

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

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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.

California Informatics for Equitable Disaster Response and Recovery

Host Campus: Los Angeles

Lead Investigator: Henry Burton *Award Type:* Planning/Pilot 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.

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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.

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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.

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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 lead to this emergence; these are also at the forefront of other physics areas 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.

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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.

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.

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Living Through Upheaval: The University of California Humanities Initiative

Host Campus: Irvine

Lead Investigator: Tyrus Miller *Award Type:* Program Award

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

Start Date: 1/1/2021 *End Date:* 12/31/2022 *Amount:* \$1,500,000

Abstract:

“Living Through Upheaval” consists of 3 research platforms:

Future of the Humanities & the University

As COVID-19 reveals, the university is a robust social infrastructure providing medical & support services in time of need, research addressing pressing social issues, longer-term challenges, & vital learning & civic platforms. We will address a 21st C humanistic research agenda & evolving curricula for graduates & undergraduates to help respond effectively to widespread upheavals: climate change, mass migrations, catastrophic natural events, COVID-19-like pandemics. What cultural, conceptual, social, & technological competencies best enable societies to address such upheavals productively & adaptively? How are such competencies best mediated, translated, & applied in contexts beyond the academy? What likely sources, forces, & forms of discrimination face vulnerable populations in times of upheaval? How do we assess & address them? What historical, cross-cultural experiences, ideas, & models can we draw on?

Literacies & Leadership in a Diverse Society

Leadership today demands innovation in forms & contents of our literacy. Traditional & new literacies play key roles in our concepts & practices of leadership. We address how humanities support leadership & collaborative problem-solving in diverse, complex social environments; develop individual & collective capacities to frame critical cultural & social problems; tell compelling stories engaging culturally diverse, politically conflicted publics; advance data & multimedia literacies for societies deluged with information of uneven quality & reliability. As California & the nation face rapid changes in work-modes, humanistic capacities are in increasing demand. We clarify how humanistic learning can respond effectively.

Living Through Upheaval Competitive Grant Programs

We renew the UCHRI+UCHC collaborative, interdisciplinary research programs supporting faculty & grad students, & public communication of humanities research for citizens of CA & other publics. We will sustain the strong international reputation of UC humanities. Our competitive programs support innovative projects leveraging UCHRI, 10 campus humanities centers, all 10 Deans (together UC Hum. Network). “Living Through Upheaval” will be built into key areas of our grantmaking initiative while supporting advancing humanistic research across UC.

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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.

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UC Coastal Resilience and Climate Adaptation Initiative

Host Campus: Santa Cruz

Lead Investigator: Borja Reguero *Award Type:* Planning/Pilot 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.

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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.

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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.

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

Host Campus: San Diego

Lead Investigator: Matthew Shtrahman *Award Type:* Planning/Pilot 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.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

The California Interfacial Science Initiative (CISI)

Host Campus: Berkeley

Lead Investigator: Michael Zuerch *Award Type:* Planning/Pilot Award

Collaborating Sites: Merced, Santa Cruz, San Diego, Lawrence Livermore National Laboratory

Start Date: 1/1/2021 *End Date:* 12/31/2022 *Amount:* \$277,970

Abstract:

The world around us is governed by constant exchange of energy and particles. The internal structure at the interface between two media determines how phases interchange, how charge carriers exchange, and how media bind to one another. Therefore, understanding interfacial chemistry at a molecular level is 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 the importance, little is known about interfacial electronic and molecular structures, their dynamics, and how these lead to observed macroscopic properties and behaviors. The overarching goal of the California Interfacial Science Initiative (CISI) is to coordinate currently separate theoretical and experimental efforts studying interfaces across the University of California and leverage the combined expertise towards the creation of a world-leading center for interfacial science. During the pilot phase, multidisciplinary investigations will focus on two main topics: exploiting novel colliding planar liquid jets to study liquid-liquid interfaces investigating interfacial molecular dynamics relevant to CO₂ capture and particle binding, and ionic charge transfer at solid-solid interfaces relevant to development of next generation batteries. The expertise for interfacial studies stems from first experiments on novel nonlinear X-ray spectroscopy that showed interfacial selectivity (UCB, LBNL) and a theory framework for nonlinear light-matter interactions (UCSD). CISI will bring together and consolidate these efforts by involving molecular level energy transfer theory (UCSC), interfacial engineering (UC-Merced) and quantum statistics calculation (LLNL). The multidisciplinary research team in the initiative will jointly develop advanced experimental techniques that enable studying these complex interfaces, which includes novel planar liquid jet technology, nonlinear optical and X-ray spectroscopies, and numerical models to simulate and understand interfacial dynamics. By understanding interfacial dynamics on a molecular level new approaches will be developed for addressing critical challenges.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

UC Initiative to Save California's Citrus

Host Campus: Riverside

Lead Investigator: James Borneman *Award Type:* Program Award

Collaborating Sites: Berkeley, Davis, San Diego

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$1,100,000

Abstract:

THIS PROJECT IS TO SAVE THE CALIFORNIA CITRUS INDUSTRY FROM HUANGLONGBING (HLB). This deadly disease is currently causing annual losses of over 1 billion dollars and 7,900 jobs in FL. As HLB spreads throughout the US, similar losses are expected in CA unless more effective management strategies are developed.

METABOLIC MODELING IS A TRANSFORMATIVE EXPERIMENTAL APPROACH. Modern molecular approaches endeavor to understand complex living systems by creating a list of their parts. This is akin to trying to understand how an airplane flies based on its parts list. In contrast, metabolic modeling determines how all of these individual parts function and interact to create a living organism.

The SPECIFIC AIM of this project will take advantage of newly developed software to construct a cutting-edge model (ME) of the pathogen associated with HLB. This will produce an unprecedented understanding of HLB, providing insights leading to the creation of more effective HLB management strategies that will save the citrus industry in CA, the US, and worldwide.

TO INCREASE THE CAPABILITIES AND COMPETITIVENESS OF UC RESEARCHERS, we proposed to expand metabolic modeling throughout the UC system. To achieve this goal, we will hold a workshop at the end of this 2-year project and then annually after its completion. The goal will be to train UC researchers in the construction and use of metabolic models for prokaryotic, eukaryotic and integrated systems. We will also create a web-based platform to facilitate networking and collaborations. We expect that these events and tools will be a catalyst for new UC-based collaborations enabling innovations and breakthroughs in basic science and translational/applied research. Bolstering the value of expanding metabolic modeling throughout the UC system, this approach can be used in medical, agricultural and environmental research as well as in biotechnology. Taken together, we expect this project will propel a series of events that will position UC as a leader in the field of metabolic modeling, enhancing UC's competitiveness to attract the best faculty and students and creating an enduring environment that will ensure the acquisition of awards and funding.

PUBLIC ENGAGEMENT. We will create a portable, interactive museum exhibit to educate the general public and citrus community about HLB and how metabolic models can provide solutions for HLB and many other problems including the emerging crisis of antibiotic resistance.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

An enhanced UC digital pathology infrastructure

Host Campus: Davis

Lead Investigator: Brittany Dugger *Award Type:* Planning/Pilot Award

Collaborating Sites: Irvine, Los Angeles, San Francisco

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$264,392

Abstract:

Alzheimer's disease (AD) and related disorders are expected to affect 1 million Californians by 2025; research to alleviate the burden of these devastating diseases is a national priority.

