

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Table of Contents

Click on project titles to see full abstracts

PI First Name	PI Last Name	Title	Host Campus	Start Date
Mark	Amengual	An Interdisciplinary approach to the study of Spanish-English bilingualism In California	Santa Cruz	1/1/2023
Alex	Borucki	Routes of Enslavement In the Americas	Irvine	1/1/2023
Clare	Cannon	Toxic Air Pollutants In California Environmental Justice Communities	Davis	1/1/2023
Brittany	Chambers	Advancing Knowledge and Reproductive Justice: The UC Community Research Hub	Davis	1/1/2023
Holly	Doremus	Just Transitions In Large Socioecological Systems: Drought, Sea-level Rise & Salinity In the Delta	Berkeley	1/1/2023
Anna	Epperson	Social Networks and Health among Indigenous Californians Research Collaborative	Merced	1/1/2023
Amato	Evan	UC-Dust: Addressing Future Changes In California Dust Storms	San Diego	1/1/2023
Mekonnen	Gebremichael	Toward Satellite-Based Information for Efficient Water Use and Yield Forecasting In California	Los Angeles	1/1/2023
Mengyang	Gu	UC Collaborative for AI-enabled Materials Exploration and Optimization (UC-CAMEO)	Santa Barbara	1/1/2023
Arpad	Horvath	California Center for Green Buildings Research	Berkeley	1/1/2023
Amanda	Lewis	The UC Glycosciences Consortium for Women's Health	San Diego	1/1/2023
Juliet	McMullin	Abolition Medicine and Disability Justice: Mapping Inequity and Renewing the Social	Irvine	1/1/2023
Elizabeth	Nowadnick	Ferroelectric oxide Membranes for low-energy next-generation electronics	Merced	1/1/2023
Denise	Payán	Strengthening Policy and Translational Research to Advance Health Equity in California	Irvine	1/1/2023
Marina	Radulaski	CIRQIT - Collaborative Interdisciplinary Research In Quantum Information Topics	Davis	1/1/2023
Craig	Schroeder	High-performance numerical solvers for Scalable and flexible simulation on Modern hardware	Riverside	1/1/2023
David	Strubbe	California Initiative for Solid-to-Plasma Dynamics for Fusion Energy	Merced	1/1/2023
Leti	Volpp	Anti-Asian Violence: Origins and Trajectories	Berkeley	1/1/2023
Glenn	Yiu	The Collaborative UC Teleophthalmology Initiative for Diabetic Retinopathy Screening	Davis	1/1/2023

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

PI First Name	PI Last Name	Title	Host Campus	Start Date
Erika	Zavaleta	Planning a UC Center for Climate-Adaptive Biodiversity Conservation	Santa Cruz	1/1/2023
Michael	Zuerch	The California Interfacial Science Institute (CISI)	Berkeley	1/1/2023
Tyrus	Miller	The Human in Question: Advancing Humanities Research at the University of California	Irvine	7/1/2022
Boris	Baer	Strengthening honey bee health and crop pollination to safeguard food availability and affordability	Riverside	1/1/2021
Henry	Burton	California Informatics for Equitable Disaster Response and Recovery	Los Angeles	1/1/2021
Mishuana	Goeman	Centering Tribal Stories of Cultural Preservation in Difficult Times	Los Angeles	1/1/2021
Thomas	Harmon	Labor and Automation in California Agriculture (LACA): Equity, Productivity & Resilience	Merced	1/1/2021
Barbara	Jacak	California Consortium at the Electron-Ion Collider	Berkeley	1/1/2021
Alexa	Koenig	The UC Network for Human Rights and Digital Fact-Finding	Berkeley	1/1/2021
Crystal	Kolden	Addressing California communities doubly vulnerable to catastrophic wildfires	Merced	1/1/2021
Ben	Olguin	The Global Latinidades Project: Globalizing Latinx Studies for the Next Millennium	Santa Barbara	1/1/2021
Borja	Reguero	UC Coastal Resilience and Climate Adaptation Initiative	Santa Cruz	1/1/2021
Laurel	Riek	Robot-facilitated Health Equity in Post-Pandemic California and Beyond	San Diego	1/1/2021
Jesse	Rothstein	California Policy Lab: Data-Driven Solutions to California's Most Complex Issues	Berkeley	1/1/2021
Matthew	Shtrahman	Two-Photon Calcium Imaging of Human Brain Activity: The Next Frontier in Neuroscience	San Diego	1/1/2021
Roya	Zandi	UC Coronavirus Assembly Research Consortium	Riverside	1/1/2021

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

An Interdisciplinary approach to the study of Spanish-English bilingualism In California

Host Campus: Santa Cruz

Lead Investigator: Mark Amengual *Award Type:* Planning/Pilot Award

Collaborating Sites: Berkeley, Los Angeles

Start Date: 1/1/2023 *End Date:* 12/31/2024 *Amount:* \$ 266,815

Abstract:

This collaborative initiative will enhance the research capacity and leadership of the UC system to address the linguistic issues of language contact, language shift, and language maintenance in the Spanish-speaking population of California by developing a robust and linguistically rich corpus of bilingual Spanish-English speech samples (Multilingual Hispanic Speech in California; MuHSiC) culled from sociolinguistic interviews and naturalistic conversations among speakers of diverse social profiles and regional origins throughout California. The audio recordings will be made available on an open website where researchers, teachers, students, and the public will be able to access a linguistic map of California Spanish-English bilingual speech. This research has two main outcomes: (i) the creation of an open-source oral corpus of Spanish-English bilingual speech in California, and (ii) the inauguration of a conference on bilingualism and speech in California to disseminate the results and encourage cross-campus collaborations. The project will design a targeted research strategy for UC by involving graduate students, engaging underrepresented undergraduate students in field research experience, and engaging with multiple cities and counties in our state, ultimately establishing UC as an international leader in bilingualism research.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Routes of Enslavement In the Americas

Host Campus: Irvine

Lead Investigator: Alex Borucki *Award Type:* Program Award

Collaborating Sites: Merced, Santa Cruz

Start Date: 1/1/2023 *End Date:* 12/31/2025 *Amount:* \$ 839,629

Abstract:

Launched online in 2018, the Intra-American Slave Trade Database, created by Alex Borucki (UCI) and Gregory O'Malley (UCSC), documents more than 27,000 trafficking voyages from one part of the Americas to another from 1550 to 1860. This MRPI will expand this collaboration to a network of scholars and students to strengthen the study of this traffic at the UC and to increase the database's coverage. With Sabrina Smith (UCM), they will target three core areas: 1) interregional movements of African and African-descended captives within colonial Mexico (including California), 2) investigation of the Black Pacific by tracking coastal trafficking routes involving ports from California to Chile, and 3) further research on Caribbean migrations (coerced and free) of African-descended people between islands and with the mainland Americas. Borucki, O'Malley, and Smith will coordinate with other UC faculty, postdoctoral fellows, graduate, and undergraduate students, as well as with other scholars from the United States, Latin America, and the Caribbean. Year 1, led by O'Malley, examines Caribbean maritime spaces and the trafficking of enslaved people between French, Spanish, Dutch, Danish, and British colonies. Since this is a core region of coverage for the existing database, the focus here will be on expanded collaboration and new research strategies to address gaps. This year will also focus on outreach to new collaborators to plan for new research directions of years two and three. It will also involve the creation of an undergraduate internship program at UCSC to facilitate student research on the project. Year 2, led by Borucki, highlights the Black Pacific by systematizing regional databases and examining primary sources on the traffic of captives between ports of the Pacific Americas such as Acapulco, Lima, and Valparaiso. Year 3, led by Smith, focuses on creating a database to examine the movement of enslaved people within the colony of New Spain (today's Mexico and parts of the United States and Central America). The creation of this database will bring together research on regional archival records across Mexico from scholars in the United States and Mexico. Both in year 2 and year 3, teacher workshops will be organized at UCI and UCM, which will connect California's past with the broader histories of the slave trade in the United States and Latin America.

Our program targets three research areas: 1) interregional movements of African and African-descended captives within colonial Mexico (including California), 2) investigation of the Black Pacific by tracking coastal trafficking routes from California to Chile, and 3) further research on Caribbean migrations (coerced and free) of African-descended people, between islands and with the mainland Americas. Borucki, O'Malley, and Sabrina Smith will each oversee one target area, while collaborating on the project's shared goals. Each will lead a year of the initiative, centered on their campus and theme, and will coordinate with other UC co-investigators, postdoctoral fellows, graduate, and undergraduate students.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Toxic Air Pollutants In California Environmental Justice Communities

Host Campus: Davis

Lead Investigator: Clare Cannon

Award Type: Program Award

Collaborating Sites: Irvine, Merced

Start Date: 1/1/2023

End Date: 12/31/2026

Amount: \$ 1,160,917

Abstract:

California has the worst air pollution in the US. Over the last few decades, regulations have improved air quality in areas suffering the most: Los Angeles, the Imperial Valley, the San Joaquin Valley, and the San Francisco Bay Area. In 2017, the state began focusing on disadvantaged communities through the enactment of Assembly Bill 617 (AB617): “The Community Air Protection Program.”

AB617 established the nation’s first state-run community-scale program to detect air pollution hotspots in communities, helping to reduce air pollutants that tend to occur at higher levels in low-income communities of color. The development of new air pollution measurement tools to implement AB617 can be an exceptional form of relief for these communities who for years have been advocating for access to cleaner air. Disadvantaged communities in California are typically exposed to two kinds of hazardous air pollutants (HAPs): toxic metals and toxic volatile organic compounds. As part of this effort, the California Air Resources Board funded Dr. Wexler, a co-PI of this proposal, to develop a cost-effective instrument to measure toxic metals in the air. Conventional toxic metal instruments cost about \$200,000, while Dr. Wexler’s instrument has similar performance but only costs \$3,000 to build. With US EPA funding, Dr. Wexler is also developing an inexpensive instrument for measuring toxic VOCs. Conventional instruments that measure these compounds cost on average over \$500,000. Dr. Wexler’s instrument will cost about \$20,000.

