coding to ask and answer a specific research question.

The will be an option to attend clinical intervention and home visits for assessment for children with disabilities.

PREFERRED MAJORS

Psychology, Kinesiology, Child Development, Education, Special education, Pre-med, Pre-PT, Pre-OT

CAMPUS

Health Sciences Campus; HRA building just off campus from HSC.

OPEN TO

4-year college students, Spanish bilingual encouraged, not required

OPHTHALMOLOGY, PHYSIOLOGY & NEUROSCIENCE

DR. SUN YOUNG LEE

Extracellular Vesicle Therapy for Diabetic Retinopathy

In our ongoing research activities, we made an exciting observation that Müller glia cell-derived EVs improved retinal thinning, reduced retinal macrophages recruitment and decreased vascular leukocytes infiltration, in a streptozotocin-induced diabetic retinopathy mouse model. Based on this exciting observation, we are poised to extend our study to investigate the mechanism of the protective roles of Müller glia cell-derived EVs on the neurovascular units in diabetic retinopathy.

Since 2018

Lee Retina Laboratory

STUDENT LEARNING OUTCOMES

Learning about physiology of extracellular vesicle (EV); learning how to isolate and characterize EV; learning to study the therapeutic effect of EV in mouse models of diabetic retinopathy using several key end points

PREFERRED MAJORS

Cell biology; Neuroscience; Biochemistry

CAMPUS

Health Sciences Campus

OPEN TO

Community college students, 4-year college students

HERMAN OSTROW SCHOOL OF DENTISTRY - CRANIOFACIAL MOLECULAR BIOLOGY

DR. YANG CHAI

Craniofacial birth defects and tissue regeneration

The human face represents the unique identity each of us present to the world. Many of our important sensory organs, our brain, and the entry points to the systems by which we breathe, eat, and speak are housed in the face and skull. Craniofacial biology is an interdisciplinary field that seeks to understand how these delicately interconnected systems develop in normal circumstances and how this development can go wrong, producing birth defects like cleft lip/palate and skull malformations. Chai lab pioneers research investigating the molecular and cellular regulatory mechanisms of craniofacial development with special emphasis in both health and disease.

Dr. Chai is the interim Dean of USC's dental school, and co-directs the National Institute of Health's FaceBase Consortium (facebase.org) as well as the Center for Dental, Oral & Craniofacial Tissue & Organ Regeneration (C-DOCTOR.org). These projects present unique opportunities for students to be involved in basic and translational research in craniofacial morphogenesis and regeneration.

STUDENT LEARNING OUTCOMES

Students have the opportunity to:

- Hone skills and cellular biology techniques that will provide a strong foundation for future graduate studies or laboratory-based positions.
- Gain confidence in visualization and communication of scientific concepts.
- Learn to analyze and present research data in a clear and compelling manner.
- Perform cutting-edge research with a full suite of state-of-the-art equipment shared by our graduate students and affiliated researchers.
- Participate in weekly seminars, lab meetings and monthly journal clubs.

Research is conducted at the Center for Craniofacial Biology (CCMB). CCMB represents a diverse group from all points of the globe and is a part of the Ostrow School of Dentistry of USC. More information about Chai lab can be found at - https://chailab.usc.edu/

PREFERRED MAJORS

Biological Sciences (such as Microbiology, Cellular or Molecular Biology), Biomedical Engineering, Biochemistry, Genetics, Chemistry, Bioinformatics, or other related STEM field.

CAMPUS

Health Sciences Campus

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Community college students, 4-year college students

MATHEMATICS

DR. YIZHE ZHU

High-Dimensional Tensor Data Analysis

Tensors, the higher-order generalization of matrices, are essential for capturing complex data structures in fields like machine learning, numerical analysis, and network science. Unlike matrices, which model pairwise relationships, tensors enable the representation of intricate, higher-order connections required in the era of big data. However, transitioning from matrices to tensors poses unique challenges. This project addresses these challenges through a focus on tensor completion and hypergraph community detection, aiming to infer the ground-truth signal from large datasets with only partial observations.

STUDENT LEARNING OUTCOMES

Students will gain foundational knowledge in linear algebra, probability, and statistical methods for tensor data. They will develop and analyze novel algorithms for tensor completion and hypergraph community detection. Through this project, students will also engage in collaborative research across institutions and disciplines, gaining hands-on experience in cutting-edge methodologies and teamwork.

PREFERRED MAJORS

Mathematics, Applied Mathematics, Statistics

CAMPUS

University Park Campus

OPEN TO

4-year college students

COMPUTER SCIENCE

DR. YUE WANG

Bridging Spatial Intelligence and Embodied Intelligence with Foundation Models

The goal of this research is to study both spatial intelligence (3D computer vision) and embodied intelligence (robotics). We will investigate state-of-the-art computer vision models and leverage them to enable more robotic tasks. We will study: 1.Neural scene representations. 2. Robotic manipulation. 3. Real-to-sim-to-real transfer for robotics.

STUDENT LEARNING OUTCOMES

The learning outcomes include: 1. understand state-of-the-art computer vision and robotic algorithms; 2. work on a research project that is on embodied intelligence; submit a paper to leading AI conferences such as ICLR/NeurIPS/CVPR etc.

PREFERRED MAJORS

Computer Science, Electrical Engineering, Mechanical Engineering, Aerospace Engineering

CAMPUS

University Park Campus

OPEN TO

4-year college students