Current advances in technology have enabled development of whole slide image (WSI) systems, which digitize glass slides. Following digitization, scanned images can be viewed through a computer interface-eliminating the need for a microscope. These WSI systems are enhancing the field of pathology by providing computational platforms that can potentially lead to better precision for diagnosis and enhanced quantitative data to unlock the secrets of diseases. To remain on the cutting edge of AD research and benefit Californians and our nation, the primary activity of this research collaboration is to establish a resource of annotated WSIs of human brains from AD and related disorders for educational, collaborative, consultation, and research purposes. The strengths of the applicants lie within their already available archive of well characterized brains originating from subjects with a variety of diseases, including AD, vascular, and mixed dementia, and Down's syndrome (through the Alzheimer's Disease Center brain banks at UCI, UCD, and UCLA) and the existence of a UC server infrastructure. These resources are in addition to the complementary scholarly contributions of expert neuropathologists: Drs. Dugger (UCD), Monuki (UCI), and Vinters (UCLA), of multi-campus informatics infrastructure: Dr. Graff (UCD), and of machine learning / artificial intelligence (AI): Dr. Keiser (UCSF). This proposal will enable us to achieve our expected outcomes of:

- 1) Leveraging, enhancing, and expanding an existing digital pathology UC network server for adequate storage, retrieval, and analysis of WSIs of human brains that is easily accessible to qualified UC researchers/clinicians for educational, research, and consultation purposes.
- 2) Generate robust expert annotated datasets of AD pathologies for training and benchmarking machine learning/AI tools for quantitative pathology.

Although the focus of this innovative proposal is on neuropathology, it will lay a foundation for the plethora of pathology sub-specialties enhancing their prongs of education, patient care, expert consultations, and research and collaboration capabilities in the realm of digital pathology.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

UC Collaborative to Promote Immigrant and Student Equity

Host Campus: Irvine

Lead Investigator: Laura Enriquez *Award Type:* Planning/Pilot Award

Collaborating Sites: Berkeley, Los Angeles, Merced, Riverside

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$270,000

Abstract:

As federal immigration policy becomes increasingly restrictive, California and the UC system have emerged as national leaders implementing policies to incorporate undocumented immigrants, particularly youth and students. However, PI Enriquez' UC-wide survey of 508 UC undocumented students in 2016 found that undocumented students still experience significant academic, financial, and social-emotional strain. It remains unknown the extent to which current immigration policies have exacerbated vulnerabilities among undocumented students and expanded collateral consequences to citizen students with undocumented parents. This multicampus collaboration will strengthen the UC system's capacity to lead cutting-edge research on immigrant "illegality" and ensure that our pioneering research and innovative practices fulfill their maximum PromISE (our collaborative's acronym). During Winter 2020 we will conduct a second UC wide survey with 1,800 respondents in three comparison groups: undocumented students, citizen students with an undocumented parent, and citizen students with citizen/lawful permanent resident parents. We aim to: 1) compare educational and well-being outcomes among undocumented students before and after federal policies shifted; 2) assess the extent to which illegality impacts the educational outcomes and well-being of citizen students with undocumented parents; and 3) evaluate what types of institutional programming can reduce inequalities. This research will inform policy and practice across the UCs, California, and beyond. Our programming will also develop a cohort of scholars conducting policy-relevant research in this field. We will build a network of affiliates connected via a website and listserv, and host a collaboration workshop for approximately 90 faculty, graduate student, and students affairs practitioners from across the UCs. Workshop sessions will build collaborative and policy-engaged research skills. We will also hold two annual funding competitions for collaborative research grants and graduate student fellowships to foster innovative and engaged scholarship. Recipients will be invited to present at two co-hosted conferences – one to an audience of student affairs practitioners and policy makers from across California and another to receive feedback on working papers for an edited volume. All research findings will be featured as academic papers, policy reports, and publically-engaged pieces like op-eds and webinars.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

The Science of Dense Gluon Matter

Host Campus: Berkeley

Lead Investigator: Barbara Jacak *Award Type:* Planning/Pilot Award

Collaborating Sites: Davis, Los Angeles, Riverside

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$265,257

Abstract:

This consortium will take advantage of the planned electron-ion collider (EIC) to study the gluon distribution deep inside nucleons and nuclei. Protons and neutrons are each comprised of three valence quarks held together by gluons, which provide most of their mass and a significant amount of their quantum mechanical spin. Gluons at high densities form a complex many-body system and exhibit collective properties; however the emergence of nucleons from such matter remains mysterious. The EIC will provide scientists with the ability to study the complex, many-body interactions of the gluons, which are difficult to calculate and at present poorly understood. Similar many-body interactions are at the forefront of other areas of physics, including novel superconductors and warm dense plasmas. The EIC will provide a precision probe of gluon densities unattainable to date. We collect experimental expertise in charged particle tracking (Berkeley, Davis) and calorimetry (UCLA, Riverside) to design two detector systems required for experiments at the EIC. We will measure the scattered electron to fix the reaction kinematics, and the outgoing hadrons to probe how gluons contribute to the spin of the nucleon and how their distribution evolves inside nuclei. We will collaborate with LBNL, LANL and LLNL, and take advantage of the scientific and technical infrastructure at the laboratories to build these detectors in California. In addition to providing an opportunity for intellectual and technical leadership by UC faculty at the only new collider planned in the US, this consortium will provide an extraordinary educational opportunity for undergraduate and graduate students at multiple UC campuses. We have also initiated discussions with UC Merced about opportunities for their students. Students will have key roles in design and will ultimately construct and utilize large-scale detectors using state-of-the-art technologies, such as highly granular silicon pixel sensors and novel compact calorimeter technology for precise particle energy measurements. They will learn to analyze Petabyte scale data sets with supercomputers, such as those at LBNL's NERSC and the Livermore Computing facility. These technologies have many applications in addition to nuclear and particle physics. We will train future scientists with sophisticated technical skills to contribute to the California economy and to join the scientific skills pipeline for UC-managed laboratories.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Developing a New Paradigm for Natural Product Drug Discovery

Host Campus: San Diego

Lead Investigator: Paul Jensen *Award Type:* Program Award

Collaborating Sites: San Francisco, Santa Cruz

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$540,000

Abstract:

Natural products are a primary source for many of today's most useful medicines. Many of these compounds originate from microbes that were cultured in the lab. However, culture-independent studies reveal that most microbes have yet to be cultured. Even among those that have, genome sequencing tells us that only a small fraction of their natural product potential has been realized. While changing culture conditions or genetic engineering have become popular approaches to natural product discovery, these methods are ineffective, time consuming, and fail to capitalize on the fact that the optimized conditions for natural product production are found in the natural environments in which the microbes reside. This proposal employs methods recently developed in the Jensen lab (UCSD) to capture microbial natural directly from marine sediments. The resulting mixtures will be subjected to micro-fractionation techniques developed in the MacMillan lab (UCSC) and the individual components screened using image-based, phenotypic assays (UCSF) that provide critical information about cancer-relevant molecular targets. The MacMillan lab will then solve the structures of active compounds using advanced analytical techniques while the Jensen lab will use metagenomics to link compounds to the producing organisms, thus providing new insight into the types of microbes that can be targeted for drug discovery. Predicted molecular targets will be validated using secondary assays at UCSF. This culture-independent discovery approach has the potential to yield compounds that can be taken through human clinical trials within the UC system. It represents a new, multidisciplinary collaboration that seeks to transform the traditional approaches used for natural product drug discovery. It includes extensive graduate and undergraduate training and has the potential to advance human health and create technologies that benefit the California economy. Materials generated will be deposited in the UCSD Center for Compound Resources thus becoming available for screening by other UC researchers. Goals include raising federal support to continue the project, scientific publications, and extensive outreach and public engagement in the form of public lectures, K-12 education, and participation in programs that target science education for under-represented groups. This research aims to create commercially viable technologies that can create jobs and build biotechnology infrastructure in California.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