This proposal will use these novel instruments with collaborative community approaches and educational outreach to solve three problems for California’s most disadvantaged communities:

1. Partner with community groups, such as Communities for a Better Environment (L.A., S.F.), and the Central California Environmental Justice Network (San Joaquin Valley), to identify HAPs in their communities and work with them on advocacy and policy analysis to improve air quality and health.
2. Train a new generation of interdisciplinary researchers able to help disadvantaged communities with their air quality problems.
3. Support the careers of three early career underrepresented minority assistant professors, Drs. Mendez, Cannon, and Alvarez, working on community air quality problems in Southern California, the SF Bay Area, and the San Joaquin Valley, respectively.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Advancing Knowledge and Reproductive Justice: The UC Community Research Hub

Host Campus: Davis

Lead Investigator: Brittany Chambers

Award Type: Program Award

Collaborating Sites: Berkeley, San Francisco

Start Date: 1/1/2023

End Date: 12/31/2025

Amount: \$ 1,327,643

Abstract:

The proposed project aims to develop a UC hub for community research- a participatory approach to including community members as meaningful partners that we have successfully implemented in our ongoing applied research. Amidst growing calls to address structural racism in research and to center communities most affected by health inequities, this project presents an opportunity for building systemwide capacity for anti-racist research approaches.

With a focus on birth and reproductive justice, we seek to draw on our successful community-driven research collaborations to formalize the model to train community members as researchers and train UC researchers in authentic community engagement.

The proposed three-year project aims to: (1) formalize and scale-up the community research model to train and authentically engage community members as researchers and partners; and (2) train faculty, trainees, and students in actualizing birth and reproductive justice in practice and research. In Year 1, we will create a curriculum for community research. In Year 2, we pilot the curriculum by training and mentoring community members as researchers, including providing placements with ongoing research programs. In Year 3, we will refine the curriculum and provide grants for community-led research, supported by UC students and faculty; and disseminate the community research model.

Building this research model contributes to the UC's public mission and will provide a foundation for centralizing community perspectives using anti-racist research. Specifically, with the focus on birth and reproductive justice, we aim to promote a rigorous approach to knowledge production that centers the experiences and builds capacity of communities of color. Establishing this hub for innovative research approaches will support the UC's efforts to conduct cutting edge community-engaged research and provide an important foundation for future funding, particularly as NIH releases funding calls for its UNITE initiative to address structural racism and promote racial equity and inclusion.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Just Transitions In Large Socioecological Systems: Drought, Sea-level Rise & Salinity In the Delta

Host Campus: Berkeley

Lead Investigator: Holly Doremus

Award Type: Program Award

Collaborating Sites: Davis, Merced, San Diego

Start Date: 1/1/2023 *End Date:* 12/31/2026 *Amount:* \$ 2,455,739

Abstract:

This research project addresses one of the most challenging, complex, and controversial issues in the management of the California Bay-Delta: how to balance nationally significant agricultural and fisheries interests, statewide water supply reliability interests, federally and state-protected ecological interests, and local recreational, cultural-historical, and subsistence interests in the management of salinity, an increasing challenge in the face of extended drought and sea-level rise. Through a participatory scenario-based approach, we use state-of-the-art computing, coupled with locally sourced knowledge, to build holistic understanding of the multifaceted tradeoffs associated with alternative nature-based, regulatory, demand-based, and engineering scenarios for salinity management while building social capital and information-sharing networks through extended public engagement and open-science technologies. Throughout, we test how the components of this approach (e.g., stakeholder workshops, technological resources) change stakeholders' perceptions of the issues and the acceptability of potential management strategies, their trust in science, policy, and other stakeholders, and their understanding of complex scientific issues. Research outcomes include: 1) quantitative understanding of how nature-based, policy-based, and engineering strategies may function independently or in combination to mitigate future salinity challenges—with applications to other estuaries such as the Chesapeake Bay, where salinity intrusion is a growing concern; 2) new understanding of how a topically-focused, participatory, scenario-based approach may promote a “just transition” in science-informed governance for resilience of large socio-ecological systems with deep histories of conflict; and 3) open cyberinfrastructure tools and enhanced social capital that lay a foundation for addressing other “wicked problems” (e.g., harmful algal blooms, species recovery) in the Bay-Delta. Training—for undergraduate and graduate students and public agency scientists—is integrated into the research program through new curricula, a Summer Institute, formal mentorship, and capstone/incubator projects. Trainees will develop games, tools, and visualizations that will enhance stakeholder engagement and will work directly with data generated from the project.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Social Networks and Health among Indigenous Californians Research Collaborative

Host Campus: Merced

Lead Investigator: Anna Epperson *Award Type:* Program Award

Collaborating Sites: Santa Cruz, San Francisco

Start Date: 1/1/2023 *End Date:* 12/31/2025 *Amount:* \$ 738,302

Abstract:

Indigenous Peoples in California face barriers in accessing health services. Despite historical and cultural similarities, most health research examines those from tribes in the U.S. separately from those from Latin America, who are usually considered Hispanic/Latinx. California (CA) is home to the largest population of Indigenous people in the U.S. Research shows that social network composition, meaning the network of individuals connected through interpersonal relations (e.g., family, friends), influences health behaviors and health outcomes. Indigenous peoples have strong and interconnected social networks which may play an even bigger role in health-related perceptions and behaviors. However, social networks for Indigenous people in CA may span state, tribal, and national borders, leading them to prioritize health information from outside their local area. Following long-standing health inequities experienced by this under-researched population, these communities have been disproportionately impacted by COVID-19, with some of the highest rates of hospitalization and death. However, rates of COVID-19 vaccination are lower compared to other racial/ethnic groups. Despite the potential critical role of social networks, little research has examined social network composition in relation to Indigenous health decision-making; none in the context of COVID-19 vaccination. In collaboration with the Indigenous community, our study seeks to: 1) understand, through social network analysis, how variation in network characteristics is associated with COVID-19 vaccine-related knowledge, attitudes, and behaviors among Indigenous peoples living in CA; 2) design and test a health communication intervention aimed at increasing vaccination, disseminated through key influencers within social networks; 3) share resources on Indigenous health behavior research; and 4) provide health disparities training to students and community members. Our findings will characterize how individuals with transnational/trans-tribal networks make decisions about vaccines, setting the foundations for effective and targeted health interventions to increase vaccine uptake. While our initial priority is to study social network information flows for COVID-19 vaccination, our Collaborative intends to continue to contextualize Indigenous health decision-making within social networks more broadly.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

UC-Dust: Addressing Future Changes In California Dust Storms

Host Campus: San Diego

Lead Investigator: Amato Evan *Award Type:* Planning/Pilot Award

Collaborating Sites: Berkeley, Davis, Irvine, Los Angeles, Merced

Start Date: 1/1/2023 *End Date:* 12/31/2024 *Amount:* \$ 299,471

Abstract:

Dust storms are a common occurrence in many parts of California and are associated with a multitude of negative human health, economic, and environmental impacts. A growing body of evidence suggests that as the planet warms the frequency and severity of dust storms will increase, and thus it is likely that dust storms will play an increasing role in the economy, health, and environment of California. Despite this, little is known about many aspects of current dust storm activity, including the conditions in which dust storms typically occur, its connection to recent drought, the communities most affected, the spectrum of health impacts, and the costs to the state's economy. Even less is understood about future changes in dust storms and those impacts.

The main goal of UC-Dust is to address the state's looming dust storm crisis. The first steps towards achieving this goal include assessing the current level of understanding, identifying critical areas where new knowledge is needed, compiling realistic mitigation and adaptation strategies, and communicating the issues with community partners and policymakers. UC-Dust brings together scholars who possess expertise in the nature and consequences of dust storms and are particularly well-suited to assess the impact of current and future dust in California. UC-Dust proposes the following activities: 1) Quantify current dust storm activity in California and impacts on human health, the environment, environmental justice, and the economy. 2) Identify likely future dust scenarios, impacts, and mitigation and adaptation strategies. 3) Ascertain key areas where lack of knowledge inhibits our ability to characterize current or future dust storm activity and consequences. 4) Generate a detailed report communicating main findings and a scientific summary brief for policy makers, and communicate findings to policymakers and community groups representing affected people.

One expected impact of this project is to improve the level of scientific understanding of dust storms and their consequences within the state and build the capacity to address the outstanding scientific questions. Another is to foster better informed communities, community groups, and policymakers, who will in-turn have more agency to demand action and direct state resources towards addressing gaps in understanding and mitigation and adaptation efforts.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Toward Satellite-Based Information for Efficient Water Use and Yield Forecasting In California

Host Campus: Los Angeles

Lead Investigator: Mekonnen Gebremichael *Award Type:* Planning/Pilot Award

Collaborating Sites: Davis, Riverside, Agriculture and Natural Resources

Start Date: 1/1/2023 *End Date:* 12/31/2024 *Amount:* \$ 300,000

Abstract:

OBJECTIVES: The project is centered on one of the most critical environmental issues of our times – managing water scarcity in California and other similar regions. A key part of the solution is developing an irrigation water management information system based on satellite data that routinely monitors crop water use, crop water availability, and crop yield forecast, and provides optimal irrigation scheduling that maximizes crop yield given limited water resources. We aim to achieve this in two phases. In Phase 1 (this pilot grant), we test appropriate technology for ground field data collection, collect necessary field data, and identify gaps and uncertainties in existing satellite-based algorithms. In Phase 2 (for which we will seek extramural grant), we will develop an operational irrigation water management information system based on satellite data, utilizing the datasets, techniques, and findings of Phase 1.

