USC Graduate School

JumpStart

Summer Program Overview

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

JumpStart works with USC schools and programs to invite diverse candidates from outside institutions to apply for 10-week 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.

Program Benefits:

- $5,000 STIPEND*
- HEALTH INSURANCE
- PARKING PASSES
- PHD APPLICATION FEE WAIVER
- PROFESSIONAL DEVELOPMENT SESSIONS
- DEAN OF THE GRADUATE SCHOOL SCHOLARSHIP AVAILABLE TO NON-CALIFORNIA RESIDENTS**

APPLY NOW

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

**Dean's scholarship includes stipend, campus housing and reimbursement for approved travel to/from Los Angeles. Limited number of scholarships to be awarded on a competitive basis.

Eligibility

Program

- Underrepresented in your field of study
- Interested in pursuing a Ph.D.
- Rising junior or senior from outside USC *OR*
- Community college students with at least 30 completed transferrable units (in-state applicants only)

Dean of the Graduate School Scholarship

- A small number of competitive Dean's scholarships that include a stipend, campus housing and reimbursement for approved travel to/from Los Angeles are available to non-California residents studying at four-year institutions outside California

Application Checklist

- [ ] 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

Important Program Dates

Application opens January 17, 2023

Application deadline: February 15, 2023

Program begins June 5, 2023

Program ends August 11, 2023

APPLY NOW

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

Opportunities by Major

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

Major	pg.
Anthropology	11, 28, 32, 41
Architecture	8
Astronomy	22
Behavioral Economics	8
Behavioral Science	29
Biochemistry	13, 14, 16, 21, 23, 35, 37, 40, 43, 44, 45, 46
Bioinformatics	45
Biology	12, 13, 23, 29, 34, 35, 37, 39, 40, 42, 43, 44, 46, 48
Biological Engineering	21
Biophysics	21
Biomedical Sciences	34, 36, 44, 45, 46, 49
Cell Biology	23, 37, 40, 44, 45
Chemical Engineering	21
Chemistry	15, 16, 17, 23, 35, 39, 42, 44, 45
Cognitive Science	4, 24, 26
Computer Engineering	16
Computer Science	4, 18, 19, 22, 27, 32, 43, 47, 48
Data Sciences	18, 47
Education	4, 7, 9
Electrical Engineering	16
Engineering	15, 18, 29, 38, 49
Environmental Studies	12
Genetics	13, 39, 37, 40, 43, 44, 45
Geography	11, 47
Health Sciences	7, 8, 28, 33
Human Biology	21, 38
Human Development	9
Kinesiology	29, 30, 49
Labor Studies	11
Mathematics	18, 19, 22, 48
Microbiology	21, 37, 40, 44, 45, 46
Medicine/Pre-Med	9, 24, 32
Molecular Biology	13, 23, 37, 39, 40, 44, 45
Music	4
Neuroscience	4, 5, 23, 25, 26, 27, 30, 44, 48
Occupational Therapy	5, 9, 10, 30
Pharmacology	32, 42
Physical Therapy	30
Physics	15, 17, 21, 22, 48
Psychology	4, 5, 7, 8, 24, 25, 26, 27, 28, 30, 32, 33, 48, 49
Public Health	8, 10, 11, 32, 33, 41, 43, 47
Quantitative Biology	15, 19, 33, 35, 39
Rehabilitation	9
Social Geography	8
Social Work	24, 33
Sociology	8, 11, 28, 32, 33, 41, 47
Spatial Sciences	15, 19, 35, 39, 47
Statistics	4, 18, 19
Systems Biology	38
Urban Planning	8, 11
Open to any major	6, 10, 18, 28, 32, 36

Faculty Host: Assal Habibi

Preferred Majors: Psychology, Cognitive Science, Neuroscience, Music, Education, Computer Science, Statistics

Our group is interested in the interdisciplinary study of music, psychology, and neuroscience. We employ techniques such as Electroencephalography (EEG), functional, structural, and diffusion-weighted neuroimaging (MRI), and psychometric measures to answer a wide variety of questions related to how music listening and playing interacts with and influences the brain throughout the lifespan. Our current projects mainly focus on the effects of music training on child development in participants from underserved communities in Los Angeles. The JumpStart scholar will be involved in all aspects of data collection and data management, working with child participants and researchers. Students will be exposed to EEG and behavioral data collection techniques and will be responsible for learning protocol and good research habits. The student will be responsible for collecting and maintaining high quality data.

The JumpStart scholar will attend biweekly lab meetings, where they will learn the logistical aspects of managing a longitudinal research study. The student will also attend lectures and talks at the Brain and Creativity Institute centered around the topics of psychology, neuroscience, and music. This position requires attention to detail and the ability to work with children and adolescents. Students with prior interviewing experiences and Spanish fluency are especially encouraged to apply.

STUDENT LEARNING OUTCOMES

- Learning the day-to-day aspects of running a longitudinal research project
- Gain understanding of topics related to the intersection of psychology, neuroscience, and music, and the methods in which scientific questions are approached (behavioral testing, neuroimaging)
- Be able to diagnose research setbacks and develop skills in creative problem solving
- Learn to communicate research and scientific findings to a variety of audiences

OTHERNESS AND BELONGING

Faculty Host: Lisa Aziz-Zadeh

Human have a motivational drive to belong to a group. By contrast, the feeling of being othered or being excluded, is painful and can lead to a multitude of negative outcomes. Our group is conducting brain imaging and behavioral studies that probe the neural basis for the motivational drive toward feeling like you belong. We are also looking at interventions to mitigate the feeling of otherness.

Preferred majors: Psychology, Neuroscience, Occupational Therapy

STUDENT LEARNING OUTCOMES

- Run behavioral studies
- Assist with brain imaging studies
- Data entry
- Literature review
- Data presentation

TRAUMA AND RESILIENCE AMONG MINORITIZED FAMILIES OF AUTISTIC GIRLS: TOWARDS CULTURALLY-COMPASSIONATE, NEURODIVERSITY-CENTERED, TRAUMA-INFORMED SERVICE PROVISION

Faculty Host: Amber Angell

Preferred majors: Open to any major

This exploratory qualitative study in the USC Chan Disparity Reduction and Equity in Autism Services (DREAmS) Lab will develop a culturally-compassionate, neurodiversity-centered, trauma-informed framework for underrepresented autistic communities and their families. We will build upon 1) existing relationships with 18 families of 19 autistic girls who have minoritized racial/ethnic identities and 2) the lived experience knowledge and expertise of the DREAmS Lab "Autistic Lived Experience Collaborators" (ALEC), our autistic stakeholder group, to bring a depth of understanding to a critical and timely issue, 'trauma-informed' services and systems of care. With a commitment to stakeholder engagement, this project includes qualitative interviews with 30 caregivers from these families to gain emic perspectives of constructs that are of great importance to autistic communities right now: Trauma, resilience, survival, 'masking,' belonging, culture, family, and intergenerational experiences. Neurodiverse students and students with Spanish-language proficiency are encouraged to apply.

The DREAmS Lab conducts stakeholder-engaged research, which means that all our projects incorporate some level of participation and/or perspectives of our autistic collaborators. This is a critical aspect of our work, so applicants should be interested in doing this kind of work. Feel free to check out our social media to learn more about the lab: @DREAmSLabUSC

STUDENT LEARNING OUTCOMES

- Learn to independently conduct thorough literature searches
- Participate in weekly lab meetings and sub-group meetings
- Learn best practices for qualitative interviewing
- Learn best practices for stakeholder-engaged research
- Engage with diverse team members with compassion and clear communication, providing or asking for accommodations to increase accessibility for all neurotypes
- Participate in dissemination and social media content production
- Participate in data transcription and/or analysis

QUANTIFYING SENSORY EXPOSURES PROVIDED DURING NICU HOSPITALIZATION

Faculty Host: Bobbi Pineda

Preferred Majors: Health Sciences, Psychology, Education

A student will assist in reviewing video footage of NICU hospitalization to assist in quantifying sensory exposures that are provided to infants as part of an R01 funded research study examining the impact of the NICU sensory environment on neonatal brain development and neurodevelopmental outcome.

STUDENT LEARNING OUTCOMES

- Student will achieve basic competencies in neonatal/NICU terminology (diagnoses, interventions, medical equipment, etc.)
- Student will gain experience in quantifying sensory exposures using video recordings
- Student will gain experience in being part of a large R01 clinical trial and will learn about study team member roles and clinical research practices

DESIGNING BELONGING: IDENTIFYING ASPECTS OF THE BUILT AND SOCIAL ENVIRONMENT THAT FOSTER SOCIAL CONNECTION AMONG INDIVIDUALS WITH SERIOUS MENTAL ILLNESS

Faculty Host: Joy Agner

Preferred Majors: Psychology, Sociology, Public Health, Urban Planning, Architecture, Behavioral Economics, Social Geography, Health Sciences

The COVID-19 pandemic has dramatically increased social isolation among the general public, and has had an outsized impact on vulnerable populations such as individuals with serious mental illness. The negative effects of social isolation, and the protective impacts of social connection are apparent in our everyday lives, and underscored by decades of research. Social connectedness decreases risk of mortality, enhances quality of life, and can facilitate the successful management of chronic illness. However, little is known about how to design environments that promote a sense of connection and belonging. This research aims to fill that gap using innovative, mixed-method research. We focus on the relationships between engagement in activities, social connection, and characteristics of the built and social environment. This work takes place in partnership with mental health Clubhouses, which are empowering, consumer-run mental health treatment centers, that treat mental illness through community engagement. I prefer that students intend to continue to volunteer with the lab after the experience (as their schedule allows, but ideally for at least one year) because it takes time to develop your role, understand the communities we work with, and to contribute meaningfully.