The Development of a UC-wide Clinical Genomics Database

Host Campus: Irvine

Lead Investigator: Dan Mercola *Award Type:* Planning/Pilot Award

Collaborating Sites: Los Angeles, San Diego

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$270,000

Abstract:

We propose a pilot program for the development of a UC-wide Genomic Clinical Database as a resource for the analysis of personalized medicine across the UC medical system. Modern treatment of many cancers, genetic diseases, and other conditions utilize knowledge of the genetic alterations of the patient to choose pharmaceutical agents that best treat that patient: “Personalized Medicine”. Hundreds of treatments have been developed. In order to improve these treatments, researchers compare the results of different treatments for similar genetic alterations with the length of time patients remain disease free. The UC system maintains the UC Clinical Data Warehouse with over 5 million UC patients which provides the disease free period following treatment. However the genomic and genetic data is deficient. This is because treating physicians provides genetic testing results in a form that cannot be retrieved by researchers or they only provide partial information like the name of one or more altered genes and not the DNA sequence change. This is in part because companies that do the genetic and genomic testing do not provide reports in a computer-searchable format. In our project we will ask all major genetic testing companies used by UC physicians to provide the entire genetic testing results of all patients they have ever tested for UCI, UCSD, and UCLA. This information is to be provided in a “searchable” form. This information will be added to the UC Clinical Data Warehouse entries for the corresponding patients. Administrators and researchers with IRB approval of the UC system will then be able to determine compare treatments with the patients’ survival data for thousands of patients, will be able to determine whether results vary by campus, which treatment is best and answer many other questions.

In our pilot program we will also apply test searches to the updated database to provide a proof of principal. If this project is successful, it will be extended to the other 3 UC medical centers, UCD, UCR, and UCSF.

The UC system is also developing the California Initiative for the Advancement of Precision Medicine. This is a large multi-investigator group that is forming public-private partnerships to bring the most modern software to medical problems. Genetic information is a common subject of analysis. The enhanced UC Data Warehouse will rectify the current defect and greatly extend the utility of the UC Clinical Data Warehouse.

Exploring a mechanism for viral host range evolution

Host Campus: San Diego

Lead Investigator: Justin Meyer *Award Type:* Planning/Pilot Award

Collaborating Sites: Berkeley, Los Angeles

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$270,000

Abstract:

Viruses vary greatly in host range, from specialization on subpopulations within a species to infecting across diverse species. Understanding what governs viral host range is key to solving a number of problems, including controlling disease emergence, understanding the assembly rules for microbiomes, and developing synthetic viral therapies. Despite this, little is known about the mechanisms that control viral host range and the conditions that foster host range expansions. PI Meyer and Co-I Petrie have put forward a novel hypothesis for the genetic and physical changes that allow viruses to expand their range. They recently found that bacteriophage lambda evolved a broader host range through destabilizing mutations in the host-recognition protein that cause bistability in the protein folding process. The bistability causes multiple particles to form, some adept at the original host, and others able to exploit a new host. This discovery provides a novel mechanism for host-range evolution and predicts a trade-off between host-range breadth and stability that could help explain why viruses vary widely in their host-range. If generalizable, this trade-off could be an important Achilles heel for emerging diseases, as this instability would be vulnerable to extrinsic perturbations. We propose to test the generality of this mechanism through three interrelated and collaborative projects. First, PI Meyer's team will develop a mathematical model to determine the conditions where viral proteins are likely to evolve expanded host ranges through protein bistability. The goal of the model will be to translate Meyer's findings made in the laboratory into predictions for natural pathogens. Co-I Moberg-Parker has developed a course-based undergraduate research program for students at UCLA to study phages from human skin microbiomes. Moberg-Parker's team will design a new curricular module in collaboration with Co-I Petrie to test the bistability hypothesis on a much larger set of phages than any single laboratory could study. Co-I Koskella will then test these predictions in natural microbial communities by leveraging her large collection of phages from the plant phyllosphere. Her preliminary data show hugely variable host ranges among phages from this natural environment, and provide an ideal testbed for examining the link between viral host range and stability. This work will have far-reaching benefits, from enhancing teaching to cutting-edge translatable research.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Human Conditions: UC Humanities Initiative

Host Campus: Irvine

Lead Investigator: Tyrus Miller *Award Type:* Program Award

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

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$1,900,000

Abstract:

The UC President’s Humanities Advisory Committee proposes to renew the systemwide UC Humanities Initiative. We will renew the extensive collaborative, interdisciplinary research support programs that the Initiative provides to faculty and students across all ten UC campuses as well as the creative public programming for California citizens. The Initiative will build on our ongoing success, sustaining the outstanding international reputation of UC humanities at this critical juncture in our national dialogue. The Initiative’s programs support innovative projects by individual scholars and collaborative, interdisciplinary research in a network productively leveraging the system-wide UC Humanities Research Institute (UCHRI), all ten campus-based humanities centers (HCs), and all UC Humanities Deans. The humanities always address the changing nature of the human and its historical, contemporary, and future conditions of existence. We face enormous changes in our technological, socio-economic, environmental, political, and cultural contexts. Technology is no longer just part of our surroundings or an extension of our bodies; it has been increasingly integrated into living, thinking, feeling bodies to prolong and improve life and extend our natural powers of cognition and perception. Environmental impacts of human waste and demographic explosion are increasingly challenging our social- and life-systems. In the near future, the projected loss of work due to AI and robotic enhancements will have enormous implications politically, legally, and socially. The widespread adoption of social media is transforming how we relate to and interact with each other. The implications for our sense of identity, work and recreation, and life-history are enormous. The humanities are innovating to help make sense of these changes and to articulate new individual and collective narratives that can help us make the emerging forms of life truly worth living. Our proposal include sresearch initiatives intended to address such momentous changes facing human existence and culture. How do we understand what constitutes contemporary modes of truth? What are the social and environmental impacts of massive demographic shifts? As artificial intelligence and robotics evolve, how do the distinctively “human” features of human being change? Our initiative will include support advancing both digital humanities and public humanities activities in addressing such crucial issues.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

UC Network on Child Health, Poverty and Public Policy

Host Campus: Davis

Lead Investigator: Marianne Page *Award Type:* Planning/Pilot Award

Collaborating Sites: Berkeley, Irvine, Los Angeles, San Francisco, Santa Barbara

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$150,000

Abstract:

Purpose: Develop a trans-disciplinary network across the UC that produces a more comprehensive understanding of the varied pathways by which early life health disparities influence children's contemporaneous and long term well being, with an eye towards informing cutting edge policy interventions. Significance: Despite rhetoric around the "American Dream," numerous metrics suggest that there is less upward mobility in the United States than in most developed countries in the world. For example, a child born to parents in the bottom fifth of the income distribution has a more than 40% chance of remaining there as an adult, and a 65% chance of ending up in the bottom two fifths. In contrast, in Canada and most western European countries, the odds of the same child ending up in the bottom two fifths is closer to 50% (Winship 2011). Studies in economics, psychology, and the biological sciences increasingly suggest that early life health and health environments may play a critical role in reducing children's chances of escaping poverty and reducing disparities. The UC system includes many noteworthy scholars who are independently contributing to this knowledge base, but narrow, disciplinary specific approaches will not yield the most impactful results. Small steps taken in tandem with multiple disciplines, using multiple approaches, will add up to larger gains in knowledge that can ripple through to create bigger societal influences. We can further speed up these ripple effects by targeting graduate student training. Approach: Year 1: Run transdisciplinary workshop(s) that bring together faculty and graduate students across a wide range of disciplines (e.g. economics, psychology, nutrition, epidemiology) to share disciplinary specific expertise, identify group research strengths, important gaps in knowledge and research questions. Begin to build relationships with policy practitioners to ensure that ensuing research is decision-relevant. Year 2: Support 1-4 network projects that prioritize graduate student training, continue to build trans-disciplinary knowledge and stakeholder relationships through in-person meetings that also expand networks across the UC. Submit for a MRPI award and other funding.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

