UC Multicampus Research Programs and Initiatives

Abstracts for Active Awards

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Next Generation Noninvasive Magnetic Neuroimaging

Host Campus: San Diego
Lead Investigator: Robert Dynes Award Type: Multi-year 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 Magnetoenceptahalography (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.

Critical Refugee Studies

Host Campus: San Diego
Lead Investigator: Yen Espiritu Award Type: Multi-year 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 Consortium on the Developmental Science of Adolescence

Host Campus: Los Angeles
Lead Investigator: Andrew Fuligni Award Type: Multi-year 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.

Fighting Drought With Stormwater: From Research to Practice

Host Campus: Irvine
Lead Investigator: Stanley Grant Award Type: Multi-year Program Award
Collaborating Sites: Los Angeles, Riverside, San Diego, Santa Barbara
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.

Science-based Innovation in Learning Center

Host Campus: San Francisco
Lead Investigator: Fumiko Hoeft Award Type: Multi-year Program Award
Collaborating Sites: Berkeley, Davis, Irvine, Merced
Start Date: 1/1/2017 *End Date*: 12/31/2019 *Amount*: $577,751

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.

Heterogeneously Integrated Memory Subsystem for the IoT Era

Host Campus: Los Angeles
Lead Investigator: Subramanian Iyer Award Type: Multi-year Program Award
Collaborating Sites: Berkeley, Los Angeles, 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

Will California's New Electorate Reflect the New California?

Host Campus: San Diego
Lead Investigator: Thad Kousser Award Type: Multi-year 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: Multi-year Program Award
Collaborating Sites: Davis, 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: Multi-year Program 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.

Towards A Nicotine Therapy For Age-Related Hearing Disorders

Host Campus: Irvine
Lead Investigator: Raju Metherate Award Type: Two-year Planning/Pilot Award
Collaborating Sites: Berkeley, Riverside
Start Date: 1/1/2017 *End Date*: 12/31/2018 *Amount*: $296,207

Abstract:
Age-related hearing disorders are a major health issue affecting a third of adults over 60 and involve altered brain processing that can occur even in the apparent absence of deficits in the ear. This central auditory processing disorder (CAPD) is characterized by poor speech perception despite normal results from standard hearing tests that use simple tone stimuli. Since behavioral therapies and hearing aids are only partly effective treatments for CAPD, this proposal is a first step towards a drug therapy that can be integrated with existing strategies to better treat age-related hearing disorders. Because nicotine enhances cognitive function and sensory processing, drug companies are developing nicotine-like proprietary drugs to target cognitive deficits in disorders such as Alzheimer's disease and Attention Deficit Disorder. These drugs are non-addictive, yet nicotine when delivered topically (patch) or orally (gum) is also considered non-addictive, and additionally is inexpensive and freely available. However, the clinical benefits of nicotine have not been exploited beyond its use as an aid to stop smoking. Notably, nicotine's effects on auditory processing are unknown. This proposal is motivated by parallel studies on nicotine's effects on individual neurons (in particular, inhibitory neurons) and on age-related loss of auditory neurons (again, inhibitory neurons in particular). We propose that nicotine can reverse auditory deficits in aged individuals by stimulating inhibitory neurons that are spared in aging. We will test this hypothesis in aged humans and mice, using: 1) cellular neuroanatomy in mouse, to study nicotine regulation of inhibitory neurons; 2) auditory neurophysiology in mouse, to examine nicotine effects on neural processing of complex, speech-like sounds; 3) human brain imaging, to characterize nicotine effects on brain responses and selectivity for speech-like sounds; and 4) human psychophysics, to determine nicotine effects on auditory and speech perception. A unique aspect of this proposal is a parallel technical approach, including the use of similar acoustic stimuli for human and mouse experiments (after accounting for species differences in hearing), to target common underlying mechanisms. Over 70% of funds will support graduate students, who will be cross-trained across projects. This broad yet integrated approach will promote an understanding—and potentially, the first-ever drug therapy—for age-related hearing disorders.

The Middle Ages in the Wider World

Host Campus: Berkeley
Lead Investigator: Maureen C Miller Award Type: Two-year Planning/Pilot Award
Collaborating Sites: Berkeley, Davis, Santa Barbara
Start Date: 1/1/2017 *End Date*: 12/31/2018 *Amount*: $291,817

Abstract:
Medieval scholarship is at a remarkable moment of challenge and opportunity. The field is undergoing a transformation as scholars turn away from a narrow focus on Western Europe, recognizing that European developments cannot be understood in isolation from the wider world. Currents of mutual influence and exchange—as well as conflict—ranged far beyond the Mediterranean to include Islamic scholars in Timbuktu or debates over religion at the courts of the Mongol khans. The result is not only a richer understanding of our past but of the complex medieval origins of aspects of the contemporary world, not only sectarian differences but shared developments like institutions of higher learning and diplomacy. This is important: contemporary events have underscored the pressing need for scholars to communicate to students and the broader public deeper understandings of the links and tensions among world cultures, understandings grounded in their long histories of interaction, influence and conflict. These understandings can no longer be Eurocentric. Yet ironically we are also experiencing a crisis in the humanities, a turning away from exactly the research and teaching needed to develop and convey those deeper understandings. This proposal addresses these concerns. It is shaped by our recognition of UC's responsibility to public education: we seek both to foster research with wide-reaching implications and to develop ways to make those new understandings accessible to educators as well as researchers. The over-arching goals of this initiative are 1) to support and intensify the geographically wide-ranging intellectual visions of the Middle Ages pursued by graduate student and faculty researchers in the UC system, and 2) to bring this wide ranging and inclusive understanding of the Middle Ages to a broad audience by supporting the transformation of widely-accessed general narratives of the field, including textbooks. Specifically, the project will foster collaborative research and exchange among scholars studying the millennium from 500 to 1500 CE in Africa, the Americas, and Eurasia through competitive grants and interdisciplinary workshops. The initiative will generate new narratives of the Middle Ages that foreground the diversity within Europe and contextualize it within a global frame through critical comparative investigations. Expected long-term outcomes include scholarly articles, collaborative source translations, and instructional materials.