STUDENT LEARNING OUTCOMES

- Students will work on a close-knit team, with the principal investigator, long-term research assistants, and interaction with members of mental health Clubhouses.
- Our lab follows a community-based participatory research (CBPR) model, which means this work is done in close partnership with community members. Students will develop understanding of the principles of CBPR and how to put them into action with vulnerable, underrepresented groups.
- This project will utilize mixed-method research skills, linking qualitative, quantitative, and spatial data. Students will have exposure to each, but will focus on an area suited to their skills, background, interest and goals.
- Students will be engaged actively in dissemination of findings throughout the process, with opportunities to collaborate with the team on presentations and publications.

UNDERSTANDING SENSORY PROCESSING IN INFANTS AND CHILDREN WITH AND WITHOUT AUTISM

Faculty Host: Julia Lisle

Preferred Majors: Occupational Therapy, Rehabilitation, Special education, Human Development, Pre-med

Differences in sensory processing and communication are two of the earliest risk signs of autism seen in infants and toddlers. Understanding these differences and identifying them early on is critical as it helps families to receive developmental services sooner and achieve better outcomes. The Innovations in Neurodevelopmental Sensory Processing Research (insp!re) lab is committed to advancing knowledge of early risk signs of autism and other neurodevelopmental disorders. Dr. Baranek and the insp!re team have created screening tools to identify at-risk infants, sensory processing assessments for children, and interventions for caregivers and infants. Our lab has multiple projects in progress that use various types of data, some of which include: clinical behavioral assessments, physiological data (e.g., respiratory sinus arrhythmia [RSA], EEG), and qualitative interviews with parents, autistic children, and clinicians.

The insp!re lab has a multidisciplinary team with a total of 17 faculty, staff and students. Dr. Julia Lisle will serve as your primary mentor and supervisor but other members of the team will also provide support.

STUDENT LEARNING OUTCOMES

1. As part of this research team, students will use qualitative coding techniques to analyze parent interview data about their child's sensory experiences. Students will be challenged to think critically about findings and their applicability to research and clinical settings.
2. Students will gain exposure to physiological data collection measures, such as respiratory sinus arrhythmia (RSA), that are used to measure the impact of sensory experiences on an infant/parent's physiological state.
3. Students will gain insight into research processes (e.g., IRB, grants, etc.) through participation in general lab meetings and publication meetings and gain experience in public speaking and professional writing through sharing findings with the team.

IMPACT OF THE ENVIRONMENT ON STRESS DURING CHALLENGING HEALTHCARE ENCOUNTERS

Faculty Host: Leah Duker

There are two possible projects students may help with: (1) A scoping review of the environment challenges experienced by autistic adults during primary care health encounters, or (2) manuscript development of a qualitative study examining the pediatric primary care experiences of Latinx families with autistic children.

Preferred Majors: Occupational Therapy, Public Health, etc -- very flexible and open to different majors.

STUDENT LEARNING OUTCOMES

- Literature Review
- Development of scientific writing skills
- Identification and assessment of possible journals for publication
- Team science
- Qualitative research methods
- Scoping Review methodology
- Develop critical thinking skills
- Develop and practice scientific presentation skills

RECONCEPTUALIZING THIRD PLACES: COUNTERING SOCIAL ISOLATION IN LIVES WITHOUT WORKPLACES

Faculty Host: Rebecca Aldrich

Preferred Majors: Sociology, Anthropology, Geography, Urban Planning, Labor Studies, Public Health

This critical ethnographic study will explore how 'third places' (i.e., places essential for social connectedness, such as coffee shops, libraries, and parks, that exist outside 'first' (home) and 'second' (work) places) are situated in the lives of people without distinct workplaces. Study participants will include adults experiencing long-term unemployment and people aged 65 and older who are retired. Multiple methods, such as occupational mapping, go-along interviews, participant observation, and photo elicitation, will be used to: 1) Enhance awareness and deepen understanding of third places within the lives of individuals without workplaces; 2) Develop a relational and dynamic characterization of third places that addresses how intersecting social categories shape access to, inclusion/exclusion in, and occupational possibilities in these places; 3) Consolidate a critical reconceptualization of third places and stimulate stakeholder dialogue regarding approaches for cultivating and sustaining third places that ameliorate social isolation and its inequitable distribution.

STUDENT LEARNING OUTCOMES

- Students will develop knowledge and skills related to critical ethnographic research, including how to conduct semi-structured interviews and participant observations based on critical theoretical foundations.
- Students will learn about spatial and visual elicitation techniques, such as occupational mapping, go-along interviews, and photo elicitation, that complement traditional ethnographic methods.
- Students will develop skills for working with interdisciplinary collaborators across the fields of occupational science, public policy, geography, and social network analysis.
- Students will learn about knowledge mobilization processes that aim to generate impact by moving knowledge to end users through an engaged, co-developed process.
- Students will develop skills for managing multiple kinds of research data across two research sites.

WHAT DRIVES INDIVIDUAL DIFFERENCES IN CORAL GROWTH?

Faculty Host: Carly Kenkel

Preferred Majors: Biology, Environmental Studies

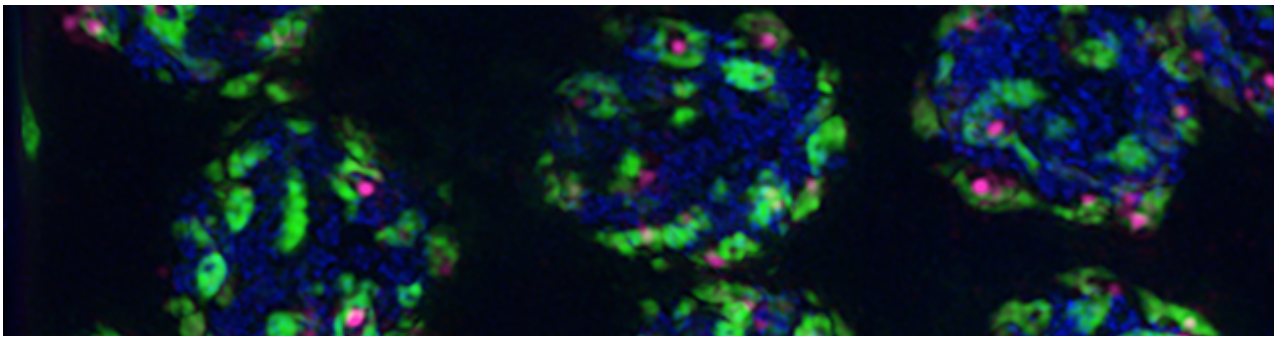
We will be running a tank experiment in summer 2023 to test the hypothesis that variation in coral growth is driven by underlying changes in calcification patterns. Coral are calcifying organisms, precipitating a calcium carbonate skeleton that forms their three-dimensional structure. In Acropora cervicornis coral, absolute calcification rate varies as a function of host genotype and the environment. We will expose known genotypes of Acropora cervicornis to different flow and light conditions in a controlled laboratory experiment. We will measure changes in morphology, growth, and physiology in addition to examining microstructural differences in calcification. JumpStart students will ideally assist in the execution of the experiment, data collection, and analysis.

STUDENT LEARNING OUTCOMES

By the end of this experience students will

1. understand basic coral biology and ecology
2. become familiar with running experiments in closed system aquaria
3. be able to conduct photogrammetry and buoyant weight measures
4. become familiar with statistical analyses and graphing using the R language environment.

Work should be achievable within normal working hours. An emergency might necessitate coming in on a weekend, but this would largely be handled by graduate students.



INVESTIGATING HOW SMALL RNAS REGULATE GENE EXPRESSION TO PROMOTE FERTILITY

Faculty Host: Carolyn Phillips

Preferred majors: Biology, Molecular Biology, Genetics, Biochemistry

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.

MOLECULAR PHARMACOLOGY OF NEUROMODULATORS

Faculty Host: Cornelius Gati

Preferred majors: Biochemistry

Our lab is interested in the structure determination of membrane proteins with pharmacologically important small molecules. We complement our structural work with functional experiments to decipher key interactions and kinetics.