METHOD: The project involves extensive field study over several alfalfa fields in the Imperial Valley, CA, and Davis, CA, deploying state-of-the-art sensors, and evaluating satellite-based retrieval algorithms. The sensors include TerraRad Tech’s Portable L-band Radiometer (a recently invented and patented portable sensor), Eddy covariance station, UAV with multispectral/thermal sensors, and UAV with microwave L-band. The team will survey farmers and collect field data on crop yield and auxiliary information in the study domains. In addition, team members will also share field datasets acquired from various previous projects.

IMPACT: This project establishes a new collaboration between four UC institutions (UC Los Angeles, UC Davis, UC Riverside, and UC Agriculture and Natural Resources). The team members have been studying irrigation water management from a single-discipline perspective, but this project allows them to integrate perspectives and develop a holistic approach for irrigation water management. The project increases the efficiency of existing equipment and datasets housed in various UC units as team members plan to share these resources. The team will collectively train a number of postdocs, graduate and undergraduate students. The anticipated outcomes include improved knowledge in irrigation water management information system for California’s alfalfa farms, and increased multi-campus collaboration opportunities.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

UC Collaborative for AI-enabled Materials Exploration and Optimization (UC-CAMEO)

Host Campus: Santa Barbara

Lead Investigator: Mengyang Gu *Award Type:* Planning/Pilot Award

Collaborating Sites: Irvine, Los Angeles, San Diego

Start Date: 1/1/2023 *End Date:* 12/31/2024 *Amount:* \$ 299,912

Abstract:

While machine learning is gaining traction across disciplines, the access to, and awareness of data science/artificial intelligence (AI) tools have progressed unevenly across different domains of research. Domain scientists often lack the necessary expertise to fully utilize the libraries of experimental data they generate. Equally, data scientists may not be aware of the research challenges from other disciplines that can motivate new data-science/AI-enabled solutions to important problems relevant to society. There is a critical need to address societal challenges through AI-enabled research and to equip next-generation scientists and engineers with the skills to understand, utilize, and innovate data-science enabled techniques that will lead to optimized processes and reduce the cost (and time) of experiments, eventually enabling more sustainable manufacturing.

This pilot project will establish a new collaboration of an interdisciplinary team of leaders and junior scholars from four UC campuses, to advance innovations in processes for useful chemicals and materials. The technologies being addressed are highly relevant and timely, such as efficient polymer degradation, renewable energy storage, and cost-efficient pharmaceutical development. Although effort has already been invested into these critical issues, significant challenges remain, as the chemical input space has very large dimensionality, and the experiments populating this space are sparse. Our mission is to integrate human and machine intelligence to achieve the necessary synergies that will allow advances that cannot be achieved solely within an individual discipline. In particular, we will develop probabilistic models to estimate correlations in the databases we create, coupled with existing ones, for predicting optimal processes and conditions of candidate materials, and to quantify the uncertainty in predictions that will motivate new simulations and experiments. We will construct high-fidelity surrogate models to accelerate simulations, and to sequentially reinforce predictions by experiments.

The outcomes of this Collaborative will augment databases, automate experimental protocols, and advance software packages across research domains. The proposed platform will greatly accelerate digitization in chemical and materials research, and impact standardization and increase productivity.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

California Center for Green Buildings Research

Host Campus: Berkeley

Lead Investigator: Arpad Horvath *Award Type:* Planning/Pilot Award

Collaborating Sites: Davis, Irvine, Los Angeles, Santa Barbara

Start Date: 1/1/2023 *End Date:* 12/31/2024 *Amount:* \$ 299,997

Abstract:

Green buildings are a linchpin in the development of a sustainable future in California. Already about 40% of the world's CO2 emissions are attributable to construction and use of buildings. California is faced with the critical and simultaneous challenges of housing shortage, high costs of construction, earthquake hazard, forest fires, water shortages, climate change, and urban air quality problems while needing to renew, expand, and renovate the building stock consisting of several million commercial, residential, government, industrial and other buildings. The UC system alone must take care of more than a thousand buildings. How can we do all of this sustainably?

The future of buildings needs to be very different than the past. We need to minimize the environmental and human health burdens of buildings throughout their supply chains. Decarbonization is a societal goal, but action plans of how to do that for buildings have not been created. The reduction of other pollutants and the consumption of materials and water are also critical and most urgent challenges, with very little to no research done on them to date.

We will create new paradigms in how building design and materials for construction and renovation can be assimilated to mitigate environmental and human health impacts while improving building comfort and functionality at the lowest possible economic costs and with maximum societal benefit.

Our Center will initially develop a set of most urgent questions to answer, identify data needs, collect data, design a decision-support tool, complete case studies, partner with building owners and architecture-engineering-construction companies, create a website, and develop results that can be adopted by practitioners and policy makers and implemented in codes. These initial efforts in the pilot project will begin to position the UC system at the forefront of the transformation that will yield advanced environmentally, economically, and socially sustainable design, construction, and renovation approaches for buildings.

Our focus will be on California and the supply chains behind materials, wherever they may extend geographically. Through development of databases as well as robust methodological frameworks for assessment and improvement, the proposed research center will strive for global reach.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

The UC Glycosciences Consortium for Women's Health

Host Campus: San Diego

Lead Investigator: Amanda Lewis

Award Type: Planning/Pilot Award

Collaborating Sites: Davis, San Francisco *Start*

Date: 1/1/2023 *End Date:* 12/31/2024

Amount: \$300,000

Abstract:

Our goal is to advance areas of women's health research that are understudied relative to their impact on quality of life, health outcomes, and participation in the California workforce. To do this, our consortium (in the planning stage) will cross-fertilize women's health with another unique strength of the UC system – Glycoscience.

All cells display and secrete a complex molecular code of carbohydrate chains (glycans). Glycans establish cellular identity and function and are directly implicated in many common human diseases. Likewise, glycans are also commonly used as pharmacologic agents that promote or disrupt biologic processes. Our goals are to maintain the University of California's position as a world leader in the separate fields of glycoscience and women's health, while building cohesion and capacity for pioneering research at their interface.

This 2-year planning grant aims to establish the UC Glycosciences Consortium for Women's Health. The consortium will be led by investigators at UCSD (PI: Lewis), UCSF (Co-PI: Fisher), and UCD (Co-PI: Lebrilla). As a planning grant, the goals are threefold. First, we aim to attract women's health researchers into the glycosciences by providing seed support for glycan analysis for new collaborative projects. We have selected five pilot projects for initial support in diverse areas impacting women, such as the vaginal microbiome, maternal immunity, pregnancy complications, and birth injury. Analysis of project samples, most of which are already available, will occur in the GlycoAnalytics core facility at UCSD and the Lebrilla Medical Glycomics Mass Spec Lab at UC Davis. Second, we hope to foster cohesion and world-class research in the Glycoscience of Women's Health by hosting two events: 1) a research symposium that cultivates innovative UC research collaborations, mentorship, and career development, and 2) GlycoBootcamp, a hands-on research training workshop in glycan analysis. We will enhance training opportunities and encourage diverse trainee participation by awarding scholarships to attend these events. It is our intent that these activities will 1) attract and retain diverse talent to the Glycosciences, 2) drive new discoveries that value the health of women, and 3) build a framework that will ultimately establish UC as the premier global leader in the glycoscience of women's health.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Abolition Medicine and Disability Justice: Mapping Inequity and Renewing the Social

Host Campus: Irvine

Lead Investigator: Juliet McMullin *Award Type:* Program Award

Collaborating Sites: Los Angeles, Riverside, Santa Cruz, San Francisco

Start Date: 1/1/2023 *End Date:* 12/31/2025 *Amount:* \$ 1,287,993

Abstract:

The COVID-19 pandemic and its health disparities, climate change-related disasters, continued anti-Black racism, SCOTUS decisions affecting patient autonomy, and racist border and immigration policies, have brought to the surface the deep entanglements of institutions and policies that maintain inequity and disparate health outcomes. Calls for health equity are not new, but faculty and students throughout the UC system are looking for new ways to contribute to our effort to identify structures of inequity and implement practices that dismantle systemic racism to reimagine education and the delivery of health care within and outside the clinic. Indeed, the UC Executive Report *Disrupting the Status Quo* (2020) identifies structural racism, social determinants of health, and diversifying the UC at all levels as “imperatives” for action. Examining structural inequity is also a focus of health humanities which has centered disability studies in an effort to shift away from a medical humanities focus on narratives of fixing the body to transforming the environment. Health humanities has a recent turn to engage questions of abolition medicine. Similar to disability studies, abolition medicine is also a commitment to building new institutions and processes for reimagining an equitable society. The project collectively engages with structural transformation through research, curriculum development, and training in the fields of health humanities and disability studies.

The expertise of this MRPI research collective will achieve these aims through a social mapping project that examines the consilience between and friction among locally-identified health equity issues and community reimaginings. Each campus’s mapping will be a shared resource to support educational and policy projects, enhance graduate training in health humanities and disability studies, and develop eight course modules for undergraduate, graduate, and medical students. Our engagement with communities across California includes calls for community participation in our advisory board, paid internships for students, research experiences for community members, scholarly presentations, creative performances and dissemination, and scholarly publications. Each activity is designed to amplify a reimagining of care, collaborative engagements with health equity and to dismantle systemic racism and ableism.