UC network for viral capsid dynamics and pathogenesis

Host Campus: Riverside
Lead Investigator: ALN Rao Award Type: Two-year Planning/Pilot Award
Collaborating Sites: Irvine, Los Angeles, Riverside
Start Date: 1/1/2017 *End Date*: 12/31/2018 *Amount*: $300,000

Abstract:
The majority of viruses contain RNA genomes protected by a shell of capsid proteins. Although viral capsids appear to be highly uniform, recent measurements suggest that virions are highly dynamic in nature. Does capsid dynamics functionally regulate pathogenicity? And to what extent does the packaged genomic RNA affect capsid dynamics? We propose to answer these questions via a multidisciplinary approach involving genetics and molecular biology (Rao [PI], UCR), physical chemistry (Gelbart, UCLA), nanotechnology (Zhou, California NanoSystems Institute [CNSI]) and biochemistry (Qiao, UCI). To this end, we exploit as a model system the genetically and structurally well-characterized Brome mosaic virus (BMV), pathogenic to plants. The three genomic RNAs (RNAs 1, 2 and 3) and a single subgenomic RNA (RNA4) of BMV are distributed among three physically inseparable virions. Using the Agrobacterium-mediated transient expression approach worked out in the PI's lab, we propose to assemble in planta – one at a time – the three virion particles of BMV, i.e., capsids containing only RNA1 (B1 capsids) or RNA (B2 capsids) or RNA3+4 (B3/4 capsids). The dynamics of each capsid type will be evaluated at UCLA by mass spectra following trypsin digestion, and by measuring the relative translation efficiencies of each of the three virions in cell-free extract. A combination of cryo electron microscopy (cryoEM) imaging and high-resolution 3D reconstruction of the virions will be carried out at the CNSI, facilitated by the Titan Krios apparatus with electron counting cameras and the cutting-edge software codes developed by Zhou that make possible the quantification of the structures and dynamics of capsid and RNA. To elucidate the role of RNA content on the dynamical properties of the capsids, experiments similar to these with the pure-RNA wild-type virions will be performed with virus-like particles (VLPs) reconstituted in vitro at UCLA, containing non-viral messenger RNA molecules designed at UCI to affect differently the dynamics of capsids vis a vis their proteolysis and translation properties. The goals of the project are two-fold: first to develop and demonstrate new technology and methodology for determination of the structure and dynamics of the protein and RNA components of infectious viruses and virus-like particles; and second to establish the role of capsid dynamics in determining the relative translation efficiencies and infectivities of different RNA viruses.

UC Valley Fever Research Initiative

Host Campus: San Francisco
Lead Investigator: Anita Sil Award Type: Multi-year 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.

Enabling Therapeutics Discovery Across the UC System

Host Campus: San Francisco
Lead Investigator: Cathy Tralau-Stewart Award Type: Multi-year Program Award
Collaborating Sites: Davis, Irvine, Los Angeles, San Diego
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 Consortium for Vascular Mechanics and Mechanobiology

Host Campus: Santa Barbara
Lead Investigator: Megan Valentine Award Type: Two-year Planning/Pilot Award
Collaborating Sites: Irvine, Los Angeles
Start Date: 1/1/2017 *End Date*: 12/31/2018 *Amount*: $300,000

Abstract:
We propose to form a consortium of biologists and engineers to investigate how blood vessels know when to grow and shrink, and how can we control these decisions to fight human diseases such as cardiovascular disease, macular degeneration and cancer. Cells in blood vessels experience many mechanical stimuli: fluid stresses, tension/compression as the heart beats, stresses at the interfaces between neighboring cells and the matrix surrounding them. We know forces play important roles in vascular growth and maintenance, but the ways by which mechanical signals are sensed, processed and converted to biological outputs are not understood. And since these signals are typically generated and processed deep within tissues, manipulation and analysis is nearly impossible. Answering these fundamental questions requires new specialized engineering tools to measure cell forces and mechanics, and new biological systems that allow in situ manipulation of living vessels. Our team has exactly the expertise and tools needed to succeed, including a model organism with completely untapped potential for discovery: the marine organism Botryllus schlosseri. Botryllus grows abundantly off the CA coast and we have recently shown it offers unexpected, unique advantages in studying vascular mechanics and signaling. This proposal will add an entirely new aspect to the UC's already considerable strength in vascular disease and engineering, putting us on the forefront of using the unexploited potential of new models, while simultaneously integrating our substantial marine resources into a larger biomedical context. This combination will provide extraordinary opportunities for training, discovery and innovation, and improved health outcomes to the citizens of CA. We propose collaborative research projects among the founding consortium members to dissect how cells sense and react to mechanical signals, while identifying reagents and conditions that enhance or suppress responses. We will provide coupled training in engineering and biology to graduate and undergraduate students, and anticipate that this work will lead to conference presentations, publications, intellectual property development, and future funding opportunities. At the same time, we will expand our consortium to leverage unique CA resources and tackle even more complex questions in human biology through a sustainable, large-scale systemwide effort on Vascular Mechanics and Mechanobiology.