STUDENT LEARNING OUTCOMES

- Basics in molecular biology and protein biochemisrty

SPECTROSCOPY OF COLD MOLECULAR IONS

Faculty Host: Andrey Vilesov

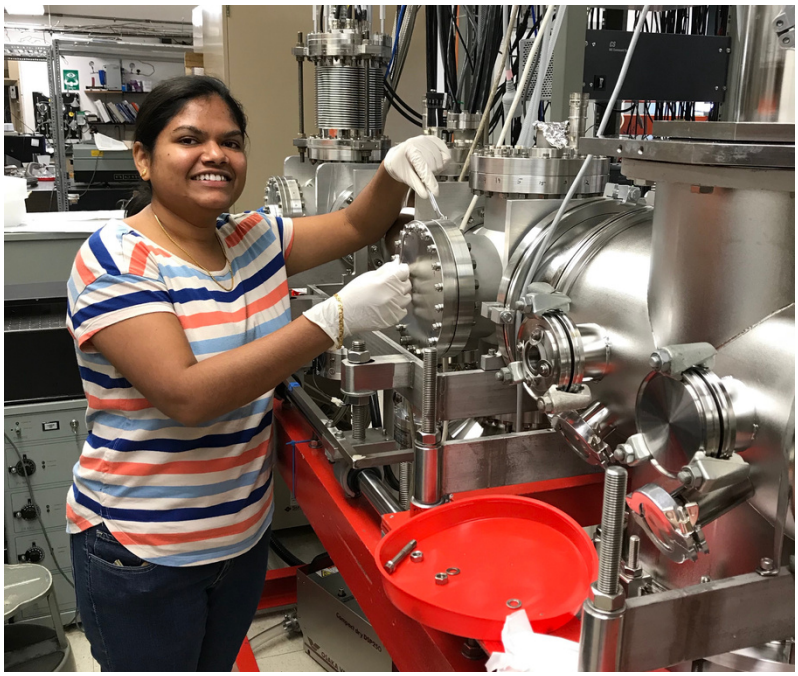
Preferred majors: Chemistry, Physics, Engineering

Students will take part in experimental study of molecular ions. Molecular ions are important intermediates in the chemistry of condensed phases or in the gas phase such as in earth's upper atmosphere or outer space. We study the structure of the ions by infrared laser spectroscopy. In order to obtain meaningful spectra, the ions are first cooled in liquid helium droplets. From the spectra the structure of the ions is deduced.

See the site: https://sites.google.com/usc.edu/vilesov-group

STUDENT LEARNING OUTCOMES

- Vacuum technology
- Laser technology
- Molecular spectroscopy
- Data analysis



SNAPSHOTS OF CHEMISTRY: VISUALIZATION AT THE MOLECULAR LEVEL

Faculty Host: CHEMISTRY FACULTY

Preferred majors: Chemistry, Biochemistry

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.

You will work one-on-one in a lab with a faculty advisor and graduate student mentor. 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, Loker Hydrocarbon Research Institute and 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.

STUDENT LEARNING OUTCOMES

- We provide comprehensive research opportunities, individualized 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 perspectives and the large role of chemical research in solving the current societal and environmental issues.

DIRECTING WATER STRUCTURE AT ELECTROCHEMICAL INTERFACES

Faculty Host: Jahan Dawlaty

Preferred majors: Chemistry, Physics

Most electrochemical reactions of interest for energy conversion require delivery of protons, often from water, to surface adsorbed species. However, water also acts as a competitor to many such processes by directly reacting with the electrode, which necessitates using water in small concentrations in a background organic solvent. Controlling the water content and structure near the surface is an important frontier in directing reactivity and selectivity of electrochemical reactions. The student will use surfactants and spectroscopy to achieve this task. We are looking forward to seeing you here in the summer.

STUDENT LEARNING OUTCOMES

The student will learn the following skills:

- Basic electrochemical methods.
- Vibrational spectroscopy methods (IR and Raman)
- Data processing and programming
- Presentation and communication skills

FAKE NEWS IN REAL TIME: PROBABILITY MODELS OF (MIS)INFORMATION STREAMS

Faculty Host: Andrew Daw

Preferred Majors: Math, Statistics, Engineering, Data science, or other Mathematical Sciences

The speed at which information can be shared online has democratized the documentation of major events, but it has also created vulnerabilities in the accuracy of information. This is particularly true in real time, as it can be hard to verify events until reality can be observed.

Suppose you are watching a stream of posts regarding the same situation. Some posts say that Outcome A happened, whereas some say that Outcome A did not happen. From an outsider's perspective, it can be hard to tell what is true. Some people may share or repeat information without actually knowing what happened, accidentally or even antagonistically lending credence to what may eventually be false.

In this project, we will create probability models for the sharing process and its underlying virality. We will propose and analyze policies for when and why an outside observer should believe a real time story. We will evaluate these models and policies through mathematical analysis and simulation study. Furthermore, we will also collect and analyze data, evaluating the models' fit and usefulness in practice.

STUDENT LEARNING OUTCOMES

The goals of this project are to model, simulate, and analyze the contagious spread of information in real time through probabilistic representations of reality. Hence, the learning outcomes for this project include:

- Construct and evaluate probability models, particularly the Hawkes self-exciting point process
- Simulate probability models through developing and deploying Monte Carlo experiments and algorithms
- Collect, analyze, and apply data from social networks such as Twitter

The particular details of the project can be tailored to the student(s) and their interests in background. The core of this project is in mathematical modeling, code, and data, but the relative focus on each component can shifted to best suit the student.

Typically, research of this style is most natural for students majoring in math, statistics, engineering, data science, or other mathematical sciences, but enthusiasm and excitement for the research are also accurate predictors of success in research. If you're excited about the problem but not too familiar with the topics, don't hesitate to apply!

UNCERTAINTY, BIAS, AND FAIRNESS IN MACHINE LEARNING

Faculty Host: Matteo Sesia

Machine learning algorithms are applied in many fields and can identify hidden patterns in large data sets. Their predictions inform high-stakes decisions, such as how to invest precious resources, which credit applications to accept, or which defendants to grant bail. Unfortunately, machine learning models can be quite obscure, sometimes unreliable, and are based on data which are not always representative. Consequently, their output may be difficult to trust and often underestimates the true difficulty of predicting complex phenomena. Further, sampling biases risk getting automatically absorbed into these models, raising safety and fairness concerns.

In this project, students will acquire hands-on-experience on how to properly use state-of-the-art machine learning algorithms. They will learn about different notions of algorithmic fairness and their relative advantages. They will implement these impactful algorithms and have the opportunity to observe their usefulness by conducting large-scale numerical experiments.

Preferred majors: Computer Science, Mathematics, Statistics

STUDENT LEARNING OUTCOMES

By the end of this program, students will be able to:

- Import, manipulate, analyze, and summarize data using the Python programming language
- Implement and apply different types of machine learning algorithms in Python
- Identify and explain possible limitations of machine learning models, such as overconfidence, bias, and different notions of unfairness.
- Explain, implement, and deploy mitigation methods for the aforementioned issues, including state-of-the-art techniques based on conformal inference.
- Present their results in a clear and articulate manner, for both technical and non-technical audiences.
- Produce professional reports combining nicely formatted text and neat visual elements (e.g., charts and tables) using Jupyter notebooks.

DATA SCIENCE FOR PUBLIC HEALTH

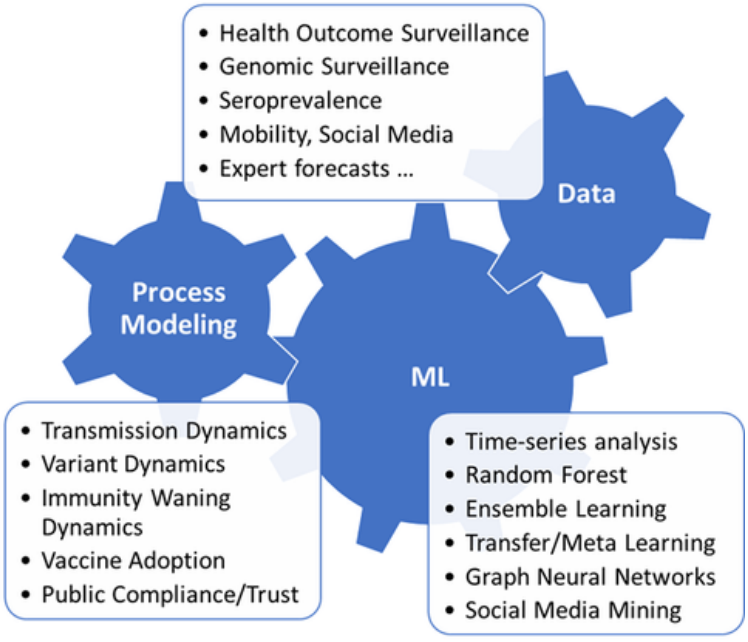
Faculty Host: Ajitesh Srivastava

Preferred majors: Computer Science, Computer Engineering, Electrical Engineering, Math, Statistics, Quantitative Biology

Understanding the epidemiological situation and generating short-term forecasts and long-term scenario projections are important to drive public health decisions. For epidemics of interest, collaborative efforts take place worldwide between experts, government agencies, and stakeholders. In this project, the candidate will conduct research to address how to improve epidemic forecasting by using data pre-processing, machine learning models, ensemble techniques, and social media data. The candidate may also work on exposing the dynamics of competing variants, and learning the dynamics of the imperfect vaccines.