Ferroelectric oxide Membranes for low-energy next-generation electronics

Host Campus: Merced

Lead Investigator: Elizabeth Nowadnick

Award Type: Planning/Pilot Award

Collaborating Sites: Berkeley, Davis

Start Date: 1/1/2023

End Date: 12/31/2024

Amount: \$ 299,628

Abstract:

Despite ever-improving computing efficiency, information technology represents the fastest growing energy consumer and will have significant implications for U.S. energy consumption in the near-term future. This impending challenge threatens the nation's ability to solve important problems across science, technology, and energy. Without improvements in computing efficiency, the explosion of the Internet of Things and Artificial Intelligence applications will exponentially increase energy use. A complete rethinking of how computing is performed is needed to develop the next generation of microelectronics. One pathway to highly efficient computing is to introduce novel materials that can be operated at voltages (powers) much lower than those in use today. In this project, we propose to investigate a family of ferroelectric oxide materials which hold promise for enabling energy-efficient electronics. Ferroelectrics are materials that exhibit a spontaneous electrical polarization that can be reversed by the application of an electric field. The two directions of the polarization in a ferroelectric encode two states (0 and 1), which can be harnessed for use in logic and memory devices. Typically, scientists create ferroelectric oxides in bulk or thin-film form (where thin layers of the ferroelectric are grown on top of another material). We will investigate ferroelectric oxides realized in a novel form introduced in just the past few years: freestanding membranes. Ferroelectric-oxide membranes may hold several advantages for device applications, including low-energy operation, ultrafast polarization switching speeds, and ready integration with existing silicon-based platforms. However, these properties of oxide membranes remain almost completely unexplored. This program will combine experimental synthesis, characterization, and quantum mechanical computer simulations of ferroelectric-oxide membranes with the goal of understanding and optimizing their properties for energy-efficient computing. We will investigate how mechanical stretching of the membranes tunes the energy landscape and facilitates low-energy and ultrafast polarization control, thus enabling low-power applications. The expected outcome will be a proof of concept of ferroelectric-oxide membrane functionality, which we will further develop by applying for external funding opportunities.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Strengthening Policy and Translational Research to Advance Health Equity in California

Host Campus: Irvine

Lead Investigator: Denise Payán

Award Type: Program Award

Collaborating Sites: Berkeley, Merced, Riverside

Start Date: 1/1/2023

End Date: 12/31/2025

Amount: \$ 943,165

Abstract:

Strategies to bridge the gap between research evidence and policy can help to address health inequities in California. This MRPI will catalyze a new multicampus collaboration across four UC campuses (UC Irvine, UC Berkeley, UC Merced, UC Riverside) to strengthen and expand health equity and policy research capacity. Our specific aims are to:

1. build health equity and policy research capacity and infrastructure across three Minority Serving Institutions in the UC system (UC Irvine, UC Merced, UC Riverside);
2. conduct formative research to inform the development and implementation of translational research products; and
3. collaborate with policy and community stakeholders in Merced and Riverside Counties to conduct translational research-to-policy projects that address local health equity needs.

This three-year initiative will have short-term and intermediate impacts by producing policy-relevant products and scientific articles to advance the translation of research evidence into policy. The California Initiative for Health Equity and Action (Cal-IHEA), a UC faculty-led effort housed at UC Berkeley to promote health equity through state policy change, will serve as the lead organization. In 2023, Cal-IHEA's leadership and administration will transition to UC Irvine, a Hispanic Serving Institution with growing health policy expertise. This project leverages this leadership transition and would launch a distinct focus on local evidence-based policymaking with new collaborators at UC Merced and UC Riverside.

Project activities include research and analytical training, mentoring, and financial support for graduate and undergraduate students at three UC campuses. First, we will examine how research evidence is used and integrated into state and local policy and identify the extent to which health equity values and concerns are reflected. Next, we will collaborate with two equity-focused community partners in Merced and Riverside Counties to carry out community-engaged research projects to promote local policy change and improve regional health. These projects can serve as models of how to conduct multidisciplinary health research aligned with local needs. Results will be used to develop grant proposals for extramural funding from policy-focused foundations, federal research agencies, and state government agencies.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

CIRQIT - Collaborative Interdisciplinary Research In Quantum Information Topics

Host Campus: Davis

Lead Investigator: Marina Radulaski

Award Type: Planning/Pilot Award

Collaborating Sites: Berkeley, Merced, Santa Cruz

Start Date: 1/1/2023

End Date: 12/31/2024

Amount: \$300,000

Abstract:

Overview - The goal of Collaborative Interdisciplinary Research in Quantum Information Topics (CIRQIT) initiative is to create an interdisciplinary alliance of Northern California UC campuses to explore quantum phenomena that transcend experimental platforms. Our team combines experts in quantum nanophotonics (UC Davis, Radulaski), quantum nanoelectronics (UC Berkeley, Siddiqi), solid state quantum computing and quantum optics (UC Merced, Tian), ab initio studies (UC Santa Cruz, Ping), and correlated quantum matter (UC Davis, Scalettar), that span career stages, experimental and theoretical research. We plan to work with LBNL's Advance Quantum Testbed - AQT (headed by Co-PI Siddiqi) through the established user program and at no additional cost to the project. Our plan is focused on 1) the CIRQIT community creation with inclusive training of graduate students and 2) the pursuit of interdisciplinary research goals in quantum information systems.

Community – We plan to leverage the broad expertise of our team and the diversity of students represented on our campuses to meaningfully engage students in education and hands on research in quantum information. Three of our campuses (UCM, UCD, UCSC) are minority serving institutions that train a number of Hispanic, Asian American, and Pacific Islander students, as well as first-generation college students. We will follow our institutions' proven diversity, equity, and inclusion practices in engaging the community. Bringing on board different perspectives in this academically and economically growing field will benefit both the quantum information research and the communities that engage in it.

Research – Our team has identified interdisciplinary research goals in quantum electrodynamics (QED) to pursue over the two-year duration of the pilot program. Here we start from the parallels between the cavity QED and the circuit QED, which both study light and matter interaction but at energy levels, optical and microwave, that are five orders of magnitude apart. We find that the emerging phenomena in cavity QED unique to the development of quantum internet and distributed quantum computing over the next decade, can already be explored in circuit QED and used to drive research in quantum communications, simulation and computing forward at a much faster pace.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

High-performance numerical solvers for Scalable and flexible simulation on Modern hardware

Host Campus: Riverside

Lead Investigator: Craig Schroeder

Award Type: Planning/Pilot Award

Collaborating Sites: Davis, Los Angeles

Start Date: 1/1/2023 *End Date:* 12/31/2024

Amount: \$300,000

Abstract:

We propose a joint effort to build a scalable, generalizable and hardware-aware open-source codebase for solving nonlinear problems in simulation-based engineering science. Engineering and related simulations involve solving long sequences of very large systems of nonlinear equations. These problems arise naturally from computational physics and mechanics problems with a variational structure, often taking the form of nonconvex optimization problems with nonlinear constraints. Solving these systems takes up the bulk of the total computational cost of many practical simulations and typically limits the size and scope of problems that can be practically simulated on the hardware available. To be practical on larger problems, these solvers must be specialized to take advantage of the special structure common to many of the problems that are of interest and also be optimized for modern hardware, including GPUs, and take advantage of optimizations such as vectorization, threading, and distributed dispatch techniques. Undertaking this collaborative project will allow the PIs to combine their expertise in applied mathematics and computer science to provide this functionality while avoiding the need to duplicate this effort at multiple UC campuses. The PIs will release the library as a broader open source project that will benefit the wider community and bring recognition to the UC system. Furthermore, its broader adoption will naturally facilitate projects that can be funded by large collaborative multi-institutional grants. The proposed effort heavily involves fundamental skills in scientific computing, numerical optimization, nonlinear solvers, partial differential equations, computer architecture and high performance computing that require practical experiences, on which science and engineering students of various levels ranging from high school to Ph.D. will be trained.

California Initiative for Solid-to-Plasma Dynamics for Fusion Energy

Host Campus: Merced

Lead Investigator: David Strubbe *Award Type:* Program Award

Collaborating Sites: Berkely, Irvine, San Diego, Los Alamos National Laboratory,
Lawrence Livermore National Laboratory

Start Date: 1/1/2023 *End Date:* 12/31/2024 *Amount:* \$ 1,399,999

Abstract:

The quest for laser fusion reached a critical milestone in 2021 when ignition was achieved on the National Ignition Facility at Lawrence Livermore National Laboratory. After decades of effort, these experiments reached the cusp of energy output equaling input (which was then surpassed in late 2022), demonstrating the potential of laser fusion as a clean energy source. To make further progress, it is imperative to better understand the first stage of such experiments, in which a solid at ordinary temperature and pressure absorbs laser light and transitions into a plasma, reaching conditions similar to the center of the Sun. Newly developed materials, such as aerogel foams, hold the promise of even higher energy gains, but our ability to model these complex materials has only just begun. It remains unclear how the initial solid and foam structure affects the resulting plasma and for how long a memory persists. This project aims to develop advanced multiscale simulation models and use these models to develop and apply experimental platforms to validate the simulations. UC PhD students and postdocs will perform the research with an interdisciplinary faculty team, working closely with national lab scientists and learning advanced theoretical and experimental methods. We will study the impact of material structure on the atomic scale and larger scales, comparing different forms of carbon: diamond, graphite, and graphene foams. The solid-to-plasma transition involves a cascade of processes over increasing time and length scales: absorption of light, redistribution of energy among electrons and then ions, plasma homogenization, and plasma expansion. These scales require different theoretical techniques, from quantum mechanical treatment of electrons, to classical treatment of atoms, to coarse-grained treatment of electrons and ions, and finally a macroscopic treatment. Models developed by machine learning will connect our simulations across these scales. We will perform experiments, and design future ones, to validate modeling predictions. Findings will improve the fundamental understanding of laser-matter interactions, develop innovative ways to measure plasma conditions, and develop critical simulation capabilities for early times through better physics and machine-learning models, helping to advance the quest for controlled fusion in this new era.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Anti-Asian Violence: Origins and Trajectories

Host Campus: Berkeley

Lead Investigator: Leti Volpp

Award Type: Planning/Pilot Award

Collaborating Sites: Davis, Irvine, Los Angeles

Start Date: 1/1/2023

End Date: 12/31/2024

Amount: \$ 243,446

Abstract:

Violent attacks against Asian Americans have risen exponentially since the advent of the COVID-19 pandemic. Nearly 40 percent of incidents reported nationwide have occurred in California. Our transdisciplinary research team will undertake an in-depth examination of the multi-faceted conditions of this violence, and of possible responses.