UC Water Security and Sustainability Research Initiative

Host Campus: Merced
Lead Investigator: Roger Bales Award Type: Multi-year Program Award
Collaborating Sites: Berkeley, Davis, Merced, Santa Cruz
Start Date: 1/1/2015 *End Date*: 12/31/2018 *Amount*: $3,529,748

Abstract:
Achieving a water-secure future requires strategic research to build the knowledge base for better water-resources management. Unprecedented climate change, population growth and changing landcover are radically altering the water cycle, with dramatic impacts on human and environmental uses of water. As California grapples with a multi-year drought, the need for water security is clear. Now is an ideal time for UC to establish a Water Security and Sustainability Research Initiative (WASSRI), alongside California's water leaders. This multi-campus initiative blends UCs technical advances in water resources with parallel innovations in policy analysis and decision support to meet the state's water-security challenges. Three elements of water security underpin the research. First, salient, credible and legitimate water information at the proper spatial and temporal scale is a bottleneck for sound decision making. WASSRI will develop innovative, quantitative water accounting and analysis methods that replace century-old technology and provide the foundation for better decisions under increasing uncertainties. Embedding modern information systems into both natural and engineered infrastructure is feasible, affordable and timely. Second, understanding the way water flows through the natural environment, and how it is extracted, conveyed and stored in built and natural infrastructure is fraught with uncertainties. WASSRI will make immediate research contributions by developing understanding of landcover changes on source-water areas, and tools and techniques for better groundwater management. Third, water-management institutions in California have not kept pace with yesterday's scientific and engineering developments, let alone developed the capacity to adapt to 21st-century stressors. We will tightly weave legal and policy research through our scientific agenda to create an integrated whole. Through integration of measurement and modeling technologies, and drawing on UC expertise across disciplines, we will make rapid progress towards filling the gaps. Focusing initially on two natural laboratories, the Kings River basin and Pajaro Valley, we will develop approaches that link source-water variability with groundwater recharge and use. We will also develop core elements of information systems for wide adoption by stakeholders. Our approach will inform management of groundwater and surface water to enhance water quality, improve the efficiency of water storage and help the state achieve long-term water security.

UC Consortium on Social Science and Law

Host Campus: Riverside
Lead Investigator: Steven Clark Award Type: Two-year Planning/Pilot Award
Collaborating Sites: Berkeley, Davis, Irvine, Los Angeles, Merced, Riverside, San Diego, Santa Barbara, Santa Cruz
Start Date: 1/1/2015 *End Date*: 12/31/2017 *Amount*: $298,341

Abstract:
Social science and law is a vital area of scholarship that advances theory and application to solve societal problems of immense importance to Californians. This field combines basic theory in social science and law with rigorous empirical research to yield crucial practical application to law, medicine, and public policy. The research is inherently inter-disciplinary, with scholarship in psychology, psychiatry, neuroscience, human development, sociology, criminology, economics, anthropology, philosophy, political science, public policy, and law. UC researchers address fundamental questions regarding legal decision-making, eyewitness memory, inequality, immigration, lifespan development and law, mental health and violence, as well as theories of justice, social control, and corrections. However, the inter-disciplinary nature of the research also presents one of its challenges, as social science and law scholars are distributed across departments, colleges, and campuses within the UC System. This distribution across infrastructure and distance creates barriers to cross-fertilization of ideas, collaboration, and sharing of resources. This proposal will establish the University of California Consortium for Social Science and Law, to create infrastructure and facilitate multi-campus collaborations that will build upon the existing strength of the UC system. The specific aims in creating the Consortium are: (1) to convene the first UC Conference on Social Science and Law, (2) to develop working groups to pursue innovative and multidisciplinary projects, (3) to provide funds for graduate student and law student support and training, and (4) to create a website that will bring together the broad scope of UC social science and law scholarship and research. The research methodologies will include legal analyses, archival analyses, survey and ethnographic techniques, field work, and laboratory experiments. Progress will arise from multidisciplinary convergence and innovative collaborations that cut across research domains and disciplinary boundaries. This intellectually exciting research will contribute to fundamental theory and will address crucial concerns of the people of the state of California.

All-UC Group in Economic History

Host Campus: Davis
Lead Investigator: Gregory Clark Award Type: Multi-year Program Award
Collaborating Sites: Berkeley, Irvine, Los Angeles, Riverside, San Diego, Santa Cruz
Start Date: 1/1/2015 *End Date*: 12/31/2018 *Amount*: $150,000

Abstract:
The All-UC Group in Economic History, active on the UC campuses since 1973, will apply for continued funding from UCOP in the next grant cycle. The All-UC group is a collaboration of economic historians across most of the campuses of the UC system to promote graduate education and research in the field of economic history. Members of the group include faculty and graduate students from economics, history and political science departments. Economic history is a modest sized research group on any particular campus, but the All-UC group has allowed for a critical mass of researchers to interact. It has thus played an important role in graduate education in economic history at the UC, and in the strong placement of graduate students in this field in tenure track positions. Typically 35-40 percent of the group budget has been spent on graduate student support, and we will continue this in the current proposal. The group also brings together faculty in the various UC campuses for 2-3 conferences per year. These conferences have attracted considerable outside financial support from such as Caltech, the Huntington Library, Stanford, Chapman University, and the San Francisco Federal Reserve Bank. They have thus fostered a vibrant research community in economic history in the UC system, one that is known internationally. UCOP is a vital source of funding for this group within the UC system. While individual campuses, such as UC Davis, have made significant contributions to the group, and will make substantial contributions in this next grant cycle, UCOP support is essential.