STUDENT LEARNING OUTCOMES

- Combining machine learning and mathematical modeling
- Understanding of real-world data issues
- Developing ensembles
- Understanding evaluations and questions of interest to public health agencies



VESICLE PRODUCTION WITHIN WILD BACTERIAL POPULATIONS

Faculty Host: James Boedicker

Preferred Majors: Physics, Biophysics, Microbiology, Biochemistry, Biological Engineering, Chemical Engineering

Bacterial cells are capable of producing and taking up tiny pieces of cells called vesicles. These vesicles, which are surrounded by cell membrane, contain biomolecules such as enzymes, signal molecules, mRNA, and DNA. Vesicles enable both molecular exchange between cells and help cells run extracellular reactions, making vesicles a critical component of evolution and metabolism of microbes in the wild. This project will quantify the production of vesicles from wild bacteria isolated from the environment, and explore how the content of these vesicles assists with processes such as gene transfer, environmental remediation, and nutrient flow through microbial communities. Feel free to email the lab if you have any questions about the project. We are open to modifying the project goals based on your interests.

STUDENT LEARNING OUTCOMES

Students will isolate bacteria from the wild and measure the production of vesicles over time using nanoparticle tracking. Uptake of these vesicles will be measured via fluorescence microscopy and flow cytometry. The project will teach basic skills for microbiology and molecular biology. The project may involve genetic engineering techniques, depending on student interest. Students will learn how to plan, execute, and analyze scientific experiments. Participants will gain experience presenting their findings and thinking critically about scientific data.

Feel free to email the lab if you have any questions about the project. We are open to modifying the project goals based on your interests.

LOOKING FOR DARK MATTER WITH STELLAR DATA

Faculty Host: Kris Pardo

Preferred Majors: Physics, Astronomy, Mathematics, Computer Science

Dark matter makes up most of the mass in the Universe; however, its exact nature is still not known. The way that dark matter clumps within galaxies, including our own, tells us about the possible properties of dark matter and helps us pinpoint its true nature. Data from existing and upcoming telescopes, like Gaia and the Nancy Grace Roman Space telescope, give us unprecedented views of our own galaxy. By looking at how stars change over time in these data, we can try to look for hints of dark matter. For example, gravitational lensing could affect the brightness and locations of stars, and these will change with time as dark matter halos move on the sky. This project involves looking for dark matter using these signatures.

STUDENT LEARNING OUTCOMES

- As part of this research, the student will learn how to analyze time series astronomical data to look for hints of weak lensing of stars from dark matter. They will also learn how to compare this data to predictions from various dark matter models.
- This project will teach the basic skills behind working with and analyzing astronomical data. It will also teach some basic statistical skills regarding likelihood analysis and model comparison.
- The student will also learn important aspects of how to think about scientific data and present their findings.

DERIVING NEW TREATMENTS FOR STROKE PATIENTS USING PROTEOMICS AND GENOMICS

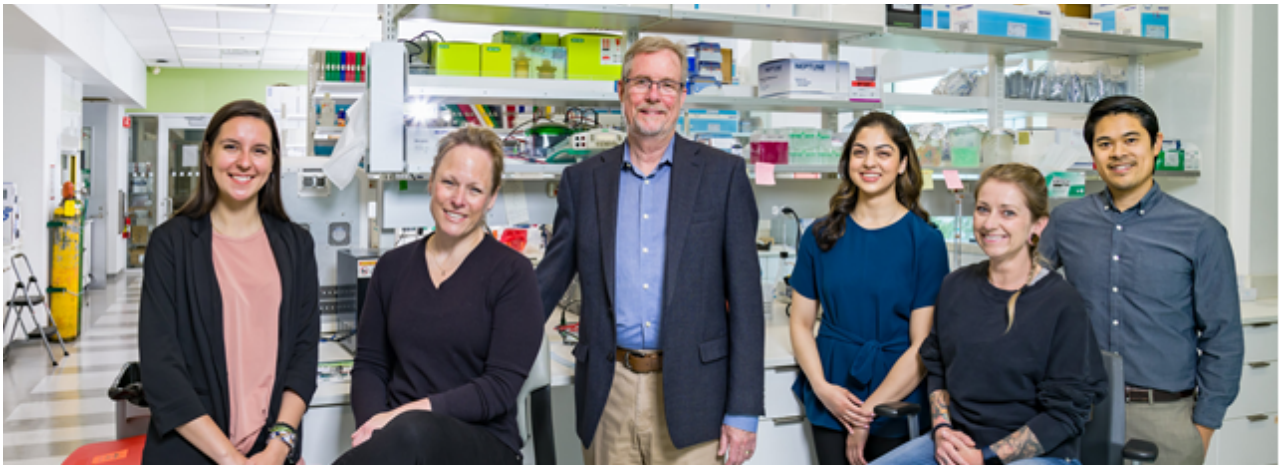
Faculty Host: Patrick Lyden

Preferred Majors: Biochemistry, Chemistry, Biology, Molecular Biology, Cell Biology, Neuroscience

I have a laboratory effort funded by NIH, VA and AHA focused on translational pre-clinical stroke modeling, pharmacology, and vascular biology. Our lab has recently focused on the role of thrombin mediating cytotoxicity in the brain and the molecular mechanisms of PAR-1 mediated neuroprotection. We have considerable experience with a variety of animal stroke models; neurobehavioral testing; histology and immunocytohistochemistry; MR imaging of rodent brain; recombinant molecular biology; and cell biology. We currently (Fall 2022) have one graduate student (PIBB) and 4 neuroscience undergraduates working in the lab. We hope to host summer student in 2023. The student will learn basic lab safety, how to assist with cell culture, proteomics, microscopy and will learn PCR.

STUDENT LEARNING OUTCOMES

1. Learn basic scientific method, integrity, experimental method
2. Assume responsibility for personal safety by understanding hazards in a modern lab
3. Learn basic methods such as weighing, pipetting, mixing
4. Learn advance methods such as microscopy, spectrophotometry, image analysis



DISMANTLING RACIAL INEQUITIES AROUND MENTAL HEALTH (DREAM) LAB

Faculty Host: Chardee Galan

Preferred Majors: Psychology, Cognitive Science, Pre-Med, Social Work

We are conducting two research studies focused on better understanding the mental health effects of race-related stressors on Black and Latinx youth. We are also examining cultural strengths that help to protect youth from the detrimental effects of racism, such as positive racial ethnic identity, cultural pride, and civic engagement. We are recruiting 10-to-17-year Latinx youth and their primary caregivers to participate in 2.5-3 hour assessments on USC's campus. During these visits, families complete questionnaires as well as observational assessments. Families have the opportunity to participate in English or in Spanish. I look forward to reviewing your application!

https://galanlab.org/

STUDENT LEARNING OUTCOMES

JumpStart interns will have the opportunity to:

- Assist with running study assessments with families
- Code observational discussion tasks and other qualitative data
- Conduct literature reviews
- Learn more about use of community based participatory research methods, such as the development of a community advisory board to guide inclusive and equitable research practices.

USC NEST LAB: STUDYING FAMILY INTERACTIONS AND THE BRAIN

Faculty Host: Darby Saxbe

Preferred majors: Neuroscience or Psychology

Our lab studies how families cope with challenges. We are bringing families into the lab seven years after we first recruited pregnant couples, so our kids are now in the first and second grades. Our lab visits include family interaction tasks, a child neurocognitive assessment, and a neuroimaging scan. We also have an online sample of families originally recruited during COVID-19 pandemic that we are continuing to follow.

STUDENT LEARNING OUTCOMES

- As part of this research, students can help run visits with our families and assess the attention and cognition of seven-year-olds
- This study also includes neuroimaging scans of the child and their father, so there may be opportunities to help with MRI scans
- We will also invite JumpStart students to help with recruitment and tracking of participants and managing our datasets
- Students will gain experience collecting multimodal data from kids and their parents

COGNITION AND AFFECT REGULATION (CAR) STUDY

Faculty Host: Kaley Keefe

Preferred Majors: Psychology or neuroscience majors, minors, or majors in a related discipline with relevant experience

The CAR lab examines cognitive and affective processes involved in the regulation of negative affect, in an effort to identify vulnerability factors for mood disorders.

We take a multi-method approach to examining individual differences in styles of thinking and regulating negative affect. This work involves laboratory-based measures of brain activity (using fMRI and event-related potentials), autonomic nervous system functioning (heart rate and respiration), and behavior (computer tasks and questionnaires). In addition, to understand behavior outside of the lab, we utilize ambulatory assessment to measure person-centered variability in autonomic functioning (with wearables), sleep quality (with actigraphy), affect and regulation strategies (using ecological momentary assessment), and digital phenotyping approaches to measuring behavior.