One predominant narrative of anti-Asian violence posits a unitary historical figure subject to exclusion, drawing a direct line between the historical legal context and the violence of today. A predominant response is to assume that this violence will end through more surveillance, policing, and the designation of cases of anti-Asian violence as hate crimes. Our research team has found that these dominant narratives put too much weight on the concept of hate, rendering anti-Asian violence the effect of individual prejudice, leading to limited responses. We will examine several historical trajectories of anti-Asian violence across multiple scales, in relation to causes that are local, national, and transnational. In addition, we will examine differences of gender, class, nationality, sexuality, and ethnicity elided in the idea of a unitary “Asian American” victim of violence. We will critically examine how the Asian/American body is mobilized in relation to the carceral state and will work to envision diverse modes of sustaining livable communities and forging multiracial alliances.

Drawing from expertise in the fields of Asian American Studies, Law, Gender Studies, Art, Performance, Social Welfare and American Studies, our research will tackle this problem with multiple approaches. We plan a working group to research historical trajectories of and existing responses to anti-Asian violence and will generate a white paper with our findings. We will edit a special issue of a journal devoted to new approaches to anti-Asian violence. We will co-teach an undergraduate course drawing from our expertise on this issue, and will organize a graduate student workshop that will lead to peer reviewed publication. Finally, we will curate a creative production and mini-exhibition to showcase the role of the arts in responding to anti-Asian violence. These activities will enable the University of California to emerge as the thought leader on the urgent issue of how to understand and address anti-Asian violence.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

The Collaborative UC Teleophthalmology Initiative for Diabetic Retinopathy Screening

Host Campus: Davis

Lead Investigator: Glenn Yiu

Award Type: Program Award

Collaborating Sites: Los Angeles, San Diego, San Francisco

Start Date: 1/1/2023

End Date: 12/31/2026

Amount: \$ 2,000,000

Abstract:

Diabetic retinopathy (DR) is the leading cause of blindness in adults, and early detection and treatment are critical to prevent vision loss. Yet, fewer than 50% of the 3.2 million Californians with diabetes undergo recommended annual eye screening, with disproportionate impact on vulnerable populations. Teleophthalmology using retinal cameras deployed in primary care settings can increase adherence to retinopathy screening and expand eye care access in California. Recently, implementation of a remote, point-of-care retinal imaging program at UC Davis during the COVID19 pandemic improved eye screening from below national median (46%) to the top quartile of the Integrated Healthcare Association (IHA) benchmarks (>65%). A UCSD study also found that 23% of patients who underwent remote DR screening showed ocular pathology beyond diabetic retinopathy alone. However, widespread and sustained adoption of telehealth programs has been limited by technical, logistical, and financial barriers that vary between UC systems. We propose to establish a Collaborative UC Teleophthalmology Initiative (CUTI) between four UC health campuses (UCD, UCLA, UCSD, and UCSF) to 1) identify barriers to tele-ophthalmology utilization, 2) develop implementation packages to provide long-term, effective solutions to expand eye care access, and 3) develop a centralized repository of retinal images from UC sites for future research correlating retinal pathology to health data using artificial intelligence (AI). Our interdisciplinary collaboration includes experts in public health, diabetes care, clinical informatics, implementation science, and ophthalmic imaging to address obstacles in clinical workflow, technology integration, financial sustainability, and quality reporting. Our program provides training opportunities for medical and research trainees to utilize implementation science to address a public health problem, study health disparities, collaborate in health services research, and develop system-level solutions for long-term sustainability of teleophthalmology programs. Our primary mission is to achieve a 65% benchmark for diabetic eye screening across all 4 UC sites, with secondary goals of reducing healthcare disparities in eye care access in California and developing infrastructure for AI-based health research.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Planning a UC Center for Climate-Adaptive Biodiversity Conservation

Host Campus: Santa Cruz

Lead Investigator: Erika Zavaleta

Award Type: Planning/Pilot Award

Collaborating Sites: Berkeley, Santa Barbara

Start Date: 1/1/2023 *End Date:* 12/31/2024

Amount: \$ 299,130

Abstract:

With an MRPI planning grant, we will convene a new multi-campus collaboration, the UC Center for Climate-Adaptive Biodiversity Conservation, to propel innovation and research on cutting edge approaches to adapting biodiversity to climate change. Rapid development and testing of strategies to support the species that underpin the resilience and stability of whole ecosystems is critical to sustaining both California's unique biodiversity and the fundamental social goods that it supports. Drought and fire frequency and severity in California are projected to increase over the next century, and in the last decade climatic changes already have dramatically affected the state's ecosystems, through events like the die-off of over 100 million trees, the trapping of endangered salmon in drying streams and some of the worst fire seasons in recorded history. Our ability to tackle these threats is limited by scarce data on new climate-targeted conservation strategies, and a lack of coordination among researchers across disciplines, and between different sectors. The proposed Center will bring together UC researchers, in collaboration with state agencies and community partners, to guide conservation planning for foundational species (those species that underlie ecosystem structure and function) in California's terrestrial ecosystems, globally recognized for their high proportion of unique and imperiled biodiversity. This effort will synergize with the PI team's existing research foci, efforts to increase representation in conservation science, and cross-sector engagements addressing biodiversity and climate change, including their roles in state agency conservation efforts like 30x30 and the California Fish and Game Commission. In Year 1 we will conduct outreach and a literature review to develop a synthesis of climate change impacts, a needs assessment and three climate adaptation case studies. In Year 2, we will share these findings in a series of climate-adaptation workshops, design a collaborative research agenda for the proposed Center, and pursue funding to support the Center into the future.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

The California Interfacial Science Institute (CISI)

Host Campus: Berkeley

Lead Investigator: Michael Zuerch *Award Type:* Program Award

Collaborating Sites: Los Angeles, Merced, Santa Barbara, Santa Cruz, San Diego,

Lawrence Livermore National Laboratory

Start Date: 1/1/2023 *End Date:* 12/31/2026 *Amount:* \$ 1,083,072

Abstract:

The world around us is governed by constant exchange of energy and particles at interfaces. Understanding interfacial chemistry at a molecular level is therefore of striking importance for a wide array of current challenges, such as clean water production, carbon dioxide capture, removal of plastics from water, clean energy production by photocatalysis, and energy storage in next-generation solid-state batteries. Despite this central importance of interfacial chemistry, relatively little is known about interfacial electronic and molecular structures, the electronic and atomistic dynamics, and how structure and dynamics lead to observed macroscopic properties.

The overarching goal of the California Interfacial Science Institute (CISI) is to coordinate and consolidate theoretical and experimental efforts across the University of California and to leverage the combined expertise towards the creation of a world-leading center for interfacial science. In this program, building on important results and unique method developments from the pilot phase of this program, we propose to expand the research to complex chemical phenomena in liquid water and hydrophobic liquid interfaces relevant to carbon dioxide capture, electric field induced surface catalysis relevant to the environment and green chemistry, in operando ion-charge dynamics at solid-solid interfaces relevant to energy conversion and storage, and the local electric field and dielectric effects in solutions and at interfaces relevant to all interfacial chemistry.

CISI involves leading experts in condensed phase and interfacial linear and nonlinear spectroscopy experiments (UCB, UCM, UCLA, LBNL), transport design (UCB, LLNL), and theory and computation (UCSC, UCM, LLNL, UCSD, UCSB, UCLA). Our multidisciplinary research team will jointly develop advanced experimental techniques that enable studying complex interfaces, and models to simulate and interpret interfacial structure and dynamics. The molecular level understanding obtained in the proposed studies will lead to new technological developments for addressing critical contemporary challenges. CISI includes a broad training component for both graduate and undergraduate students for developing the next generation of interdisciplinary researchers in interfacial science. CISI also will engage with the public through an expansive outreach program.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

The Human in Question: Advancing Humanities Research at the University of California

Host Campus: Irvine

Lead Investigator: Tyrus Miller

Collaborating Sites: Berkeley, Davis, Los Angeles, Merced, Riverside, San Diego, San Francisco, Santa Barbara, Santa Cruz

Start Date: 7/1/2022 *End Date:* 6/30/2027 *Amount:* \$ 600,000

Abstract:

Since 1987, the UCHRI and the Humanities Network have furthered humanities research on key questions facing the state, the nation, and the world, including the cultural impact of digital technologies; the origins and consequences of racism and racialization; the creative expression and agency of marginalized groups and the pluralism and global reach of literary and artistic traditions; the social components of climate change; the experiential and historical dimensions of mass migration; the future of the liberal arts; and humanities and work. In all of these domains, the human is a set of open questions: What does it mean to be human? What happens to the human when the non-human can be programmed to think, feel, and express? What value does humanity offer to a world that humans have divided and degraded? And how can we channel the power of arts and ideas to reshape how people think about human and nonhuman forms of life in an interconnected world? The humanities are everywhere, embedded in the visual world, enacted in civic life and faith practices, and transmitted in the stories people tell about themselves and their communities. Connecting the ten campuses around common concerns, “The Human in Question” fosters research on all areas of human expression and activity, both historical and contemporary, in order to recover models of identity, community, and capacity that might contribute constructively to a shared future.