University of California Medical Humanities Consortium

Host Campus: San Francisco
Lead Investigator: Brian Dolan Award Type: Multi-year Program Award
Collaborating Sites: Berkeley, Davis, Irvine
Start Date: 1/1/2015 *End Date*: 12/31/2018 *Amount*: $218,210

Abstract:
In 2009 we received MRPI funding to establish the UC Medical Humanities Consortium. Before then, there was no coherent representation or structure to demonstrate what "medical humanities" could offer anywhere within the UC system. As an interdisciplinary endeavor at its core and by definition – not only bridging biomedical science and humanities, but embracing multiple sub-disciplines – the Medical Humanities Consortium uses the strength of the relationship between the UC campuses, systemwide, to establish a strong presence in healthcare training and research and is poised to draw international attention to its achievements. Humanities disciplines – history, literature, the visual arts, philosophy, and the social sciences such as anthropology – underscore the importance of holistic approaches to understanding disease and its impact on patients' lives. Our work has bridged divergent cultures of inquiry to support projects with a mission to enhance our understanding of the human response to disease and suffering, deepen the interpretive skills of health professionals, situate medicine in its broader social and cultural context, and improve the delivery of health care. We produce high-quality research that advances scholarship and strengthens our training programs in health science campuses, answering a call by students for a curriculum more inclusive of humanistic approaches to healthcare, patients' perspectives, and professionals' ways of dealing with challenging issues and occupational stressors. With continued funding to support our teaching, student research stipends, and publication series, we aim to take what we learned to have the most impact from our first years and bring our curricular innovations and scholarship to the next level, demonstrating impact on academic communities as well as patient populations far outside UC and beyond California.

Reducing Obesity: Sugar, Stress and Environment

Host Campus: San Francisco
Lead Investigator: Elissa Epel Award Type: Multi-year Program Award
Collaborating Sites: Berkeley, Davis, Irvine, San Diego, Hastings
Start Date: 1/1/2015 *End Date*: 12/31/2018 *Amount*: $369,057

Abstract:
Our proposal builds on our highly successful MCRP (Stress, Environment, Weight, SEW) that developed a cohesive group spanning disciplines (psychology, nutrition, neuroscience and epidemiology) which has accomplished it's research and training goals and is well poised to deepen and expand our impact. We propose to include UCI and UCSD, spanning 5 campuses. Over the last five years we have created outstanding initiatives and collaborations among the three campuses, involving basic discoveries in social status, stress, and obesity, and continued education of postdocs and graduate students through mentoring and symposia. We held yearly 3-campus symposia on cutting edge topics SEW topics, attended by over 100 scholars, clinicians, and policy makers. These have had on average one million viewings on UCTV each (see http://chc.ucsf.edu/sew/). We have leveraged outside funding to help develop SEW. One goal was to revive the NHLBI National Growth and Health Study, a unique opportunity to examine transmission of obesity with a multiple campus collaboration. We were recently awarded a Multiple PI NICHD R01 that stemmed from SEW pilot work. In the next phase, we plan to expand our training program to recruit and include SEW fellows across five campuses, with shared training opportunities, mini internships, and ability to compete for pilot funds. SEW is now ideally poised to conduct experimental interventions, based on our discoveries, using technology and neuroscience of reward and stress, and novel developmental clinical trial designs that can be performed rapidly with pilot funds. Lastly, we will expand the scope and impact of SEW by capitalizing on UC's new Nutrition Policy Institute to conduct policy relevant research. By focusing on food policy, we can conduct strategic research on communities in California to show the benefits of food policy. A larger goal is to obtain an NIH Nutrition and Obesity Research Center (NORC). Our initial application (Vaisse as PI, Epel as Associate Director) scored well but was not funded. We plan to increase translational research between the northern California campuses as a focus of a re-submission of the NORC, with the support of a continuation grant of the MCRP. With the strong foundation of SEW collaborations, expertise and trainees of 5 campuses, the new food policy initiatives in obesity (UC wide, UCSF), we are well poised to make significant progress in understanding, preventing, and reversing obesity and benefitting our communities, with implications worldwide.

California Immigration Research Initiative

Host Campus: San Diego
Lead Investigator: David FitzGerald Award Type: Multi-year Program Award
Collaborating Sites: Berkeley, Irvine, Riverside, Los Angeles
Start Date: 1/1/2015 *End Date*: 12/31/2018 *Amount*: $525,255