STUDENT LEARNING OUTCOMES

- Scoring and analyzing physiological data, such as heart rate and respiration
- Learning to administer psychology experiments, including executive functioning tasks and psychophysiological assessment
- Observing and assisting neuroimaging (fMRI) visits
- Opportunities to generate, test, and present independent research questions

STUDY OF TEMPERAMENT AND ATTENTION REGULATION

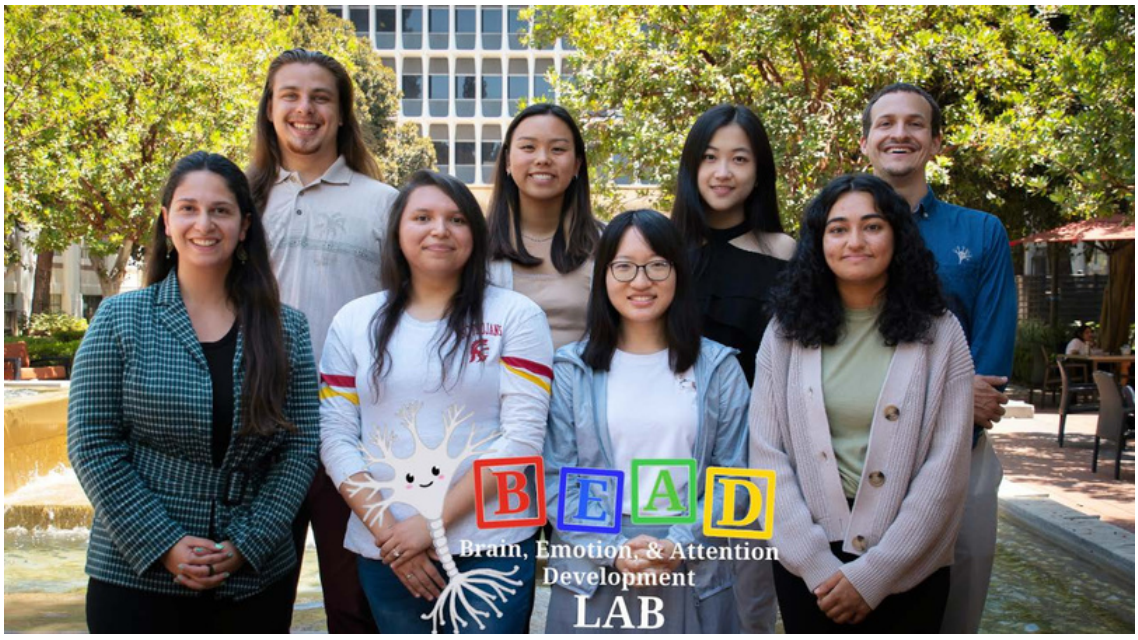
Faculty Host: Santiago Morales

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 early 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 use a combination of behavioral observations, computer-based tasks (eye tracking), and neuroscience measures (EEG).

Preferred Majors: Psychology, Neuroscience, and Computer Science

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.



REDUCING BEHAVIORAL HEALTH DISPARITIES IN UNDERSERVED POPULATIONS

Faculty Host: Stan Huey

Preferred Majors: Psychology or other Health or Social Sciences

Research in our lab focuses on reducing disparities in behavioral health by optimizing treatments for high-risk populations, particularly those from under-resourced ethnic minority groups. Current studies include:

- A meta-analysis exploring the effects of mental health interventions with ethnic minority populations, with a particular focus on cultural tailoring effects.
- A collaborative project with LA County's Office of Violence Prevention (OVP) evaluating the effects of five violence intervention programs in South Los Angeles – programs designed to interrupt cycles of violence in hospital and community settings for crime victims and other high-risk individuals.
- A collaboration with the Los Angeles County Department of Probation (LACDP) evaluating the effects of a case management approach that provides evidence-based supervision to moderate-to high-risk probationers. Website: stanhuey.com

STUDENT LEARNING OUTCOMES

- Students will learn how to review published psychotherapy outcome trials, code for treatment characteristics and cultural content, and calculate effect sizes.
- Student will learn about experimental design and meta-analytic methods in clinical psychology, particularly as it relates to psychotherapy outcomes with marginalized populations.
- Students will learn the logistics, methods, and challenges of conducting clinically-oriented research in community-based settings with marginalized populations.
- Students will use the software Comprehensive Meta-Analysis (CMA) to assist with a treatment outcome meta-analysis.
- Using data from one of our ongoing studies, students will carry out their own project, which includes developing a project proposal, analyzing data, summarizing results, presenting preliminary findings to our lab, and possibly submitting a poster proposal to present at a regional or national conference.

PERINATAL HEALTH BIOMECHANICS RESEARCH

Faculty Host: Kate Havens

Preferred Majors: Engineering, Kinesiology, Behavioral Science, Biology

The Perinatal Health Research Group aims to characterize the biomechanics of postpartum mothers during common infant care tasks. The DIA Jumpstart scholar will be introduced to all aspects of a career in research. The scholar will be able to explore options of ongoing projects to work on, depending on the ability to actively collect laboratory data given the COVID-19 pandemic. Examples of projects include:

1) Contribute to a systematic review of literature on the topics of pelvic girdle pain, low back pain, and current physical therapy interventions in the postpartum population
2) Collect biomechanical motion capture data on postpartum mother and her infant in the Jacquelin Perry Musculoskeletal Biomechanics Research Laboratory
3) Create a data processing pipeline to analyze previously collected pilot kinematic and electromyographic data in innovative and streamlined ways
4) Design motion characterization methods for analyzing publically available videos of mothers interacting with their infants
5) Establish scientific writing skills by contributing to written work on a project

STUDENT LEARNING OUTCOMES

- Contribute to all aspects of human motion data collection: setting up motion markers and electromyographic and acceleration sensors, calibrating cameras, placing equipment on participants, running software programs and timers during collection, assuring data quality, and completing equipment protocols.
- Understand current data analysis processing techniques, including Qualisys motion tracking and/or Visual 3D. Creatively conceptualize ways to streamline these processes using data reduction, coding, or other techniques.
- Identify sources of publicly available videos and keyword search procedures to identify usable videos for mother-infant physical activities, and identify analysis methods quantitatively describe movements.
- Critically analyze research evidence, including determining risk of bias, understanding basic principles of statistical methods used in relevant literature, and interpreting key findings.
- Disseminate findings of project by writing and presenting updates at lab meetings, and contributing to abstracts or manuscripts to present findings at conferences.

PEDIATRIC PHYSICAL THERAPY RESEARCH EXPERIENCE

Faculty Host: Stacey Dusing

Preferred Majors: Kinesiology, Physical Therapy, Occupational Therapy, Psychology, Neuroscience

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, examining developmental effects of posture on object exploration and social attention, observing infants' motor and cognitive experiences in their everyday environments, and implementing the Supporting Play Exploration and Developmental Intervention to a clinical setting. You may be mentored by Dr. Stacey Dusing, Dr. Kari Kretch, or Dr. Christiana Butera in this program

STUDENT LEARNING OUTCOMES

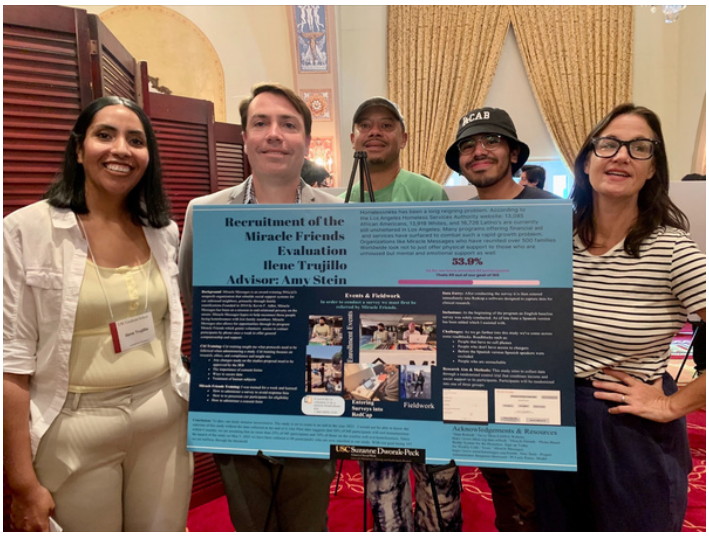
1. Learn the ethical and safety considerations needed to participate in research and demonstrate the ability to integrate these values during interactions with participants and their families.
2. Gain an understanding of the multiple steps and roles of different researchers involved in clinical trials and pediatric research.
3. Develop their skills in reading and discussing literature.
4. Demonstrate skills with behavioral coding to ask and answer a specific research question.

MIRACLE FRIENDS AND MONEY EVALUATION

Faculty Host: Ben Henwood

Preferred Majors: No major preferred. Anyone who has an interest in working with a vulnerable population is welcome.