The 2022-23 UCHRI theme, “Refuge and Its Refusals,” addresses the humanities as spaces of creative reflection and furthers the work of refugee scholars and refugee scholarship. Future themes will be established in consultation with humanities centers and other campus stakeholders. UCHRI will continue to run a competitive grant-making program that fosters intercampus and public-facing partnerships. The campus humanities centers will collaborate on endeavors of mutual interest and benefit. Related projects support mentorship across the system, including the UC Underrepresented Scholars Fellowship mentoring program, now in its second year, and a graduate student mentorship program that involves UC Humanities PhD alumni. UCHRI is also running a multi-year working group on humanities research infrastructure, and continues to foster conversations about the future of graduate education in the humanities.

Strengthening honey bee health and crop pollination to safeguard food availability and affordability

Host Campus: Riverside

Lead Investigator: Boris Baer *Award Type:* Program Award

Collaborating Sites: Davis, Merced, San Diego

Start Date: 1/1/2021 *End Date:* 12/31/2023 *Amount:* \$ 894,518

Abstract:

Honey bees are responsible for the pollination of >80 food crops worldwide and an estimated annual global value of up to \$570 billion, of which \$29 billion in the US agriculture. However, these essential pollination services are threatened by dramatic declines in honey bee health. In the US, recent annual colony losses have been around 40%; almost twice of what is acceptable to sustain sufficient hive numbers for pollination. Research into honey bee declines has identified several environmental stressors that contribute to this pollination crisis, such as parasites, pesticides, climatic and land use changes. Beekeeping practices have also been named as contributing factors. This is due, in part, to the current inability to accurately monitor and manage bee health in a manner similar to what veterinarians are able to provide for domesticated livestock.

Safeguarding honey bees and their pollination services requires beekeepers to be better able to manage the health and survival of colonies, which requires research into the causal factors and interactions affecting pollinator health, and the development and implementation of novel tools in close collaboration with industry partners. To do this, we will form a California wide, cross disciplinary research network and

1. Experimentally study the ecological and molecular factors and their interactions that affect honey bee health and their interactions to identify biomarkers of their health,
2. Use the knowledge gained to develop and deliver new, effective solutions for stakeholders, including remote sensing of bee health, a marker-assisted breeding program, and the development of novel medications,
3. Build a research industry nexus to conduct collaborative research. We will also develop and deploy new extension and outreach modules that will be offered through UC Cooperative Extension statewide. We will support California beekeepers to build and maintain a sustainable and profitable beekeeping industry, which has implications for food security on a national level.

The current coronavirus pandemic and impending recession is putting more pressure on agriculture to provide sufficient and affordable food. Honey bees are key to such efforts, and supporting a California based beekeeping industry also decreases the state's dependence on managed pollination from elsewhere, thereby creating new jobs and income.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

California Informatics for Equitable Disaster Response and Recovery

Host Campus: Los Angeles

Lead Investigator: Henry Burton *Award Type:* Planning Award

Collaborating Sites: Irvine, Merced, Riverside

Start Date: 1/1/2021 *End Date:* 12/31/2022 *Amount:* \$262,428

Abstract:

Natural hazards are an inescapable part of the California experience. Whether wildfire, earthquake, flood, or drought, these events have a documented history of stymieing the social and economic well-being of impacted communities. The ability to rapidly respond and recover in ways that enhance disaster resilience and reduce adverse effects is a central part of risk mitigation efforts. During the hours, days and weeks following a major natural hazard event, state and local government officials are tasked with making urgent response and recovery decisions. These decisions are informed by a continuous stream of information and data, which are often considerably large in volume, highly uncertain, and difficult to interpret. These challenges are often compounded by pre-existing socioeconomic inequities that drive differences in exposure, vulnerability, and ultimately, disaster impacts. While modern information technologies have increased access to disaster-related (but often not purpose-built) data and information in support of timely situational awareness, there are major gaps in the ability of state and local governments to perform early impact assessment and manage the flow of information.

This planning/pilot project will catalyze a new collaboration among a multidisciplinary team of researchers from four UC Campuses. Using a convergence approach, we seek to develop well-being metrics to inform early decision-making processes following a natural hazard, whose measurements will be enabled by models, tools and technologies that integrate geospatial data from multiple sources to create actionable information. We will develop new models and tools to provide rapid and more accurate estimates of hazard-induced physical damage that integrates geo-spatial imaging (e.g. field and satellite images), natural language (e.g. population-generated text) and engineering (e.g. loading intensity, infrastructure vulnerability) datasets. The newly developed metrics will advance our ability to recognize the diversity in social vulnerability, which drives the extent to which certain communities are burdened with losses and their ability to recover in a timely manner. We will conduct a pilot study utilizing data from recent flooding and earthquake events in California. Yet, the resulting framework would be applicable to multiple natural hazards.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Centering Tribal Stories of Cultural Preservation in Difficult Times

Host Campus: Los Angeles

Lead Investigator: Mishuana Goeman *Award Type:* Program Award

Collaborating Sites: Davis, Riverside, San Diego

Start Date: 1/1/2021 *End Date:* 12/31/2023 *Amount:* \$874,939

Abstract:

Cultural heritage protection is of the utmost urgency for many UC students and their communities across California because their irreplaceable sites and natural environments face increasing impacts from development and climate change. UC researchers have led specific conversations around these issues in environmental science, biology, ethnography, and archaeology, but the millennia of expertise within Indigenous Californian communities who live reciprocally with these lands is often overlooked. Indigenous peoples' traditions and continued stewardship of the land allows for an intimate understanding of the effects of climate and environmental change throughout time, as a longitudinal study which has run for over 10,000 years. Only through interdisciplinary conversations can we highlight the knowledge of California Native communities in order to effectively understand the full scope of potential impacts of climate change and development on cultural heritage. Training UC students to address these issues requires engaging with Indigenous cultural heritage management experts around California. A team of UC professors who have been engaged in community based research with Indigenous people throughout California will work together to create a holistic teaching approach on the interdisciplinary topic of cultural heritage protection.

UCLA's Carrying Our Ancestors Home, an Indigenous community based repatriation education project, will host 8-10 modules, culminating in an online class covering interdisciplinary approaches to cultural heritage protection. The modules will include four elements each: an original video or podcast co-created with Indigenous communities, primary resources gathered from University archives, secondary sources, and a classroom activity tying the components together. Topics include land and homeland introductions, land rematriation, repatriation of ancestors, healing from historic trauma through heritage protection and the arts, protection of Indigenous genetic data resources, and climate change's impact on cultural heritage sites and practices. The modules will be available for UC professors and the public through the COAH's Mukurtu CMS website, and therefore have a broader impact within the UC and across California. Providing a multidisciplinary understanding of the issues will lead to better dialogues and innovative solutions.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Labor and Automation in California Agriculture (LACA): Equity, Productivity & Resilience

Host Campus: Merced

Lead Investigator: Thomas Harmon *Award Type:* Program Award

Collaborating Sites: Berkeley, Davis, Riverside, University of California Agriculture and Natural Resources

Start Date: 1/1/2021 *End Date:* 12/31/2024 *Amount:* \$3,102,383

Abstract:

California is an agriculturally diverse and productive state, and yet its food system is vulnerable to climate change, regulatory change, water availability, and unexpected disturbances. Agricultural workforce shortages are also negatively affecting our food system. The proposed Labor and Automation in California Agriculture or LACA team is an interdisciplinary group spanning 4 UC campuses and UC Agriculture & Natural Resources (ANR) that is striving for transdisciplinary outcomes. Partnering with farmers, workers, and agriculturalists, LACA's goal is to create a new model for agricultural technology, the AgTech-Labor, that is farmer- and worker-friendly, while enhancing productivity and environmental sustainability. The proposed research approach will launch UC to the forefront of agrifood system research because of its (1) participatory design framework, (2) features aimed at sustaining California's agricultural culture and the environment, and (3) intention to create attractive and equitable career pathways in AgTech.

We will achieve the LACA objectives using 4 interwoven research thrusts which, although described separately, required a convergent (trans-disciplinary) approach to be successful. The 3 primary, interwoven thrusts are: (1) AgTech – Developing novel AgTech systems, specifically 3 types of stationary and robotic systems, (2) The Environment – Developing novel environmental sustainability tools and functions in the context of the 3 initial AgTech systems, and (3) Labor – Using the same 3 systems to examine the future of farm work, barriers to adoption, and California farm labor markets. Thrust (4), Underlying and Emerging Issues, will strategically attack key policy and legal issues, agro-economic, and social issues that LACA needs to consider while creating the new AgTech-Labor model. We will transfer knowledge created by LACA to the betterment of California, its students, workers, and citizens by disseminating our research outcomes in case study reports, curricula, AgTech training materials and best practices. We will impact UC graduate students by cross-training them in the 4 research thrusts, motivate UC undergraduates to pursue exciting AgTech-related careers, and inspire California middle-schoolers from under-resourced communities to better lives and careers as part of an equitable, productive, and resilient California food system.