California Policy Lab: Studying Inequality and Homelessness

Host Campus: Berkeley

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

Collaborating Sites: Davis, Irvine, Los Angeles, San Francisco

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$1,249,963

Abstract:

Our project will blend interdisciplinary research expertise from UC faculty with administrative data collected by CA state and local agencies to generate evidence to address the state's most pressing social issues. We will focus initially on two complex problems: Preventing and addressing homelessness, and designing education and training to meet workforce needs. UC has tremendous multidisciplinary expertise on each issue. But research progress is hampered by the difficulty of accessing data that is fragmented across multiple agencies covering education, workforce training, health, substance abuse, housing, and criminal justice. We will develop a UC-wide IT, legal, and communications infrastructure, beginning with five campuses but growing to the rest of the system, that can support new, interdisciplinary research teams to produce cutting-edge research on these and other topics, using heretofore unavailable data sources and data linkages from public administrative data. A key component of our project will be close partnerships with CA state and county public agencies. The collaboration will enable us to build on existing relationships that project researchers already have, supporting broader partnerships that allow us to serve the state's research needs, ensure that research results influence future policy, and provide access to data that are crucial to conducting innovative research. The collaboration will support a range of projects in the areas of homelessness, workforce training, and beyond. Illustrative projects include: - A predictive study aimed at identifying events and characteristics that are predictive of near-term homelessness, based on linked data from county health, criminal justice, housing, and welfare systems. This will support targeted interventions to prevent homelessness, the effectiveness of which we will then evaluate. - An evaluation of the impact of adult vocational education and workforce training programs on subsequent employment and earnings, accounting for overlap in program offerings among the many different public training providers. This will lead to success metrics for each program and measures of gaps in access to effective services. We will form a network of scholars that will cooperate on specific projects; provide opportunities for training of graduate and undergraduate students; convene regularly to share knowledge; and work together to improve access to data in CA.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

The California Magnetic Resonance eXploration Initiative

Host Campus: Santa Barbara

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

Collaborating Sites: Berkeley, Davis, Irvine, Los Angeles, Riverside, San Diego, Santa Cruz

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$269,862

Abstract:

The ultimate goal of the California Magnetic Resonance eXploration Initiative (Cal-MRX) is to create a unique Magnetic Resonance eXploration (MRX) facility that will vastly enhance the sensitivity of magnetic resonance spectroscopy to all atoms in the periodic table, half of which cannot currently be measured at all. The MRX facility will enable unprecedented explorations of the nanoscale environments around the atoms that make up matter as we know it—for example, in living organisms, in natural and man-made materials, and in the devices and machines that underpin modern technology—making it a powerful engine for discovery in biology, chemistry, physics, materials science, engineering and medicine. The MRX facility is enabled by recent breakthroughs in superconducting magnet technology at the National High Magnetic Field Laboratory in Florida and in electromagnetic source technology at UC Santa Barbara’s Free-Electron Laser (FEL) facility. The primary activities of Cal-MRX will be to hold one or more meetings of magnetic resonance researchers from UC campuses (including undergraduates, graduate students, post-docs, and faculty), and to support exploratory experiments using the UCSB FEL-powered magnetic resonance spectrometer, which can be viewed as a prototype of the MRX facility. The meetings will define the most interesting scientific opportunities opened up by MRX, and determine which exploratory experiments are most promising. The scholarly contributions of Cal-MRX will include publications and conference presentations that result from exploratory experiments, the training and education of graduate student researchers in new methods of magnetic resonance, and the rich exchange of ideas between diverse researchers from different campuses, disciplines, and career stages. The desired outcomes of Cal-MRX are to establish the MRX facility at UC Santa Barbara, and to forge collaborations to conduct pioneering interdisciplinary research at MRX. The successful establishment of the MRX facility will make California a unique and leading international destination for magnetic resonance research. Discoveries made at MRX will illuminate deep scientific mysteries and may spin off successful commercial ventures in California. Undergraduate and graduate student researchers from California will benefit from unique training and educational opportunities. The construction of the MRX facility will employ California workers and companies.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

California Institute for Quantum Entanglement

Host Campus: Berkeley

Lead Investigator: Dan Stamper-Kurn *Award Type:* Program Award

Collaborating Sites: Los Angeles, San Diego, Santa Barbara

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$850,000

Abstract:

The quantum mechanics of systems comprising many interacting particles accounts for how materials acquire their distinct properties, how they undergo transitions between phases, and how they can be used most effectively for various applications. However, the theoretical complexity of quantum mechanics bars us from fully understanding large systems. And even when explanations are proposed to explain the emergent nature of macroscopic systems, the complexity of real materials bars us from testing those predictions. Experimental systems now exist in which systems with many connected quantum objects – specifically, atoms, ions and molecules cooled to near-zero temperature – can be prepared and tracked in full detail as they evolve. These serve as quantum emulators, i.e. as tractable physical models for materials in which we can test theoretical propositions and unravel the mystery and power of quantum science. The California Institute for Quantum Entanglement will establish the world-leading center for exploring advanced ideas in quantum science and their application toward materials science, metrology, and quantum information processing. We propose to overtake rival institutions by coalescing UC's strength in experimental atomic and molecular physics and theoretical quantum science. Collaborative investigations will focus on three main topics: the emergence of novel properties in strongly driven materials, the nature of phase transitions in open quantum systems, and the use of many-body quantum states for technological applications such as sensing and information processing. To define future directions in quantum emulation, Institute researchers will jointly develop advanced experimental techniques such as ultrastable optical systems, extreme high vacuum, methods to bring more types of atoms and molecules to the ultracold temperature regime, agile systems for tailoring the spatial and frequency content of light fields, and numerical methods for characterizing highly entangled quantum systems. Collaboration between Institute personnel will be intensified through the appointment of jointly supervised students and postdocs, exchange of personnel between campuses and between experiment and theory groups, workshops and retreats, teleconferenced journal clubs, and joint development of novel technologies. The impact of the Institute will be enhanced by scientific publications in leading peer-reviewed journals, all jointly authored by multiple UC campuses.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Speculative Futures

Host Campus: San Diego

Lead Investigator: Shelley Streeby *Award Type:* Planning/Pilot Award

Collaborating Sites: Irvine, Riverside, Santa Cruz

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$270,000

Abstract:

Dystopian visions of disastrous futures, a ruined planet, racial conflict, and polarizing global inequalities are ubiquitous today in popular culture and policy predictions. At the same time, practitioners, scholars, and theorists in the emergent field of Speculative Futures Studies use speculative forms—including literature, art, and theory—to try to create more sustainable worlds and futures. We understand the speculative as an umbrella term under which a wide range of strategies for world-making and imagining the future, including those connected to the popular genres of science fiction and fantasy, are situated. Building on the premise that in order to create a better world, we first have to imagine it, we envision building a cross-UC research group involving faculty, graduate students, undergraduates, and community members who will use speculative cultural forms and theories to conduct collaborative research on the future of education, ecology, gender, sexuality, race, and addressing inequalities in California and the world. Outcomes include: 1) an anthology on Speculative Futures Studies 2) UC-wide symposia and 3) a teaching archive. We will extend our impact through digital humanities projects, including a website that will include teaching materials such as syllabi and media resources and also serve as an archive of the visions of the future generated by project participants, students, and others. We hope this website will help us engage scholars, activists, students, and policymakers in California and the world. We will also work to create a broad conversation on speculative futures on our campuses, bringing together clusters of faculty and students that already exist but need to be better connected to each other. We will organize a series of multidisciplinary events at the host campus (UCSD) and UCR during the first year and then at UCI and UCSC during the second year. We will end with a major conference in collaboration with campus partners such as the Arthur C. Clarke Center for Human Imagination and the Clarion Science Fiction and Fantasy Writers Workshop. This conference will allow practitioners, scholars, and students of Speculative Futures Studies from around the world to connect the work they are doing using speculative cultural production and theory to imagine futures for California and the world that are not dystopian and which offer hope and different possibilities, informed by research, for creating transformative change.