Abstract:
If California were its own country, it would have the world's fourth largest immigrant population. It has the most immigrants in the United States (more than 10 million) and the highest share in its population (27%). The way these newcomers are integrated into the state will shape California's schools, workforce, businesses, public health, politics, and culture. Understanding the incorporation of immigrants and their descendants and how public agencies and community-based organizations affect integration is essential for the state's future well-being. The California Immigration Research Initiative seeks a 4-year Program Award of $583,616 to launch and sustain the most comprehensive research in California's history to elucidate the complex processes of immigrant integration; provide analytical frameworks and applied solutions for policymakers and non-governmental organizations working on immigration-related issues; and build the capacity of the University of California as the premiere institution for immigration research in the world. The initiative will harness the strength of five UC interdisciplinary immigration studies centers. The Center for Comparative Immigration Studies (CCIS) at UCSD will host the initiative in coordination with the UCLA Program on International Migration, Center for Research on Immigration Population and Public Policy at UCI, Center for Latino Policy Research at UCB, and Immigration Research Group at UCR. Affiliated faculty and graduate students are drawn from sociology, political science, public health, economics, public policy, geography, history, law, medicine, nursing, psychiatry, psychology, and education. Principal research activities include: 1) Collaboration with the California Health Interview Survey (CHIS) based at the UCLA Center for Health Policy Research will allow an unprecedented assessment of the integration of diverse groups over multiple immigrant generations by adding questions to the existing survey of 50,000. 2) A second survey, the Pilot California Immigration Panel Survey, will assess the feasibility of doing a much larger, longitudinal survey that draws on the CHIS sampling frame to understand a wider array of outcomes among California's immigrant population. 3) An assessment of how policymakers and civil society are addressing the integration of immigrants will be carried out using experiments and qualitative interviews.

University of California Cosmic Dawn Initiative

Host Campus: Los Angeles
Lead Investigator: Steven Furlanetto Award Type: Two-year Planning/Pilot Award
Collaborating Sites: Berkeley, Irvine, Santa Barbara, Santa Cruz
Start Date: 1/1/2015 *End Date*: 6/30/2017 *Amount*: $288,477

Abstract:
Astronomers have now observed nearly thirteen billion years of galaxy evolution, watching galaxies grow by nearly a factor of one hundred in size. But pressing into earlier times – the era of the "Cosmic Dawn" when the first stars and galaxies appeared and transformed the universe around them – requires new instruments and new approaches. The landmark event of this era is the "reionization" of the intergalactic medium, when the light from these first objects ionized the hydrogen that pervades the universe. One of the most exciting ways to study this era is through the "spin-flip" or 21-cm spectral transition of neutral hydrogen. While extraordinarily weak, modern radio telescopes like the UC-led Precision Array to Probe the Epoch of Reionization (PAPER) and the forthcoming Hydrogen Epoch of Reionization Array (HERA) aim to use this transition to measure the properties of the early universe and especially reionization. These difficult observations require substantial modeling and analysis to extract the most useful astrophysical information. However, the tools to forge these connections – as well as connections to other observational techniques – have not yet been built. The University of California Cosmic Dawn Initiative (CDI) will launch a collaboration between theorists, observers, and data analysts to build tools to leverage the forthcoming data into the best possible constraints on the earliest generations of structure in the universe. We will also develop a framework to combine these cutting-edge observations with more traditional astronomical observations (such as those from UC's Keck Observatories and Thirty Meter Telescope). In particular, the proposal will support: (1) graduate student projects to build a theoretical framework to interpret the forthcoming observations most effectively; (2) postdoctoral work on parameter estimation from spin-flip data in combination with other astrophysical observables; (3) a kickoff meeting to build an overarching framework within which this analysis can function and to educate the broader community on these issues; and (4) travel for collaboration-wide meetings, focused projects. The CDI will combine two strengths of the UC astrophysics system – theory of the early universe and work on low-frequency radio telescopes – to produce a team poised to lead the science interpretation of observations, both from spin-flip observatories and other telescopes. This initiative will position UC at the forefront of one of the most exciting areas of astrophysics.

Consortium for Black Studies in California

Host Campus: Los Angeles
Lead Investigator: Robin Kelley Award Type: Multi-year Program Award
Collaborating Sites: Irvine, Riverside, San Diego, Santa Barbara
Start Date: 1/1/2015 *End Date*: 12/31/2018 *Amount*: $1,077,050

Abstract:
Aiming to advance an area with system-wide potential, our proposed UC Consortium for Black Studies in California seeks to make the UC the premiere institution for Black Studies nationwide. This consortium will arrive at the most opportune moment to create an infrastructure for collaborative research, foster regional partnerships, build an international network of scholars in Black Studies throughout the Pacific Rim, and position the UC as a national and international leader in the field. Black Studies in California has the potential to be a recognizably distinct and distinguished field, and the formation of Black Studies in the Southern California region is unique. Unlike Black Studies elsewhere, this region-specific field has pioneered the humanistic and arts-based study of film, art, music, poetry, fiction, and performance in a field in which topics such as race and inequality are more often pursued through social science paradigms. Yet despite the depth and breadth of Black Studies scholars systemwide, there exists no overarching unit or program that brings these scholars and projects together systematically, enables cross-UC collaboration and synergy, and publicizes and disseminates this scholarship. As such, the scholarship and initiatives coming from the UCs is often eclipsed on the national stage. The UC Consortium for Black Studies in California will ensure that this region will be recognized as the most innovative and productive site of research in the field today. The Consortium's activities will be organized around four main areas or themes: • The Body: Affect, Intimacy, Performance • The Question of Theory: Blackness as a Problem for Thought • The Black Pacific • Black Arts and Black Publics We will advance these programs through a variety of linked activities designed to build on each other, through convening twice yearly meetings, funding and coordinating events, granting research support funding, creating structures for mentorship, training, and faculty development, publishing and disseminating research through development of a website and also in partnership with the California Digital Library, and network development throughout the UCs. The PI and Lead is Robin D.G. Kelley (UCLA). The Co-PIs and Site Leads are Stephanie Batiste (UCSB), Nahum Chandler (UCI), Dayo Gore (UCSD), and Fred Moten (UCR).