California Consortium at the Electron-Ion Collider

Host Campus: Berkeley

Lead Investigator: Barbara Jacak *Award Type:* Program Award

Collaborating Sites: Davis, Los Angeles, Riverside, Los Alamos National Laboratory, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory

Start Date: 1/1/2021 *End Date:* 12/31/2024 *Amount:* \$ 1,794,164

Abstract:

The Electron-Ion Collider (EIC) will use electrons to image the quarks and gluons inside nuclei with unprecedented precision. Following endorsement by the National Academy of Sciences, DOE approved construction of the EIC at a cost of approximately \$2B.

Our Pilot Award created a consortium of 4 UC campuses and 3 UC-managed laboratories to collectively develop science goals for the EIC. Several of our members now hold key positions in the EIC Users Group—an organization of over 1000 scientists from 30 nations. A joint faculty appointment between UC Riverside and Jefferson Laboratory has been made. A call for EIC detector construction will come soon. We will respond as a consortium, to design and begin construction of the experiment over the next four years. An MRPI will position UC for EIC leadership for several decades.

We will develop jet and heavy quark tomography of the matter deep inside nuclei, and construct the required detectors. Gluons at high densities exhibit collective properties, from which nucleons emerge. We explore many-body interactions, which are also at the forefront of physics including novel superconductors and warm dense plasmas. Tomography of nuclei with the EIC requires a tracker and calorimeter for precise momentum and energy measurements. Building on our current success and leveraging the national labs' infrastructure, we will design these and attract construction funds to California.

Emphasizing early-career scientists, we add two assistant professors to the consortium; one is a theorist who develops new experimental observables. We propose to hire postdocs jointly, along with a "California EIC Fellow" to help connect students with LLNL, LANL and LBNL. This is an extraordinary opportunity for UC students to design and construct large-scale detectors using state-of-the-art technologies, such as highly granular silicon pixel sensors and novel compact calorimeters. Students will analyze Petabyte scale datasets with supercomputers at LBNL and Livermore. Students will gain sophisticated skills to contribute to the California economy and join the pipeline for the national laboratories.

Our outreach plan aims to spark the imagination of K-12 students across California, with public lectures and exhibits about the only new particle collider in the US for the next twenty years.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

The UC Network for Human Rights and Digital Fact-Finding

Host Campus: Berkeley

Lead Investigator: Alexa Koenig *Award Type:* Program Award

Collaborating Sites: Los Angeles, Santa Cruz

Start Date: 1/1/2021 *End Date:* 12/31/2023 *Amount:* \$ 795,803

Abstract:

A daily tsunami of online information chronicles humanity's ugliest realities. Photographs, videos, and social media posts offer a digital fingerprint of war crimes, hate speech, and disinformation. Once largely hidden from external view, many are now hypervisible because of increased use of the internet and smartphones worldwide. But the abundance of information doesn't necessarily bring truth to light if we can't say with relative certainty who did what to whom, and when. That's where online open source investigations—sourcing and verifying content on the Internet—can make a monumental contribution to truth, justice, and fact-finding, especially in the midst of a pandemic where the flow of accurate information across digital spaces is essential.

Research, investigations and evidence-gathering are changing dramatically with the rise of new technologies—and the University of California system is poised to help lead this shift.

UC Berkeley's Human Rights Center launched the first university-based digital open source investigations lab in Fall 2016. Since then, faculty and staff have trained hundreds of students in open source investigation skills and contributed to dozens of investigations with our partners, including major NGOs (such as Amnesty International), media (such as the New York Times, Washington Post, and Reuters), and war crimes investigators (at the UN and international tribunals). In Fall 2019, UCSC launched a lab within its Research Center for the Americas to focus open source investigations on the Americas. These two labs are empowering students to find, verify, analyze, and present digital information and potential evidence—collaborating with leading partners to break ground and break news, and setting international standards for using digital information to secure justice for the worst abuses.

UCB and UCSC are now working with their world-class counterparts at UCLA Law's Promise Institute for Human Rights to establish a third open source investigations laboratory within the UC system.

Each campus brings unique and essential expertise. By sharing resources, curricula, and personnel, the University of California has an opportunity to become the global academic hub for digital fact-finding—training a next generation to tackle the world's greatest human rights challenges and providing critical capacity to fact-finders worldwide.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Addressing California communities doubly vulnerable to catastrophic wildfires

Host Campus: Merced

Lead Investigator: Crystal Kolden *Award Type:* Program Award

Collaborating Sites: Berkeley, Los Angeles

Start Date: 1/1/2021 *End Date:* 12/31/2023 *Amount:* \$808,629

Abstract:

Wildfire disasters increasingly put Californians at risk for significant damages, economic losses, and fatalities. Scientists have made progress in identifying wildfire risks across the state, however, fire professionals and planners do not know whether resilience planning efforts are reaching “doubly vulnerable” populations -- Californians who are both socio-economically disadvantaged and live or work in high wildfire risk areas. Numerous studies examine strategies for disaster preparedness in vulnerable urban areas, but little research addresses disadvantaged peri-urban and rural communities impacted by wildfires. This is a key gap, because disadvantaged groups are historically underrepresented during planning, but wildfire mitigation and resilience rely on participation of the entire community.

Here, we will address wildfire prevention and recovery efforts in doubly vulnerable communities and establish the foundation for the UC-wide California Wildfire Science Institute, a globally unique network of experts seeking to address wildfire vulnerability. We will answer two key research questions: 1) What are the characteristics of “doubly vulnerable” populations? 2) How can the resilience of doubly vulnerable populations be increased through equitable planning? To address this, we will work with organizations representing vulnerable communities and tribal groups in California across three phases: 1) development of a California doubly vulnerable communities spatial database, 2) a mixed-methods assessment of pre-fire planning and post-fire recovery efforts in collaboration with local community partners and tribal groups for recent wildfire disasters across the state; and 3) development of a framework guiding local resilience planning and producing an interactive, web-based toolkit that complements existing wildfire risk tools (e.g., the FireSafe program), so that communities, agencies, and NGOs can support and empower doubly vulnerable populations in resilience planning efforts. The framework and toolkit will fill key gaps by providing a stepwise process and guidance for communities seeking to engage with and improve recovery efforts and resilience planning, and collecting longitudinal data about recovery efforts that can improve future research and applications.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

The Global Latinidades Project: Globalizing Latinx Studies for the Next Millennium

Host Campus: Santa Barbara

Lead Investigator: Ben Olguin *Award Type:* Program Award

Collaborating Sites: Davis, Merced, Riverside, Santa Cruz

Start Date: 1/1/2021 *End Date:* 12/31/2024 *Amount:* \$1,846,185

Abstract:

Latinx Studies has made profound contributions to 20th- and 21st-century thought through its complex explications of culture and politics in borderlands and myriad colonial contact zones. The field's terrain, however, has remained grounded in a north American milieu, particularly the US-Mexico borderlands, Caribbean locales, and various Latin American diasporic flows to and within the US. The Global Latinidades Project expands the scope of Latinx Studies by re-focusing the field's attention onto a broader global terrain. The goal is to recover and assess new and complex models of Latinx life, culture, history and politics—or Latinidades—that are synthesized in contact with peoples and contexts throughout the world, particularly Africa and the Mediterranean, Asia and Pacific Islands, subaltern Europe, and neglected areas of the Americas.

Latinx people comprise 40% of California, 20% of the US, and are growing throughout the world. The Latinx population has always been complex, internally diverse, and global. It continues to evolve in unique ways that pose multiple challenges—and opportunities—regarding policy, social services, education, cultural politics and more. These demographic developments have led to new trajectories, such as the growing subfields of Central American studies, AfroLatinidades, Latinx-Asian studies, Latinx spiritual diversity, and global Latinx human rights paradigms. Concurrently, the field of Latinx studies has continued to expand in Latin America, Europe and Asia. However, the Latinx Studies in the US, and the University of California System, have yet to devote substantial attention to these global developments.

This five-campus interdisciplinary programming initiative addresses this lacuna through workshops, symposia, colloquia, workshops, and strategic grants-in-aid to stimulate and develop research in these new global trajectories. It involves publication and grant initiatives and culminates with a major conference. Pursuant to the field's expansion, collaborators also will create new undergraduate and graduate courses that emphasize new Latinx globalities.

To extend and consolidate the globalization of Latinx Studies, collaborators will seek internal and external funding, including NEH Summer Institutes; NEH Humanities Initiatives at Hispanic Serving Institutions; Education Department Title V awards; and other sources.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

UC Coastal Resilience and Climate Adaptation Initiative

Host Campus: Santa Cruz

Lead Investigator: Borja Reguero *Award Type:* Planning Award

Collaborating Sites: Santa Barbara, San Diego

Start Date: 1/1/2021 *End Date:* 12/31/2022 *Amount:* \$249,405

Abstract:

Climate change-driven coastal hazards such as flooding and beach and cliff erosion will increasingly impact California's shores, posing growing societal and economic challenges. California has been a leader in identifying coastal resilience as a priority concern. Yet, advancing effective community adaptation from these pioneering approaches requires bridging between geotechnical, engineering, legal, political, economic, sociological, and anthropological perspectives to resolve context-sensitive, community problems.