Maximizing the Environmental Utility of Battery Storage

Host Campus: Irvine

Lead Investigator: Brian Tarroja *Award Type:* Planning/Pilot Award

Collaborating Sites: Davis, Los Angeles, Santa Barbara

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$270,000

Abstract:

Concerns over the environmental and economic impacts of fossil-fuel usage have motivated the deployment of renewable energy resources in the electric power sector. In California, this has been codified by the Renewable Portfolio Standards and complementary policies. Renewable capacity additions in the state have been largely comprised of solar photovoltaic and wind resources. Due to intermittency in these resources, battery energy storage has been identified as a key technology for enabling their increased utilization by reducing losses due to curtailment and matching electricity supply with demand. Battery storage, however, includes a diverse array of technologies each with differing efficiency and durability, unique material compositions, manufacturing processes, disposal or recycling methods, and life cycle resource requirements that have health and environmental footprints of their own. While many battery technologies can improve system-wide performance of a renewable-intensive grid, the health and environmental benefits may be offset by impacts resulting from the battery life cycle. Before battery technologies are deployed at large-scale to support State-wide health and environmental goals, it is critical to understand the full spectrum of health and environmental benefits and impacts associated with the life cycle of different battery technologies. Therefore, the proposed research aims to: 1) develop the data and analytical capabilities for comprehensively characterizing and comparing the life cycle health and environmental footprint of different battery technologies accounting for their materials of construction, interaction with the electric grid during use, and end-of-life management options; and 2) utilize these capabilities to develop a roadmap that identifies potentially undesirable impacts and key research needs to mitigate them. These will be accomplished by leveraging expertise in energy system modeling and optimization (Tarroja and Samuelsen), materials selection (Schoenung), human health impacts (Ogunseitan), life cycle analysis (Kendall and Suh), and environmental policy and decision-making (Malloy). The outcomes of this work will be useful for California government agencies in promoting both the use of safer chemicals in products and the design of a preferred mix of energy technologies (including energy storage types) to be deployed to meet the State's environmental policy goals.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Critical Mission Studies at California's Crossroads

Host Campus: Los Angeles

Lead Investigator: Charlene Villaseñor Black *Award Type:* Program Award

Collaborating Sites: Riverside, San Diego, Santa Cruz

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$1,028,898

Abstract:

Critical Mission Studies represents an opportunity for a new engagement with our state's history through the lens of the Spanish-Indian missions, vastly mythologized and profoundly understudied. Through reconsideration of the missions as both physical sites and foci of interpretation, we pursue new research that surfaces both Native and Mexican/Mexican-American voices in the history of California and the U.S. Reflecting trends in public history over the last decade, our research will foster more complex, multidimensional public engagements with difficult histories.

The controversy over the 2015 canonization of Father Junípero Serra simultaneously united and surfaced tensions between the Native and Mexican-American communities in California. Our research seeks to bridge the disciplinary divide between Native American Studies and Chicano/a Studies, and between California Studies and Mexican Studies, fomenting new narratives of California history in which everyone has a place. Because the missions represent a shared history between California and Mexico, our project will open up new avenues of collaboration with scholars, museum professionals, and preservationists in Mexico. We aim to activate the missions in concept and space -- on multiple registers at once -- for truth telling, for the exploration of their impact as cultural and religious centers for settler and immigrant communities, historically and today.

We seek to produce new knowledge, in consultation with a California Indian advisory board, by assembling interdisciplinary, collaborative humanities labs, gathering three times a year, and by funding faculty, postdoctoral fellows, graduate students, undergraduates and community partner research projects. Each humanities lab is composed of 20 UC faculty researchers, graduate students, undergraduates, national and international experts, and community partners. Labs will engage in research in the field, in archives, in the missions, and surrounding communities. California's 21 missions are an imperfect, partial, yet essential lens to access California's various histories and engage in nuanced and frank encounters with the past, with UC scholars at the helm, producing data-driven studies.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

PlaceMakers: UC Place-based Art + Design

Host Campus: Santa Barbara

Lead Investigator: Kim Yasuda *Award Type:* Planning/Pilot Award

Collaborating Sites: Berkeley, Davis, Santa Cruz

Start Date: 1/1/2019 *End Date:* 12/31/2020 *Amount:* \$270,000

Abstract:

How do we reimagine our campuses and their neighborhoods as potential sites for new knowledge and the renewal of our commons? How are citizens and their cultural and educational institutions reinvesting in their local neighborhoods imaginatively and effectively through public research and creative place-making? Over the past decade, place-making has emerged as a community revitalization strategy that employs the inherent creativity of citizens and institutions in the shaping of place through arts engagement, cultural preservation, urban design, and workforce development. Concepts of locality and neighborhood, civic inclusion and stakeholder participation are integral to this process. Further, place-making recognizes a distinct, catalytic role of the arts and cultural sectors within a creative economy, one that do not exacerbate the social and economic inequalities of gentrification, but leverage and stabilize civic investments and local leadership of individuals and institutions who remain anchored in place over time. Considerable work on place-based, campus community partnerships has been documented within a national context, however, a gap remains in a comprehensive collection of innovative arts-based models across California and the UC system. Our proposed project is designed to identify and amplify relevant place-based research that is reimagining the spaces of higher education as innovative and publicly-accessible. Galvanized by current national conversation and institutional synergies, notably arts and 'creative place-making' focus of the 2017 Alliance for the Arts in Research Universities (a2ru) and the publication of 'The Integration of the Humanities and Arts with Sciences, Engineering, and Medicine in Higher Education' (National Academy of Sciences, 2018), lead faculty from 5 UC's have initiated plans for the coordination of research initiatives, capacity-building, and exchange across multiple campuses, establishing a core methodology to identify relevant arts + design + media research/practices, new pedagogies and programmatic that comprise the distinct UC arts research portfolio. Support is requested for a 2-year planning/pilot phase. Year 1 will manifest a current inventory of system-wide artists, research programs, and centers that exist across academic sectors that partner with communities, foundations and private/civic affiliates. Year 2 will pilot those arts initiatives and infrastructures that could be scaled systemwide.