UC Work Group for Adaptive Optics in Biological Imaging

Host Campus: Santa Cruz
Lead Investigator: Joel Kubby Award Type: Two-year Planning/Pilot Award
Collaborating Sites: Berkeley, Davis, Irvine, Los Angeles, Merced, Riverside, San Diego, San Francisco, Santa Barbara, Los Alamos National Laboratory, Lawrence Livermore National Laboratory, Lawrence Berkeley National Laboratory
Start Date: 1/1/2015 *End Date*: 12/31/2017 *Amount*: $300,000

Abstract:
In our project we will establish a system-wide work group in the development and application of adaptive optics in biological imaging. The University of California is currently the world leader in the application of adaptive optics for astronomical imaging and has done pioneering work to translate this technology into the new field of adaptive optics for biological imaging. The intent of our proposed two-year planning award will be to apply cutting edge adaptive optic technology, developed at UC Santa Cruz, to new interdisciplinary collaborations across the UC System. The award will enhance the ability of this new multi-campus collaboration to successfully compete for extramural funding in the application of adaptive optics for biological imaging. An example would be a National Institute of Biomedical Imaging and Bioengineering (NIBIB) Biomedical Technology Resource Center (BTRC). The activities will include demonstrations of the impact and benefit for the application of adaptive optics in imaging of specimens from the collaborator's labs to advance UC's research mission and enterprise. Specifically, we will work with each campus and national laboratory over the course of the two-year proposal to demonstrate the benefits of using adaptive optics on the participant's samples. A project scientist will image their samples with existing AO microscopes (wide-field, confocal and two-photon). We will also development a community of practice through education and training of graduate students and post-docs in courses and internships and we will hold annual summer retreats for all of the participants. One outcome of our project will be new imaging data sets that can be shared across the UC campuses to enhance novel research or launch new research directions. The data sets will be used as preliminary data for future extramural applications. A second outcome will be to determine a model for how adaptive optical microscopy can be implemented within the UC system (central imaging facility or central technology resource center).

Legal Economic Data and Analysis of Environmental Markets

Host Campus: Santa Barbara
Lead Investigator: Gary Libecap Award Type: Two-year Planning/Pilot Award
Collaborating Sites: Berkeley, Irvine, Los Angeles, Merced
Start Date: 1/1/2015 *End Date*: 12/31/2017 *Amount*: $283,780

Abstract:
New initiatives in environmental and natural resource management are based on property rights that assign resource ownership directly or use rights in specified ways. This rights-based approach can be more effective than traditional regulation. Rights-based management helps California meet environmental goals in innovative ways, and joint legal/economics analysis of such approaches places the University of California at the forefront of new environmental approaches. Establishing property rights is necessary for markets that create incentives and facilitate transactions to enhance resource value and provide environmental quality. Examples are individual transferable quotas in fisheries, tradable development rights and mitigation banks in land use, habitat credits for endangered species, water rights and water quality trading, and conservation banking for ecosystem protection. Knowledge of how these rights must be structured and how the resulting markets function to achieve environmental and other goals is incomplete. Comprehensive empirical research requires information bases that have not been assembled. We propose a Planning Award for this research infrastructure through efforts by scholars in economics and law and to make it available to the UC System and California. Legal scholarship is needed for understanding which aspects of property rights enable transactions, for showing how legal institutions affect creation of property rights, and for identifying how uncertainty, monitoring problems and asymmetric information are addressed. Economics scholarship is needed to understand how property rights affect incentives, resource use and social value. This project consists of economists and law faculty in the UC System. This Planning Award project has the goal of defining research agendas and assembling data bases on property rights and market transactions to solve environmental problems. These databases would include registries of transactions for use rights associated with fisheries, water, and land. Ultimately, we will use the data assembled by the Planning Award for drafting a Program Award for collaborative efforts in empirical research aimed at understanding why property rights can be used in some situations but not in others, and why markets arise easily and function smoothly in some environmental resource settings, but not for others. California policy questions motivate the databases compiled, including over-exploitation of fisheries, inefficient water use, and conservation of endangered species.

Memory Prosthetics

Host Campus: Irvine
Lead Investigator: Bruce McNaughton Award Type: Multi-year Program Award
Collaborating Sites: Berkeley, Riverside, San Diego, San Francisco
Start Date: 1/1/2015 *End Date*: 12/31/2018 *Amount*: $2,166,225