This proposal would leverage multi-disciplinary expertise at UC Santa Cruz, Santa Barbara, and San Diego (and collaborators) to address the need for integrated coastal resilience research and targeted policy development by improving the understanding of coastal impacts and adaptation solutions (e.g., coastal defense, managed retreat, or insurance mechanisms) from the physical, ecological, and socio-economic perspectives. Although there are nodes of activity in the UC system developing research independently in these key areas, significant potential exists for building a system-wide interdisciplinary network specifically focused on the integration of coastal science into policy and decision-making frameworks. The partnership will integrate coastal processes science with engineering/design and policy/law to provide solutions for the local adaptation challenges. This goal would serve multiple primary objectives of the California Ocean Protection Council strategic plan, and will inform solutions driven by local needs and contexts. MRPI funding would support seed projects; cultivate dialogue between students, coastal scientists, decision-makers and communities at risk; and support the next generation of policy-relevant, solutions-focused coastal resilience science and education. This partnership would include two workshops (that will include other centers beyond this Consortium) to identify how to align resources; learn about intercampus research and challenges; explore emerging methodologies; include graduate student training and research; and seek further funding for expanding cross-campus collaborations. The initial expected outcomes include (1) scholarly products; (2) extramural funding applications; (3) outreach, education and integration of information into actionable adaptation; and (4) identification of next phases of network development.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Robot-facilitated Health Equity in Post-Pandemic California and Beyond

Host Campus: San Diego

Lead Investigator: Laurel Riek *Award Type:* Program Award

Collaborating Sites: Irvine, Los Angeles

Start Date: 1/1/2021 *End Date:* 12/31/2024 *Amount:* \$1,157,603

Abstract:

COVID-19 is exacerbating societal inequities, and will continue to drastically affect our existence for years to come. Two populations are at an exceptionally high risk of infection, adverse physical and mental health outcomes (including suicide), and extended isolation from others: 1) Healthcare Workers (HCW), frontline staff who deliver care to others (e.g., physicians, nurses), and 2) People who cannot leave their homes due to being at high risk of infection (P@HR), e.g., people with cancer, or disabilities.

While commercial tele-medical technologies can address some of these issues, they lack touch and mobility, key features needed for meaningful, embodied, independent interaction in the world. They also place HCWs at risk (requiring bedside delivery/training), and are inaccessible and/or unusable by many P@HR. Mobile teleoperated robots with touch and manipulation capabilities are needed to protect the lives of HCWs and improve quality of life for the growing population of P@HR.

Thus, this MRPI's research goal is to advance the state-of-the-art in mobile telemanipulation and remote participation in the world to enable at-risk Californians to engage in rich and meaningful ways within health and community environments, realized via four specific aims:

- (1) Implement UC-Iris, a novel, easy-to-use, low-cost, mobile telemanipulation robot that enables embodied telepresence via touch, vision, and mobility.
- (2) Advance the state-of-the-art in tactile sensing and haptics technology to enhance a teleoperator's ability to embody UC-Iris.
- (3) Explore P@HR use of UC-Iris for independence and inclusion in their physical communities.
- (4) Assess how systems like UC-Iris may improve quality of life / work (for P@HR / HCWs)

This project will make substantial scientific, engineering, and societal contributions, including 1) Advancing innovative telemanipulation technologies to meet the needs of our changing world, including new methods for shared control, tactile sensing, and haptic interaction, 2) Deriving new insights into how to use telemanipulation robots to accomplish high-value tasks in hospitals and communities, 3) Improving quality of life and work for millions of Californians, especially those at-risk due to pandemic-related risks and restrictions.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

California Policy Lab: Data-Driven Solutions to California's Most Complex Issues

Host Campus: Berkeley

Lead Investigator: Jesse Rothstein *Award Type:* Program Award

Collaborating Sites: Davis, Irvine, Los Angeles, Merced, Santa Barbara, Santa Cruz, San Francisco

Start Date: 1/1/2021 *End Date:* 12/31/2024 *Amount:* \$3,233,696

Abstract:

This project will expand the existing California Policy Lab (CPL) infrastructure to three additional campuses (Merced, Santa Cruz, and Santa Barbara), new PIs at existing campuses (Berkeley, LA, Davis, Irvine, and SF), new policy areas, and facilitate the acquisition of three high-cost datasets that will become common goods throughout the system. The project will support UC's recruitment and retention of researchers in the social sciences and enable significant expansion of evidence-based policy research, all at a fraction of the cost and time compared to each campus accessing these data on their own.

CPL partners UC students and faculty with state and local government agencies to conduct research that helps solve the state's most urgent social and economic problems. Our shared infrastructure helps streamline data access, reduce project startup times, and facilitate linkages that bridge data silos. A core benefit of this project is the addition of three significant data resources:

UC Consumer Credit Panel: We will build and maintain the nation's largest longitudinal database of consumer credit records. These data will make possible dozens of projects related to residential mobility, housing markets, and financial distress.

Health Data Access Initiative: Health care utilization data from the federal Centers for Medicare and Medicaid Services are a key data source for population and public health research. This initiative will purchase these data as a shared resource, saving UC researchers millions of dollars by reusing the data for multiple projects.

The Homelessness Research Accelerator Datahub: Los Angeles's homelessness management information system is one of the country's largest data assets on homelessness. We will curate and broaden access to these data for UC researchers.

CPL will provide the infrastructure to ensure that these data are well used. This includes executing all data use agreements; cleaning and preparing the data; generating analysis files; facilitating data linkages; creating documentation and reusable code for researchers; and maintaining relationships with government partners. We will solicit research proposals on a regular basis, host projects on our secure Data Hub, and connect researchers with agency partners. We will also sponsor competitive awards to support students and faculty and host a Summer Institute for students.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Two-Photon Calcium Imaging of Human Brain Activity: The Next Frontier in Neuroscience

Host Campus: San Diego

Lead Investigator: Matthew Shtrahman *Award Type:* Planning Award

Collaborating Sites: Irvine, Los Angeles, San Francisco

Start Date: 1/1/2021 *End Date:* 12/31/2022 *Amount:* \$285,000

Abstract:

The field of neuroscience is undergoing a technological revolution with new methods to both manipulate and record neural activity with single cell resolution. However, rarely have these advances been adapted to the clinic or operating room to study the human brain or to diagnose and treat brain disease. Electrode-based methods have been the principal technique for monitoring human brain activity in both the experimental and clinical settings for almost 100 years. Unfortunately, current electrodes are invasive and capable of blindly sampling only a small fraction of neurons within a network.

More recently, the development of optical approaches for measuring neuronal activity offers many promising features. Specifically, two-photon microscopy takes advantage of pulsed infrared laser light, which exhibits limited interaction with biological tissue, to record optical signals in dozens to tens of thousands of individual cells. In conjunction with extrinsic fluorophores, this approach can map anatomy and report function at the cellular level. Notably, two-photon calcium imaging is used routinely to track firing in brain networks with single cell resolution in awake behaving animals, but has never been attempted in humans.

There is tremendous potential for this technology to impact the diagnosis and treatment of human brain disease. Patients with operable brain disease such as medically refractory epilepsy or intracranial tumors would greatly benefit from techniques offering precise resection of affected tissue. Imaging neuronal network activity with single cell resolution can reveal both physiological and pathological human neuronal network dynamics and synchrony, which will greatly facilitate accurate localization of clinically relevant brain states. In addition, these approaches are critical to discover important organizational principles that underlie large-scale neuronal network dynamics in the human brain.

To accomplish this goal, we bring together physicists, engineers, neuroscientists, and clinicians in the UC system to construct a novel microscope system optimized for human studies in the operating room. This technology will be portable and shared among the UC campuses, where we will perform the first studies to image neuronal network activity in the human brain, interrogating brain regions previously identified for surgical resection in patients.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

UC Coronavirus Assembly Research Consortium

Host Campus: Riverside

Lead Investigator: Roya Zandi *Award Type:* Program Award

Collaborating Sites: Davis, Merced

Start Date: 1/1/2021 *End Date:* 12/31/2024 *Amount:* \$1,755,358

Abstract:

Replication and assembly pathways of SARS-CoV-2, responsible for COVID-19, resemble those of other coronaviruses; nevertheless, the mechanisms involved are unclear. While in vitro experiments and computer simulations of viruses, including HIV and HBV, have improved our understanding of their formation and how to combat them, currently, there are no similar studies aimed at understanding coronavirus (CoV) assembly. With the goal of determining ways to disrupt viral assembly, we propose to investigate the roles of structural proteins in SARS-CoV-2 assembly using an integrated, multi-disciplinary approach across multiple scales and environments. At the single-molecule level, we will use Atomic Force Microscopy with super-resolution and confocal microscopy to study the assembly of virus-like particles (VLPs) within cell-like vesicles. The single-molecule investigations will be complemented by studying the bulk properties of cell membranes interacting with viral proteins using X-ray scattering and Langmuir monolayers. All in vitro studies will be informed and complemented by in vivo microscopy studies of VLP assembly within living cell lines and tissue culture. To interpret the experimental data and provide predictions regarding potential therapeutic targets, we will use computer simulations to study the multimerization of proteins and their interaction with RNA, and the protein-protein and membrane-protein interactions. Existing and predicted drug candidates will undergo in vitro and in vivo testing. Thus, our efforts will result in the development of a robust model platform to perform fundamental studies and test therapies targeted toward disrupting viral assembly.

Since the COVID-19 pandemic has challenged every aspect of daily life, one of our goals is to increase public understanding of the role of science in addressing this pandemic through our virus-centered outreach efforts which include K-12 workshops and public lectures. This project will also provide unique interdisciplinary training and educational opportunities for undergraduate and graduate students from underserved areas of California, producing a highly trained workforce with enhanced future employment prospects in California's biotechnology industry and beyond. Our ultimate goal is to develop a UC-wide extramurally funded multi-campus institute based on principles of physical virology.