We are conducting a randomized control trial where people experiencing homelessness are assigned to receive: (a) a social support "phone buddy" program; (b) social support and basic income of $750 a month for one year; or (c) a control group that receives no intervention. Participants are surveyed every 3 months for 15 months. Qualitative interviews will also be conducted with study participants and volunteers who participants in the phone buddy program. The project is part of the USC Suzanne Dvorak Peck School of Social Work's Center for Homelessness, Housing and Health Equity Research



STUDENT LEARNING OUTCOMES

Students will learn:

- To differentiate the rigor of various research designs including randomized control trials
- Skills to effectively engage research participants in trauma-informed interviewing
- Individual and system factors that contribute to the complex problem of homelessness
- To collaborate effectively in a research team environment

SUICIDE RISK AMONG BLACK YOUNG ADULTS

Faculty Host: Hans Oh

Preferred majors: Psychology; Sociology; Public health; Medicine; Anthropology; Computer Science; Open to all majors

In the past decade, suicide rates have increased among Black young adults. Racism is a fundamental cause of health inequality, raising concerns about whether and how suicide preventive interventions reach Black communities. In this study, we aim to develop a Person-Nominated Support Network (PNSN) approach, which adopts a systems perspective to ensure that a psychosocial intervention to prevent suicide can have its intended impact. We will interview Black young adults with prior suicidal behaviors and their confidants to understand the experiences of seeking help. We will also administer a network survey to describe the local service landscape in Los Angeles County for suicidal Black young adults. Finally, we will assess the micro-level fluctuations in risk for an individual throughout the day and explore whether mobile technologies can elicit social support during critical windows of risk.

STUDENT LEARNING OUTCOMES

- Students will learn how to conduct a literature review.
- Students will gain experience conducting qualitative interviews.
- Students will learn how to administer surveys.
- Students will become familiar with intervention development.

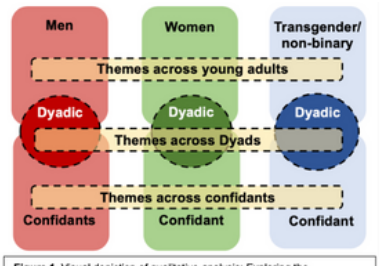


Figure 1. Visual depiction of qualitative analysis: Exploring the experiences of help-seeking for suicide among Black young adults and help-seeking behaviors among confidants

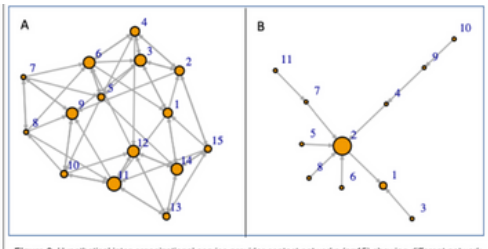


Figure 2. Hypothetical inter-organizational service provider contact networks (n=15) showing different network structures. Organizations (nodes) are represented as circles. Nodes sized by indegree (i.e., number of times an organization is contacted by other organizations). A) *Small world network:* organizations are relatively well-connected and can access each other in a small number of steps. B) *Scale free network:* one organization is contacted far more than other organizations.

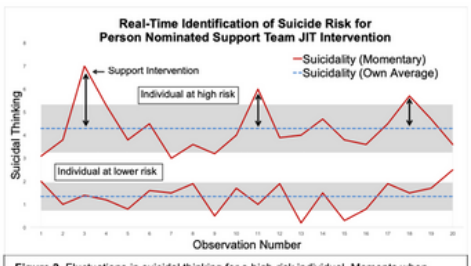


Figure 3. Fluctuations in suicidal thinking for a high-risk individual. Moments when support network can be prompted to intervene are depicted by the peaks when the individual's suicidal thinking increases above their usual range.

SHIFTING SUICIDE PARADIGMS: LOOKING BEYOND CLINICAL SETTINGS

Faculty Host: John Blosnich

Preferred Majors: Public Health, Health Promotion, Social Work, Health Sciences, Psychology, Sociology

Every 10 minutes, one person dies by suicide in the US, a result of a public health epidemic that has increased over the last 15 years and incurred over $70 billion in medical costs and lost productivity. A common lamentation in the wake of suicide is, “If we had only known how bad things were.” A crucial scientific gap in suicide prevention stems from the majority of suicide research relying on individual mental health problems, largely overlooking meaningful constellations of risk in a broader context of social environmental life disruptions that commonly precede suicide. Job loss, financial strain, divorce and relationship break-ups, legal problems, housing instability—these life disruptions can be signals of despair that are misinterpreted as coincidental rather than causal. Our studies challenge the status quo by taking an upstream perspective to suicide prevention research – the person in their context - by exploring how non-clinical industries serving individuals experiencing life disruptions could become bridges for suicide prevention. Our research is a part of the Center for LGBTQ+ Health Equity at USC. For more information please visit: https://dworakpeck.usc.edu/research/centers-affiliations/center-for-lgbtq-health-equity .

STUDENT LEARNING OUTCOMES

As a part of this research, students will contribute to recruitment efforts across studies by : (1) Compiling databases of professionals across industries of disruption (family law attorneys, mortgage bankers, unemployment services, self-storage operators). (2) Adding to database of bereavement groups for survivors of suicide loss. (3) Brainstorming ways to reach potential participants and stakeholders. (4) Students will assist with study data by editing interview transcriptions with professionals in industries of disruption and with survivors of suicide loss.

Depending on the student’s interests, they will also have the chance to assist with development of study flyers and media, data coding, data entry, and occasional projects related to suicide prevention for at-risk populations including LGBTQ+ individuals which can entail needs around conducting literature reviews and developing web-based outreach and infographic summaries that translate research findings for multiple stakeholders. Students will have the opportunity to attend weekly lab meetings and contribute their ideas.

BUILDING "THE TEAM" OF IMMUNE CELLS TO FIGHT AGAINST CANCER

Faculty Host: Fumito Ito

Preferred Majors: Biology, Biomedical Engineering

While immune-stimulating effects of radiation therapy have been recognized, how it works and how it can be enhanced remain to be elucidated. This proposal aims to investigate the therapeutic efficacy of a novel combinatorial treatment involving intratumoral immunotherapy and radiation, and understand the interaction between radiation and the host immune response using preclinical models and clinical samples. This project is expected to advance our knowledge of combining radiation therapy with immunotherapy and make significant contributions to cancer treatment.

STUDENT LEARNING OUTCOMES

- Learn pre-clinical models of cancer immunotherapy
- Learn basic tumor immunology

EXAMINING THE FUNCTION OF MIXED LINEAGE LEUKEMIA (MLL) IN LEUKEMIA

Faculty Host: Yali Dou

We will characterize mixed lineage leukemia in transcription regulation. My lab has a collaborative and fun environment for learning. People in the lab are kind and caring. There are plenty of learning opportunities.

Preferred majors: Biology, Biochemistry, Chemistry

STUDENT LEARNING OUTCOMES

- Learn basic lab techniques such as cell culture, protein expression, molecular cloning, real time PCR as well as reading broadly in the area of epigenetic dysregulation in cancer.

MECHANISMS BY WHICH CHRONIC INFLAMMATION EXHAUSTS WOUND HEALING IN THE INTESTINE

Faculty Host: Mark Frey

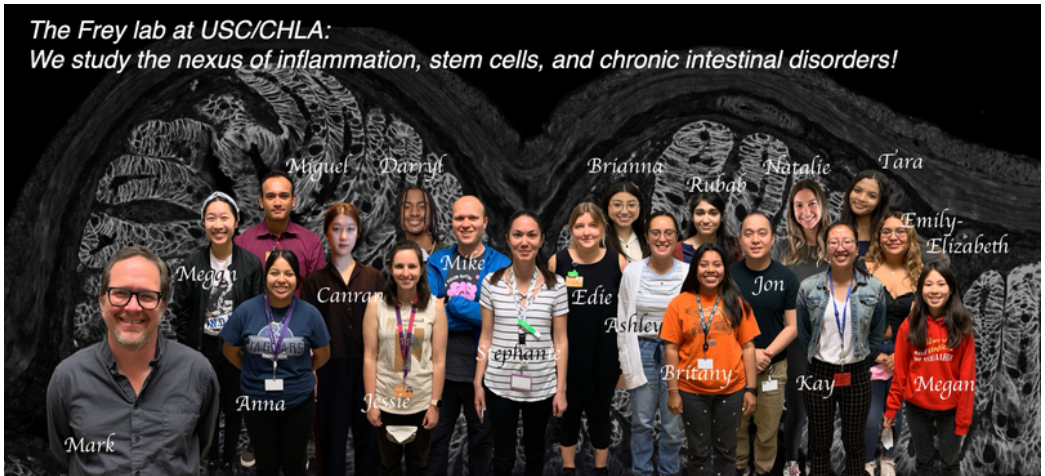
Preferred Majors: No preference; interest in biomedical research and a passion for learning are the only prerequisites.

The epithelial lining of the intestine has tremendous capacity for self-repair after inflammatory injury. However, some repair processes are blunted or "exhausted" after chronic inflammation. We are studying one of these mechanisms involving a protein called Sprouty2. This protein is a negative regulator of repair and regeneration, effectively acting as a “parking brake” on these processes under healthy conditions. After an injury or inflammatory event, Sprouty2 is suppressed, thus releasing (activating) repair and regeneration. However, repeated bouts of inflammation somehow impair the ability to suppress Sprouty2, making it more difficult to activate repair and regeneration mechanisms. Consistent with this observation, Sprouty2 levels are actually increased in the intestines of some patients with the chronic inflammatory conditions ulcerative colitis and Crohn’s disease. We are using minigut organoid cultures to try to understand how this loss of function occurs, which will hopefully lead to new treatment options for patients.