Next Generation Noninvasive Magnetic Neuroimaging

Host Campus: San Diego

Lead Investigator: Robert Dynes *Award Type:* Program Award

Collaborating Sites: Berkeley, Irvine, Riverside, San Francisco

Start Date: 1/1/2017 *End Date:* 12/31/2020 *Amount:* \$1,644,656

Abstract:

We propose to develop next-generation Magnetoencephalography (MEG) magnetic imaging instrumentation for the human brain. MEG is a non-invasive neural imaging technique that directly measures the magnetic signal due to neuronal activation with high temporal resolution and spatial localization accuracy. MEG has been routinely used in localizing seizure foci in patients with epilepsy and for pre-surgical localization of brain functions. Recently, members of our team have showed that MEG can potentially be a powerful research and diagnostic tool for autism, traumatic brain injury and post-traumatic stress disorder. The magnetic field sensors used for commercial MEG systems are based on Superconducting QUantum Interference Devices (SQUID). SQUID-based sensors have the highest combination of sensitivity and bandwidth of any sensor known, but require costly and cumbersome refrigeration for cooling to cryogenic temperatures (4.2 K). The design and materials for these sensors have not changed in nearly three decades and there has been little progress in MEG hardware. The high cost has hindered widespread use of MEG at the clinical level and there are only about 30 of these systems in the United States (two are in the UC system at UCSD and UCSF). We propose to reinvent SQUID MEG, to make it affordable, and easier to use while at the same time improving the sensitivity and resolution. Our approach uses technologies that were not available 30 years ago when SQUID development stalled. A recent breakthrough was made by members of our team in developing a new type of high temperature superconductor (HTS) SQUID by modifying the ceramic material on the nanoscale using a finely focused beam of helium ions. This results in sensors with very low magnetic flux noise. Furthermore, unlike prior HTS technologies our new technique is relatively simple, inexpensive, high yield, and scalable to wafers for large scale sensor production. The goal of our proposed development will be to optimize the sensors and to construct prototype biomedical imaging instruments. The sensors in our instruments can be placed much closer to the scalp for greater spatial resolution and sensitivity because they function at higher temperature. Additionally we will improve the ease of use and significantly reduce the costs associated with acquisition and maintenance. While our main thrust will be the brain, biomagnetic imaging of other organs such as the heart and liver will also be investigated.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Critical Refugee Studies

Host Campus: San Diego

Lead Investigator: Yen Espiritu *Award Type:* Program Award

Collaborating Sites: Berkeley, Los Angeles, Merced, Riverside

Start Date: 1/1/2017 *End Date:* 12/31/2020 *Amount:* \$1,578,150

Abstract:

Refugees have long been the objects of inquiry for fields such as sociology, history, and political science. The field of Critical Refugee Studies (CRS) reconceptualizes the refugee not as an object of rescue but as a site of social and political critique, whose emergence when traced, critically expresses processes of colonization, war, and displacement. Such reconceptualization requires approaches that integrate theoretical rigor and policy concerns with refugees' rich and complicated lived worlds. The Multi-Year Program Award will enable the development and implementation of multiple platforms for that collaborative and transformative work. The expected outcomes of this initiative are: 1) an anthology on Critical Refugee Studies 2) symposia across the UC system; and 3) teaching materials across diverse fields, from syllabi to teaching guides to media resources. We will also establish digital humanities projects, including interactive maps and possibly mobile applications allowing for situated experiences concerning refugees. Our website will visualize refugee movements globally, serving as a resource for engaging policy makers, activists, scholars, and students in California and beyond. Using mapping technology, we plan for these digital tools to be interactive, allowing users to share their perspectives on the legacies of colonialism and militarization that refugees make visible. We envision that the site will act as an open archive for refugees across the world to share information, histories, stories and images. Beyond this virtual discussion platform, we will create a forum for the discussion on global displacement at four UC campuses. We will organize a series of multidisciplinary events at the host campus (UCSD) the first year and then subsequently at UCLA and UCM, two campuses selected for their geographic proximity to refugee populations in the Inland Empire, Los Angeles, Fresno, and Merced. During the final year of the award, we will put together a major conference at UCB in collaboration with campus partners such as the Haas Institute. This conference will be a meeting point for scholars and activists from around the world to discuss refugee-related topics like militarism and war; climate change; and human rights--all from the perspectives of the refugees. Combined, our four-year plan reflects activities aimed at enriching and advancing refugee discourse with humanistic critiques, innovative methodologies, and scholarly outcomes.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

UC Consortium on the Developmental Science of Adolescence

Host Campus: Los Angeles

Lead Investigator: Andrew Fuligni *Award Type:* Program Award

Collaborating Sites: Berkeley, Davis, Irvine, Santa Cruz

Start Date: 1/1/2017 *End Date:* 12/31/2020 *Amount:* \$642,538

Abstract:

The onset of puberty represents a maturational period of challenge and opportunity for children and society. Recent scientific advances have made inroads into how pubertal and neural development during adolescence can create risk for mental and behavioral disorders. Yet, the changes beginning during puberty and extending through the teen years also create an exciting period of flexibility and potential that can be leveraged to promote strong transitions to adulthood. The key question is how these maturational changes interact with the dynamic social world to maximize the potential of youth to become integrated, healthy, and productive members of society. Finding the answers is of particular importance to California, with implications for the education and health of the state's diverse youth. In January, 2015, we received a two-year MRPI Planning Grant to begin the process of developing a new multi-campus, interdisciplinary research and training consortium on the science of adolescent development. We have spent the last 18 months convening planning meetings, holding multi-campus summer programs, interfacing with community organizations, and issuing seed grants for cross-campus and transdisciplinary collaborations. Our activities have generated a great deal of enthusiasm among participating faculty and trainees and have prepared us to launch a larger, more expansive initiative. We now propose an MRPI Program Award to support the formal establishment of the UC Consortium on the Developmental Science of Adolescence. The effort will be centered at UCLA and core campuses will be expanded to include Berkeley, Davis, Irvine, and Santa Cruz. Collectively, the campuses possess key personnel in appropriate disciplines (e.g., neuroscience, psychology, psychiatry, anthropology), critical facilities (e.g., neuroimaging centers, poverty centers, laboratories), and talented undergraduate and doctoral students necessary to make such an effort a success. Consortium activities will include: (1) an annual multi-day, UC Summer Institute on Adolescence that focuses on research and training for graduate students; (2) support for summer internships and "citizen-science" initiatives for undergraduate and high school students; and (3) seed-grants for interdisciplinary, cross-campus pilot studies to support applications for extramural funding. We also will establish mechanisms to seek support from extramural sources to make the Consortium self-sustaining in the long-term.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Science-based Innovation in Learning Center

Host Campus: San Francisco

Lead Investigator: Robert Hendren *Award Type:* Program Award

Collaborating Sites: Berkeley, Davis, Irvine, Merced

Start Date: 1/1/2017 *End Date:* 12/31/2019 *Amount:* \$577,751.00

Abstract:

In the US, 9.2% of public school children are English language learners (ELLs), and ELL enrollment has grown 50% over the past decade, outpacing non-ELL enrollment. In California (CA), a quarter of the school-aged children in the public schools are ELLs. ELLs are twice as likely as non-ELLs to live in poverty and more likely to be misidentified than non-ELLs for learning disabilities (LDs) such as reading disorders (RD). Learning disabilities and their misidentification in ELLs further contributes to ELL inequality in English proficiency and educational attainment, leading to income and health disparity. Reducing education-related risks for poor health outcomes in ELLs requires efforts to better understand the link between educational attainment and health disparity in this population, and early identification of LD in ELLs. Although there are good predictors of RD in English monolinguals, extending these to ELLs is complicated by variability in language experience, lack of English proficiency, variability in the native languages spoken by ELLs, and the lack of normed measures (except Spanish) and qualified practitioners. One third of all US ELLs are in CA, making these issues particularly significant for the state and UC, while at the same time providing the opportunity for UC to be a leader in addressing these issues. The short-term goals of the current proposal are to: (1) setup an innovative, multicampus, cross-disciplinary collaboration bridging education, cognitive sciences, medicine and policy, and (2) perform a series of pilot studies to examine the links between academic and health outcomes in ELLs and evaluate individualized prescription of reading interventions that will prepare us to compete for federal center and collaborative research grants in the near future. The long-term goal is for the proposed UC center to be a national leader in 'Precision Ed-Health', and tackle issues associated with education and health disparity in underrepresented populations, with an initial emphasis on early identification and intervention of children at risk for learning challenges. Our central mission includes performing high quality research and providing training, services and advocacy. Such efforts will ultimately enhance the lives of children and families, while addressing major issues in CA and the US, including the cost of education, difficulties of educating diverse populations including ELLs, and the health consequences of poor school performance.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Fighting Drought With Stormwater: From Research to Practice