Abstract:
Memory impairment is an increasing burden on California, due to shifting age demographics. Neuroscience has made great progress in understanding why memory fails; but, there has been almost no progress in intervention. Damage to the medial temporal lobe (MTL) of the brain is the main cause of memory impairment. The actual contents of memories are not stored in MTL, however. Rather, MTL creates a tag or "index" for each memory, which is distributed among the many cortical modules that store sub-components of each memory. Recent memories are retrieved when some components become active and cause reactivation of the original index in MTL. This triggers retrieval of the missing items. When MTL is dysfunctional, remote memories are still recoverable, but no new memory is acquired. Thus, MTL helps retrieve recent memories, and helps 'consolidate' them (during sleep) into an MTL-independent form. Can we find a way to substitute for a dysfunctional MTL and thus restore memory function? In theory, "all" that is needed to retrieve a memory is to recreate its index. This leads to a bold new idea on how to create a memory prosthesis to restore MTL function. It should be possible, during learning, artificially to stimulate the cortical layers that register the index, with complex random patterns, one for each memory, to retrieve these memories later by reinstating their artificial index codes, and to 'consolidate' them by replaying their indices during sleep. We propose a well-coordinated technological, computational and experimental assault on this problem with a collaboration involving 11 investigators and their trainees, from 5 UC campuses, representing outstanding expertise in the neurophysiological and neurocomputational basis of memory and in the creation of microelectronic, brain-computer interfaces. We will create a prototype memory-indexing prosthesis; a completely wireless, implantable array of several thousand tiny contacts that permit 2-way communication with the cortex. The array, which has several promising applications beyond memory prosthetics, will be tested in rodents with MTL damage, guided by computer modeling of cortical circuitry. The animal prototype will be scalable to future studies in humans. Our proposal has a strong interdisciplinary training component, with ~75% of the budget supporting students, meetings, workshops and cross-training of graduate students and postdocs in different participating labs.

Cross-UC Campus Data Harmonization for Pediatric Outcomes

Host Campus: Los Angeles
Lead Investigator: AnnaBarbara Moscicki Award Type: Multi-year Program Award
Collaborating Sites: Davis, Irvine, San Diego, San Francisco
Start Date: 1/1/2015 *End Date*: 12/31/2017 *Amount*: $1,419,580

Abstract:
The UC BRAID consortium, a joint effort of the UC biomedical campuses to catalyze/accelerate research across the UC system, initiated the UC Research eXchange (UC ReX) program whose initial goal was to identify populations across the UC campuses using shared data warehouses. The next logistical step of UC ReX is to extract de-identified data-sets to perform more complex data analysis. Unfortunately, the EMR documents clinical data in free text with little to no capabilities to crosstalk within and across campuses. In addition, very little attention has been given to pediatric health outcomes, which is the focus of this proposal. The objective of this project is to harmonize electronic medical record data collected prospectively within UC Regents medical settings for the purpose of conducting longitudinal studies of pediatric patient-centered outcomes. The data collection templates will be developed in full partnership with patients, parents, clinicians, and researchers across the 5 campuses to capture a feasibly limited set of not only traditional clinical and research data but also patient-centered outcomes and variables. UC Regents health systems care for about 4 million children in the most diverse state in the country. This is a unique opportunity to harmonize the systems within UC and UC affiliated clinics and hospitals thereby reaching the majority of pediatric patients within the State. This project will identify 3 pilot initial health outcomes: Disordered Eating (e.g., obesity, anorexia, food insecurity, poor nutrition), Type I diabetes mellitus and common attributes of rare diseases. The three pilots offer distinct challenges to health outcomes measurement. Type I diabetes is a classic example of a relatively self-contained disease model managed by a generally small group of clinicians. Disordered Eating is an example of a complex set of diagnoses that are still thematically linked, with large social and mental health components. Rare diseases have traditionally suffered from small sample sizes and often focus on highly specialized and non-generalizable care. However, rare diseases do in fact share numerous common attributes especially with respect to patient and family isolation and needs. Successful completion of these pilot project will provide a set of innovative and efficient models for collection and abstraction of patient centered data that will impact overall pediatric quality of health care through California.

Intercampus Consortium on Health Psychology

Host Campus: Los Angeles
Lead Investigator: Theodore Robles Award Type: Multi-year Program Award
Collaborating Sites: Irvine, Riverside
Start Date: 1/1/2015 *End Date*: 12/31/2017 *Amount*: $207,895

Abstract:
Most individuals will experience major adversity during their lives, from early life difficulties (growing up poor, experiencing parental neglect, or abuse), to significant events during adolescence and adulthood (exposure to natural or man-made disasters, diagnosis of chronic illness, interpersonal loss). Such adversities can have long-lasting mental and physical health impacts, but many people can maintain considerable resilience and thrive in the face of adversity. Numerous UC researchers in Health Psychology, which studies how psychosocial factors influence physical health (and vice versa), are actively studying the health impact of adversity, and the psychosocial and cultural factors that contribute to resilience. The first UC Intercampus Consortium on Health Psychology meeting took place in 1983, followed by several meetings over 30 years (the last in 2003), sponsored by UC system, departmental, extramural, and individual funding. The conferences provided around 75 faculty and graduate students opportunities to network and forge new collaborations. This proposal aims to revive the Consortium after a decade-long dormancy, with the broad goal of making UC the world leader in research on understanding, predicting, and cultivating resilience in the face of adversity. To accomplish that goal we propose three activities and associated outcomes: 1) Facilitating cross-campus faculty collaborations. MRPI funding would support seed funding for multi-campus projects that translate basic research on thriving in the face of adversity into interventions that promote resilience. Outcomes would include scholarly products (books, new measures and interventions), and extramural research funding applications. Most projects would involve collaborations outside psychology (e.g., biomedical research, sociology, public health). 2) Creating shared resources for graduate student training and research. MRPI funding would support: Annual workshops to learn emerging research methodologies and data analytic techniques; Developing shared teaching resources across campuses (e.g., a digital video lecture library); and pilot funding for cross-campus student collaborations. 3) Reviving yearly intercampus conferences as a central organizing event. The conference would focus on small-group faculty/student discussions of collaborative projects, and planning new or ongoing cross-campus collaborations. MRPI funding would cover graduate student registration, housing, and travel.