STUDENT LEARNING OUTCOMES

After this research experience, students will be able to:

- Discuss the response of intestinal epithelial cells to inflammation;
- Grow intestinal cells and intestinal stem cell-derived organoid cultures in the laboratory;
- Design, perform, document, and report experiments that assess how a chronic inflammatory environment affects cellular function (including assessing Sprouty2 levels at both RNA and protein levels);
- Write a scientific abstract based on their work; and
- Present data in a short talk.
- Students will also learn what it is like to work in an active biomedical research laboratory and gain insight into what the day-to-day life of a scientist is like.



GENE REGULATORY LOGIC OF VERTEBRATE HEAD DEVELOPMENT

Faculty Host: Gage Crump

Using genomic techniques, we have identified a number of putative regulatory DNA sequences that we think control the expression of key patterning genes for vertebrate head development. The project is to test the activities of these regulatory elements in zebrafish transgenesis assays. The goal is to understand how these regulatory elements control the emergence of different cell types in the vertebrate head, and how changes in these regulatory elements may underlie birth defects and evolution of the head.

Preferred Majors: Biology related fields

STUDENT LEARNING OUTCOMES

- Perform molecular biology techniques, cloning
- Understand embryogenesis, vertebrate anatomy
- Perform zebrafish husbandry and embryo injection
- Learn basic microscopy skills
- Introduction to bioinformatics and genomics analyses
- Follow the scientific method

DEFINING THE 'IMMUNOME' OF PEDIATRIC ACUTE LIVER FAILURE

Faculty Host: Juliet Emamaullee

Preferred Majors: Systems Biology, Engineering, Human Biology

In this project, the student will work with a postdoctoral fellow to deeply characterize the immune features of acute liver failure in children. This disease affects otherwise healthy children and can require emergent liver transplant. We use single cell and 'omic' techniques to identify biomarkers in patient samples.

STUDENT LEARNING OUTCOMES

1. Learn how to perform translational research using human samples
2. Gain proficiency in R and big data analysis
3. Develop skills to work in an interdisciplinary research team

MOLECULAR LUNG CANCER RESEARCH

Faculty Host: Ite Offringra

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.

Preferred Majors: Biology, Chemistry and/or genetics will be able to assimilate information more easily.

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.

EVALUATING THE EFFECT OF LINC00261 ON THERAPEUTIC RESPONSE IN LUNG ADENOCARCINOMA

Faculty Host: Crystal Marconett

Preferred Majors: Biological Science family

Lung cancer is the major cause of cancer-related death in the United States, and lung adenocarcinoma is the major subtype of lung cancer. We have identified LINC00261, a long non-coding RNA, as a tumor suppressor in lung adenocarcinoma and are exploring its mechanism of action. Our postdoctoral scholar, Jonathan Castillo, has observed that LINC00261 is functionally connected to MHC Class II expression, which allows tumor antigens to be expressed on the cell surface, but we do not yet know how this affects the ability of the immune system to recognize tumors and respond to therapy. The summer student will work in tandem with Jonathan to characterize in vivo tumor formation when LINC00261 levels are modulated and how immune response varies in these tumors.

STUDENT LEARNING OUTCOMES

Molecular biology lab techniques including but not limited to: cell culture, immunofluorescence, RNA isolation and quantification, data analysis.

As part of the lab, the student will learn: Data formatting, presenting, scientific writing and participate in lab meetings and scientific discussions.

Keck School of Medicine
Dept Population& Public Health Sciences

Maternal Cannabis Lab

Faculty Host: Rachel Ceasar

Preferred Majors: Social Sciences (anthropology, sociology)

Our research examines harm reduction approaches to substance use, including how expanding cannabis legalization may worsen existing maternal health disparities, particularly for BIPOC people.

The mission of the Maternal Cannabis Lab is to: 1. Advance understanding of cannabis use experience and related health disparities during pregnancy. 2. Integrate patient-, provider-, and retailer-perspectives in emerging maternal cannabis use and harm reduction fields. 3. Foster person- and data-driven evidence to counteract maternal health disparities surrounding substance use during pregnancy, particularly among BIPOC people who are pregnant.

Maternal Cannabis Lab – https://sites.usc.edu/maternal-cannabis-lab/

STUDENT LEARNING OUTCOMES

1. Describe how qualitative methodological frameworks are related to the lab's research questions and designs.
2. Explain the differences between qualitative methods and analyses to address the lab's research questions.
3. Explain how structural racism (i.e., racism integrated into policies and institutions) negatively impacts people's everyday health and wellbeing.

DEVELOPMENT OF DIHYDROMYRICETIN (DHM) FOR ORAL USE IN ANIMAL AND HUMAN STUDIES

Faculty Host: Daryl Davies

Dihydromyricetin (DHM), a nutritional supplement, is recognized for its broad range of pharmacological properties and benefits, including improving mitochondrial function following stress in the brain, muscle, and liver and protecting against oxidative/metabolic stress. Importantly, DHM has been reported to induce activity associated with liver regeneration, counteract EtOH intoxication, EtOH withdrawal symptoms, including seizure threshold and inhibit hepatic collagen deposition and the formation of fibrous nodules. While DHM's anti-alcohol effects are promising, a major obstacle to DHM's clinical efficacy is its suboptimal pharmacokinetic (PK) properties. As with most flavonoids, DHM is poorly absorbed into the blood stream when taken orally, with a short, variable half-life causing variable clinical efficacy. The primary goal of this project is to significantly improve oral bioavailability of DHM, which would greatly enhance its use in future animal and human studies. Dynamic, student friendly lab with multiple team driven projects.

Preferred Majors: Biology, Chemistry, Biochemistry, Pharmacology

STUDENT LEARNING OUTCOMES

Introduction to all aspects of a career in research and critical thinking:

- Conceptualizing the project
- Reading and understanding laboratory standard operating procedures (SOPs),
- Designing and performing well-controlled experiments
- Collecting and analyzing data
- Writing up and building a PPT or poster to present about the project

BIG DATA ANALYSIS TECHNIQUES (BDAT) FOR SCIENTIFIC REPRODUCIBILITY

Faculty Host: Serghei Mangul

Preferred Majors: Computer Science, Life Sciences, and Biology

We aim to provide Fellows a realistic experience, at the level of a typical first-year graduate student, in collaborative scientific research and scholarly communication. We will provide hands-on training to help Fellows gain competency in using computational tools for big data analytic techniques (BDAT) and scientific replicability. We propose a research project that is well-suited to model for the Fellow how scientific methods, data, and ideas translate in real time. The benchmarking study will require the Fellow to select performance metrics relevant to their research questions; document their work as they install, run, and debug each computational tool; generate summary statistics using open-source tools for BDAT; interpret results in the context of major scientific questions; and present project materials on an open-source data sharing platform. The fellow will perform the benchmarking of Structural Variant (SV) callers, computational tools designed to detect SVs in genomic data. SV are genomic regions that have an altered DNA sequence.

STUDENT LEARNING OUTCOMES

- Understand commonly used bioinformatics terms and definitions
- Analyze the large-scale biomedical data using commonly used interactive python-based libraries and packages
- Use various visualizations techniques to display real-world biomedical data in real-time
- Select the most appropriate statistical methods and apply it to real word biomedical data
- Use version control and public repositories for transparent and reproducible data analysis
- Write the data analysis component of a scientific manuscript and create an easy-to-navigate repository with the analysis accompanying the scientific manuscript
- Understand in brief, the components and steps involved in a typical bioinformatics pipeline and the types of input and output file formats
- Read SAM, BAM, FASTQ, and other file formats
- Prepare the “Code availability” and “Data availability” statement to make materials, data, code, and associated protocols promptly available to readers as is required by a large number of scientific journals (e.g. Nature journals)

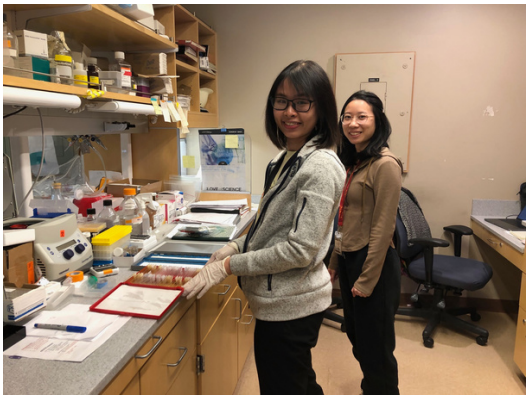
STEM CELL & TISSUE REGENERATION, AND CRANIOFACIAL NEUROSCIENCE; HUMAN IPSC CELLS & ORGANOIDS TO MODEL BRAIN AND CRANIOFACIAL DISORDERS

Faculty Host: Jianfu (Jeff) Chen

Preferred Majors: Neuroscience, Microbiology, Cellular or Molecular Biology, Biomedical Engineering, Biochemistry, Genetics, Chemistry or any STEM field

Craniofacial malformations account for close to one-third of all birth anomalies and significantly compromise the quality of life for these patients. We investigate neurological abnormalities in craniofacial disorders such as neurocognitive dysfunctions in craniosynostosis, a congenital craniofacial disorder. We also study the neuronal regulation of craniofacial stem/progenitor cell, injury repair, and tissue regeneration. We aim to provide neuroscience perspectives to craniofacial development and diseases.