Host Campus: Santa Barbara

Lead Investigator: Patricia Holden *Award Type:* Program Award

Collaborating Sites: Los Angeles, Riverside, San Diego

Start Date: 1/1/2017 *End Date:* 12/31/2019 *Amount:* \$1,892,241

Abstract:

Southern California is in the grip of a major drought, yet urban areas throughout the region “throw away” vast quantities of stormwater runoff by letting it flow to the ocean. In this proposed MRPI a multidisciplinary team of senior, mid-career, and early-career researchers from across the five southern UC campuses will join forces to catalyze a revolution in the form and function of urban stormwater infrastructure in Southern California and beyond, transforming it from a leading cause of environmental degradation into a multi-functional green system that augments urban water supply, protects human and ecosystem health, minimizes flood risk, and ensures public safety. To realize this vision we will conduct coordinated field, laboratory, and modeling studies of green stormwater infrastructure (in particular biofilters, also known as rain gardens, bioswales, and bioretention ponds), using the five southern UC campuses as a living laboratory. While our project is focused on Southern California, the science, engineering, and policy innovations we uncover will inform similar transitions occurring in rapidly urbanizing regions throughout the world. Our MRPI will support stipends for undergraduate students (5), graduate students (8), and post-doctoral researchers (3), and fund various outreach and engagement programs for K-12 students, campus stormwater programs, government agencies, consulting firms, and community college teachers (through a NSF RET Site). As public attention shifts progressively toward water scarcity, particularly in Southern California, our MRPI will be perfectly placed to help the UC become a leader in green stormwater management, and perhaps even facilitate a systemwide green stormwater initiative, along the lines of the systemwide carbon neutral initiative already in place. Looking forward, our long-term goal is to use the MRPI as a springboard for an NSF Engineering Research Center, and a hub of university/industry collaborations on green stormwater infrastructure research and practice in Southern California.

Heterogeneously Integrated Memory Subsystem for the IoT Era

Host Campus: Los Angeles

Lead Investigator: Subramanian Iyer *Award Type:* Program Award

Collaborating Sites: Berkeley, Santa Barbara

Start Date: 1/1/2017 *End Date:* 12/31/2020 *Amount:* \$1,620,000

Abstract:

Moore's law is saturating while computing has become very heterogeneous, data-centric and in dire need of new device and integration concepts. We bring three complementary efforts across three campuses to work synergistically together that make a significant impact on this problem. This will allow us to transform huge amounts of data into information, knowledge and ultimately intelligence that will bring cognitive capability to the emerging paradigm of "Internet of Things" (IoT). UCB is developing a novel non-volatile memory concept using monolithically stackable ferroelectric materials, grown on nominally processed CMOS wafers in advanced nodes. This allows us to scale high performance non-volatile memory far beyond what can be done by conventional means. The goal of the UCB effort is to optimize the materials and structure and implement a terabyte scale 3D NAND architectures required for future cognitive applications. UCSB is developing novel 2-dimensional (2D) layered semiconductors and devices that permit switching between states at significantly lower powers than possible today. These materials, by virtue of their atomically-smooth surfaces and high density of states, when integrated properly can provide unprecedented performance and power advantages compared to those based on conventional materials. These atomically-thin materials can also be monolithically stacked on top of each other and over the ferroelectric layers (forming non-volatile memory), allowing low-latency and high-bandwidth data access at unprecedented low energies. Finally, we need to make these new devices work with each other and more conventional ones to build the cognitive systems for the post CMOS scaling era. The crux of such a future system that we envision is an innovative technology platform where multiple layers of logic and non-volatile memory blocks are integrated in three dimension by exploiting unique properties afforded by emerging material systems. In this approach, very different technologies are brought together as if they were built on the same piece of silicon, using the Silicon Interconnect Fabric being developed at UCLA. This capability allows us to design these heterogeneous systems with a low energy footprint and build them reliably and economically. We believe that this project will enable a unique platform for these three efforts to work synergistically together, with game changing implications for the IoT era, medical engineering and hardware development in general that will spike innovation

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

Will California's New Electorate Reflect the New California?

Host Campus: San Diego

Lead Investigator: Thad Kousser *Award Type:* Program Award

Collaborating Sites: Berkeley, Davis, Merced, Riverside

Start Date: 1/1/2017 *End Date:* 12/31/2020 *Amount:* \$545,641

Abstract:

Three important trends are now intersecting in the politics of the nation's largest state. First, California's population is becoming even more diverse, with Latinos now making up a plurality, many Asian-American groups growing even more quickly, and immigration continuing to redefine our demographics. Second, turnout in California elections has plummeted to historically low levels, with the 2014 elections bringing the lowest participation rates on record. Third, in order to spur more turnout, the state is poised to implement a series of pioneering election reforms: Election Day registration, the New Motor Voter Act to automatically register voters through the DMV, a proposal (SB 450) to move from polling place elections to all mail ballot elections, and a proposal (AB 2455) to streamline registration for students at California's public community colleges and universities. This set of new election laws, if implemented wisely, has the potential both to expand California's electorate and to make it more reflective of the state overall. But there are also concerns that, without understanding the ways that different types of voters participate, the laws could instead exacerbate inequalities in turnout. Will California's grand experiment be a success for "low-propensity voters," the demographically diverse set of state residents who tend to vote at polling places rather than through the mail, who often do not own cars, and who typically do not attend college? We propose a multicampus collaboration that would harness the UC's expertise in studying turnout patterns in massive voter databases, understanding the obstacles to participation among racial and ethnic minorities and immigrant groups, and designing randomized turnout experiments to test different strategies aimed at mobilizing underrepresented groups. The project will train undergraduate and graduate research assistants at multiple campuses, and provide lessons for both the academic study of mobilization mechanisms and for other states which are closely watching the California experiment. We will also use the unique opportunity provided by the UC Center Sacramento to collaborate with policymakers like the Secretary of State to design and to adopt broadly effective methods of mobilizing the new Californian electorate.

Electrical Control of Topological Magnetic Order

Host Campus: Santa Cruz

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

Collaborating Sites: Davis, San Diego, Lawrence Berkeley National Laboratory

Start Date: 1/1/2017 *End Date:* 12/31/2020 *Amount:* \$1,379,094

Abstract:

The recent discovery of skyrmions in magnetic materials, originally predicted in the context of high energy physics, has sparked tremendous interest due to their unusual topologies and resulting physical properties. Magnetic skyrmions are excitations whose geometry is similar to vortices in fluids known as solitons, and often have nanometer lateral length scales. Controlling skyrmions in electrically insulating materials using electric fields, including their size, location, and chirality, could enable a new paradigm for ultra-low power and high density data storage, memory, and processing. Insulating materials that to date have been identified to sustain skyrmions are few and their response to electric fields too weak to make devices. We propose to study antiferromagnetic and weak ferrimagnetic thin films with two important requirements to sustain skyrmions, magnetic frustration and the Dzyaloshinskii-Moriya interaction, and which also have a magnetoelectric coupling that enables them to respond to electric fields. The goal is to understand the fundamental physics of these structures while assessing the feasibility of using these materials in data storage and processing devices. Multilayers composed of complex oxides and other compounds will be synthesized at UCSC, UCD and UCSD using molecular beam epitaxy, pulsed laser deposition, and sputtering. Nanoscale cylinders and other patterned geometries will also be studied to determine if the magnetic structure at edges and interfaces enables the formation of a skyrmion vortex lattice. The samples' crystalline and interface structure will be thoroughly characterized using x-ray diffraction, electron microscopy, Kerr microscopy, scanning probe microscopy, and other techniques to understand the role of defects, strain, and other extrinsic factors. The magnetic response of the samples as a function of temperature, magnetic field, and electric field will be performed to look for evidence of skyrmions and to assess and characterize any possible coupling to electric fields. In order to unequivocally identify the existence of skyrmions, the magnetic structure will be measured soft x-ray scattering at the Advanced Light Source at LBNL. In addition to soft x-ray scattering, x-ray microscopy can also be used for direct imaging. Graduate students will benefit from a holistic approach to research that involves several experimental and computational techniques, and outreach activities will target K-12 underrepresented student populations.