We use CRISPR/Cas9 approaches to introduce disease mutations into human iPSCs followed by the differentiation into brain organoids and different cell types, such as neural progenitor cells (NPCs), neurons, pericytes, neural crest cells (NCCs), and suture stem cells (SuSCs). We aim to use these in vitro/ ex vivo human models to identify new disease mechanisms and therapeutic strategies for brain and craniofacial disorders.



STUDENT LEARNING OUTCOMES

1. The summer internship will take place at the Center for Craniofacial Biology, a cutting-edge research center that provides a rich academic environment with weekly seminars, monthly journal club, and numerous opportunities to learn from each other.
2. Our JumpStart Scholar will hone their skills in important molecular and cellular biology techniques related to neuroscience, that will provide a strong foundation for future graduate studies or laboratory-based positions.
3. Additionally, the JumpStart Scholar will gain confidence in visualization and communication of scientific concepts, working directly with experienced PhD students, postdoctoral fellows and highly trained professional laboratory staff. Students will gain experience in thinking critically about scientific data.
4. To culminate the summer experience, our JumpStart Scholar will give a presentation of their research to colleagues and faculty at the Center for Craniofacial Molecular Biology.

RESEARCH IN CRANIOFACIAL BIRTH DEFECTS AND TISSUE REGENERATION

Faculty Host: Yang Chai

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

Our face represents the unique identity each of us present to the world. The face and skull house many of our important sensory organs, our brain, and the entry points to the systems by which we breathe, eat, and speak. 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.

Chai lab has a strong track record of pioneering research investigating the molecular and cellular regulatory mechanisms of craniofacial development, with particular emphasis on congenital birth defects such as cleft palate and skull malformations. Lab members also conduct basic and translational research involving mesenchymal stem cells from in vitro studies to large animal models, necessary steps in the development of stem cell-based regenerative therapies for both soft and hard tissues.

STUDENT LEARNING OUTCOMES

1. Our JumpStart Scholars will hone their skills in important molecular and cellular biology techniques that will provide a strong foundation for future graduate studies or laboratory-based positions.
2. JumpStart Scholars will gain confidence in visualization and communication of scientific concepts in a variety of settings, working directly with experienced postdoctoral fellows and highly trained professional laboratory staff.
3. To culminate the summer, JumpStart Scholars are encouraged to give a presentation of their research to colleagues and faculty at the Center for Craniofacial Molecular Biology.
4. The Center for Craniofacial Molecular Biology is a cutting-edge research center with a full suite of state-of-the-art equipment shared by all of our affiliated researchers. It provides a rich academic environment with weekly seminars, monthly journal club, and numerous venues through which to learn from each other and our colleagues at research institutions across the globe.

INVESTIGATE TARGETS OF CAMP SIGNALING IN CARTILAGE

Faculty Host: Zhaoyang Liu

Preferred Majors: Biology, Biochemistry, Microbiology, Biological Engineering

The cAMP signaling pathway is important for various biological functions. It regulates a broad range of intracellular processes that are coupled to the control of cellular proliferation, differentiation, and apoptosis. The role of cAMP signaling and its direct target genes in chondrocytes, which is the cell type that makes up cartilage, is not well studied. This study is designed to understand the function of cAMP signaling, as well as other G protein-coupled receptors (GPCR)-mediated signaling, in cartilage homeostasis.

STUDENT LEARNING OUTCOMES

- This project will teach the basic skills of histology, including paraffin sectioning, H&E staining, and IHC analysis.
- Students will learn how to isolate and culture primary chondrocytes and chondrogenic cell lines.
- Students will also learn how to analyze gene expression via RNA extraction and qPCR.
- Students will have the opportunity to learn how to design and execute scientific experiments, analyze data, and present their scientific results.

DEFINING ASIAN ENCLAVES IN LOS ANGELES COUNTY TO UNDERSTAND DISPARITIES IN CANCER DIAGNOSIS AND SURVIVAL

Faculty Host: Robert Vos and Lihua Liu

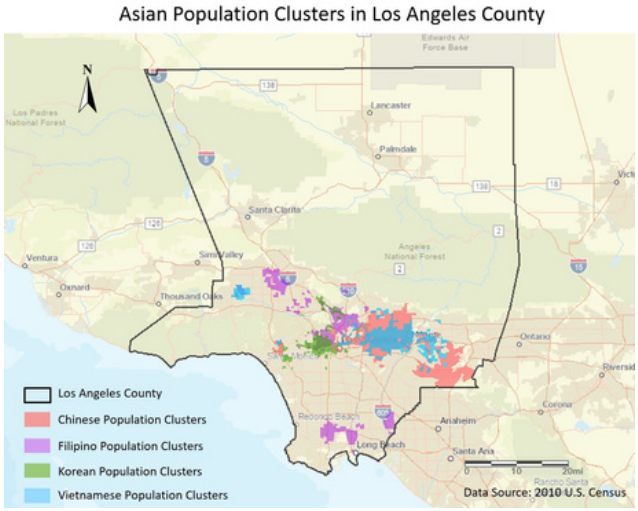
Los Angeles County (LAC) is one of the most populous and racially diverse counties in the US. Many people reside in ethnic enclaves, a type of neighborhood that features a high concentration of a specific racial/ethnic group, linguistic isolation, preservation of ethnic culture, and ethnic businesses and institutions. The social and built environment of ethnic enclaves influence residents' health behaviors and outcomes.

This project will collect specific geospatial information for a study that examines the association between living inside Asian enclaves in LAC and colorectal cancer stage at diagnosis and survival outcomes among selected Asian ethnic groups, including Chinese, Filipino, Korean, and Vietnamese. This project uses Google Street View images to explore the linguistic landscape in LAC. Triangulating different data sources and using geospatial analysis tools, this project aims to identify physical evidence of Asian enclave boundaries to help validate methods for defining Asian ethnic enclaves in LAC. We welcome applications from many different undergraduate majors who are interested in our topic.

Preferred Majors: Geography, Sociology, Public Health, Spatial Sciences (GIS), Data Sciences, and Computer Science.

STUDENT LEARNING OUTCOMES

- Learn about the emergence and development of ethnic enclaves and their influences on health and cancer disparities.
- Learn steps for data sampling, collection, cleaning, and validation.
- Gain experience with collecting neighborhood data from multiple sources, including Google Street View images and the U.S. Census Bureau's American Community Survey.
- Gain working knowledge of geospatial concepts and GIS tools in public health research.



COMPLEXITY ANALYSIS OF RESTING-STATE FMRI DATA IN NEURODEVELOPMENTAL DISORDERS

Faculty Host: Kay Jann

Preferred Majors: Physics, Math, Biology, Neuroscience, Psychology, Computer Science

Complexity analysis is a new way of looking at fMRI signals that is complementary to conventional methods but provides novel insight in brain functionality. Using this novel method we investigate if children with, or at risk, for neurodevelopmental psychiatric disorders show altered fMRI complexity. Identifying brain areas with altered complexity might help better understand the pathophysiology and facilitate novel treatment avenues.

STUDENT LEARNING OUTCOMES

- Familiarize with functional MRI
- Learn how to preprocess fMRI data
- Learn how to perform complexity analysis
- Learn how to correlate imaging data with behavioral variables
- Learn how to visualize neuroimaging data

DECISION-MAKING WHILE WALKING IN RISKY ENVIRONMENT

Faculty Host: James Finley

Preferred Majors: Biomedical Engineering, Mechanical Engineering, Kinesiology, Psychology

The risk of falling depends on the routes we choose when moving through our environment and the coordination patterns we use to walk through the environment. However, there are no theoretical frameworks that explain how we choose between alternative routes to move through the environment or decide what strategies we use to reduce risk while walking along a chose route. The ability to make rational decisions about risk-taking during walking is critical for populations who may have impairments in their ability to assess risk and respond to losses of balance. Here, we will distinguish between several theoretical models of decision-making during walking by using novel, perturbation-based approaches to modify physical risk. Developing methods to assess individual differences in risk perception and risk preference could lead to a new class of fall-reducing interventions that improve patients' ability to accurately identify and avoid potential risks that are beyond their physical capacity.

STUDENT LEARNING OUTCOMES

- Explain how computational models are use to explain human decision-making
- Understand how to collect biomechanical data during walking
- Learn how to write code to analyze biomechanical data in MATLAB
- Learn how to present research aims and results in a clear and compelling manner