Drought and Public Health in a Warming California

Host Campus: Los Angeles

Lead Investigator: Dennis Lettenmaier *Award Type:* Planning/Pilot Award

Collaborating Sites: Berkeley, Merced, San Diego

Start Date: 1/1/2017 *End Date:* 12/31/2020 *Amount:* \$2,148,949

Abstract:

Drought and the role of climate change in California have been at the forefront of public awareness since the onset of the new millennium, yet the public health consequences of drought are poorly understood. There is some evidence surrounding particular events that wildfire smoke from drought-enhanced events affects public health. However, linkages between drought, wildfire and smoke exposure resulting from any particular fire are complex and challenging to quantify and predict. Drier and warmer soils during droughts may influence the transmission of Valley Fever (VF) and West Nile Virus (WNV) in California, two infectious diseases whose transmission cycles are sensitive to temperature and surface water dynamics. The complex environmental biology and ecology of these diseases make estimating the effects of drought on their incidence challenging as well. To overcome these challenges, we intend to leverage the tremendous expertise in climate, hydrology, and public health science in the UC system to identify and quantify the pathways by which physical effects of drought lead to health effects. For wildfires and smoke, we will use a combination of physical and statistical models to identify sources of smoke and its trajectories, and hence smoke exposure of major population centers. For VF and WNV, we will use hydrological model-based reconstructions of soil moisture combined with mosquito vector data and dust emission models to assess the relationship between county-level incidence of WNV and VF and hydroclimate variability. Social equity and disparity implications motivate our choice of wildfire, smoke, and infectious diseases as the primary environmental health concerns. Smoke-related health effects are mostly an issue for coastal urban populations during offshore (Santa Ana) wind conditions. In contrast, VF and WNV illnesses mostly affect inland populations of lower socioeconomic status. We will directly examine the health disparities that stem from heterogeneous exposures to drought-related hazards – both physical (smoke) and infectious (WNV and VF). Our public engagement program will develop customized plans to target specific generations, ranging from middle and high schools, to town hall meetings in rural California. We will also work with departments of health in San Diego and Alameda Counties to develop cost-effective adaptations to protect Californians and minimize the impact from changing drought and climate patterns on public health.

Enabling Therapeutics Discovery Across the UC System

Host Campus: Davis

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

Collaborating Sites: Irvine, Los Angeles, San Diego, San Francisco

Start Date: 1/1/2017 *End Date:* 12/31/2019 *Amount:* \$2,025,000

Abstract:

The goal of the UC Drug Discovery Center (DDC) is to enable the effective translation of UC's world-class research into new therapeutics by creating a supportive multi-disciplinary environment for drug development, linking core infrastructure, educational resources and pilot funding on all of the UC sites (initiating with 5 Health campuses and expanding to the full UC system). DDC aims: (1) To support the progression of drug development projects from fundamental research to Candidate stages with i) mentorship from experienced professionals, ii) multi-disciplinary team creation, and iii) pilot funding. (2) To support drug discovery training by i) creating a mini-fellowship for graduate students for immersion into DDC-supported projects and acquisition of technical skills, ii) establishing a central database for drug discovery related educational opportunities (courses, experiential training and seminars) for faculty and trainees of all stages. (3) To support the research enterprise by enabling scholarly contribution and implementing a tool to access existing drug discovery related core facilities across the UC system. This will improve access to facilities to progress novel approaches and increase facility utilization. (4) To establish partnerships with industry and foundations and develop a strategy for securing extramural funding for future sustainability. DDC will act as a single-point of contact for partners and will facilitate collaborations with UC researchers, thus supporting the growth of California's life sciences eco-system. Industry has downsized its internal research dramatically in recent years, and academic-industry partnerships have become the accepted approach to translating fundamental research into novel therapeutics. The University of California has not exploited this opportunity to support drug discovery and enable partnerships. UC lags behind peer institutions such as Harvard, Johns Hopkins, Yale. It is urgent that we address this gap. This initiative will lead to i) increased effectiveness in translating research into novel drugs ii) development of high-value drug candidates for licensing, iii) increased competitiveness for partnerships from private and public sources, iv) increased multi-disciplinary cross-campus collaborations, v) improved training in drug discovery for students and faculty. In addition, DDC will fuel economic growth in California through start-up companies that often form around promising therapeutic approaches.

UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

UC Valley Fever Research Initiative

Host Campus: San Francisco

Lead Investigator: Anita Sil *Award Type:* Program Award

Collaborating Sites: Berkeley, Merced, Riverside, San Diego

Start Date: 1/1/2017 *End Date:* 12/31/2020 *Amount:* \$1,716,568

Abstract:

The fungus responsible for San Joaquin Valley Fever (SJVF), *Coccidioides immitis*, is endemic in the soil from Merced to Kern County, CA, where *Coccidioides* infection is on the rise. *Coccidioides* infection is a serious problem in California, Arizona and Mexico, incurring costs upwards of \$200M/year for those afflicted with the illness. This alarming public health issue is illustrated by a successful class action suit initiated by California state prisoners at Coalinga and Avenal due to nearly 40 fatal cases of SJVF since 2006. SJVF is an growing problem in California, and innovative UC-based research is needed to tackle it. The proposed research activities will position the University of California to advance scholarship on this critical issue of paramount importance to public health in California and beyond. Our research activities will also provide the preliminary results needed to obtain federal support for future research on *Coccidioides* biology. Very few research teams have the requisite expertise and infrastructure to study *Coccidioides* since biosafety level 3 (BSL3) laboratories are necessary to protect laboratory personnel from infection with this fungus during biological experimentation. This reality has rendered *Coccidioides* an understudied pathogen despite its huge public health and economic impact on California. Our transdisciplinary collaboration of eight UC scientists across five UC campuses is unique in that we have facilities and expertise necessary to examine the molecular basis of how *Coccidioides* causes disease. Our team includes experts in the molecular biology of pathogenic fungi, pioneers in the mapping of genes that cause trait differences in fungi, experts in the host response to infection, and experts in the population genetics and genomics of fungi. We will (1) use a BSL3 laboratory at UCSF to study the response of the pathogen to physical and biochemical stresses imposed by the host, (2) use cutting-edge and complementary genomics and genetic technologies at UCSF, UCR, UCB, and UCM to uncover fungal genes that underlie *Coccidioides* pathogenesis, and (3) utilize facilities and expertise at UCSD and UCSF to evaluate the effect of specific fungal alleles on virulence in the mouse model of infection. Of note, this proposal will build the first multidisciplinary *Coccidioides* research program in the UC system, including at UCM, which is located directly within the endemic region for SJVF.