Tunable Quantum Materials

Host Campus: San Diego
Lead Investigator: Ivan Schuller Award Type: Multi-year Program Award
Collaborating Sites: Davis, Santa Barbara
Start Date: 1/1/2015 *End Date*: 12/31/2018 *Amount*: $1,289,411

Abstract:
RESEARCH We propose a research program leading to transformative scientific/technological revolutions in the fields of electronics, optics, data storage, and computation. The era of artificial brains rivaling biological systems, intelligent sensors that change functionality depending on stimulus, and tunable sub-wavelength optical devices may be on the horizon. However, serious hurdles remain for the development of fault-tolerant devices, self-learning electronics and computation, controllable optical systems, and reconfigurable devices with new functionalities. New materials, which exhibit quantum correlations unavailable in the existing materials “toolkit”, provide the solution. The proposed new paradigm may lead to an equivalent scientific/technological revolution to the “silicon revolution”. To implement this we will develop nano hybrids of strongly correlated oxides interfaced with other oxides, magnetic, and semiconducting materials and will focus on: 1) Synthesis and characterization of nanoscale hybrids with high interface density designed to enhance coupling of functionalities (ferro/antiferro/ferri-magnetism, ferroelectricity, optically transparent/opaque, metallic/insulating conductivity). 2) Understand time-dependent electronic, structural, magnetic, and optical responses at ultrasmall-length and ultrafast-time scales, 3) Control quantum phase transitions by inducing magnetic/electronic/optical transitions with electric field, current, light or strain. 4) Construct reconfigurable optical systems with unprecedented control of light. EXPECTED IMPACT ON UC The broad, diverse expertise (Physics, Materials Science, Electrical Engineering) from 3 UC campuses, at different stages of their carriers together with forefront synthesis, characterization, and optics facilities makes this project unique. The differing scientific perspectives are expected to produce a major revolution in the field of Tunable Quantum Materials and educate the next generation of technologists. The proposed research may impact many interdisciplinary activities within the UC system including: neuroscience, bio-circuits, data storage, and computation. This proposal could be the basis for new efforts in advanced basic research areas and the development of new concepts in the field of functional quantum materials. As a consequence this will lead to the formation of larger groups and proposals for new extramural funding.

UC-wide Macromolecular Structural Biology

Host Campus: San Francisco
Lead Investigator: Robert Stroud Award Type: Multi-year Program Award
Collaborating Sites: Berkeley, Davis, Irvine, Los Angeles, San Diego, Santa Cruz, Lawrence Berkeley National Laboratory
Start Date: 1/1/2015 *End Date*: 12/31/2018 *Amount*: $2,578,000

Abstract:
We propose to dramatically enhance structural biology UC system wide. First, we will take one of the world's most prolific macromolecular crystallography (MX) facilities, the UCB/UCSF beamline 8.3.1, and upgrade it to the sharpest possible focus with diffraction-limited x-ray optics and a state-of-the-art detector. Second, we will leverage the resulting increase in data-collection capacity to extend access from the current UCB/UCSF partnership to a total of more than 75 structural biology labs at all UC campuses. Third, we will continue to lead the world in MX productivity and methods development, directing our efforts to the specific problems faced by UC researchers and passing on that knowledge at each beamline visit. 8.3.1 was constructed at the ALS in 2001 with $1.9M in NSF and private support. A total of 923 scientists from 51 institutions, including 555 scientists from UCB/UCSF, have used 8.3.1 to solve more than 1163 structures of biologically important macromolecules and complexes. This resulted in 488 publications with 182 in the highest-impact journals and led directly to more than $132M of NIH funding into the UC system and $935M into the California economy when our industrial partner Plexxikon was sold to Daiichi Sankyo in 2011. Advances in technology have created an opportunity to enhance 8.3.1's ability to tackle the ever-increasing challenges of structural biology. The two most crippling challenges today are systems that grow only very small crystals, and/or crystals that are not ordered enough to diffract to sufficient resolution. Large complexes, such as the ribosome [2009 Nobel Prize], membrane proteins [2012 Nobel Prize], and amyloids responsible for neurodegenerative diseases are all examples of one or both of these problems. A $450k optics upgrade will focus down our X-ray beam, simultaneously taking full advantage of small crystals and reducing resolution-destroying background scatter. No amount of photons can make a disordered crystal ordered, but upgrading our detector to the newly released ADSC HF-4.2M ($1.4M) will not only count every diffracted photon, but sample crystal patches 150x faster (at 50Hz). Only with MRPI funding for these upgrades can access be opened to UC-wide research groups that use protein crystallography as a key part of their effort. With the proposed upgrades, we can break through size and resolution barriers and position UC as an internationally recognized powerhouse of macromolecular imaging.

UC Humanities Network

Host Campus: Irvine
Lead Investigator: Georges Van Den Abbeele Award Type: Multi-year Program Award
Collaborating Sites: Berkeley, Davis, Los Angeles, Merced, Riverside, San Diego, San Francisco, Santa Barbara, Santa Cruz
Start Date: 1/1/2015 *End Date*: 12/31/2018 *Amount*: $5,586,850

Abstract:
The University of California Humanities Network is a Multi-Campus Research Program and Initiative that includes the nationally-renowned University of California Humanities Research Institute (UCHRI), a consortium of interconnected campus humanities centers and multi-campus research groups that sponsor interdisciplinary and collaborative research, plus a multi-tiered program of competitively-awarded research fellowships for faculty and graduate students. The Network engages all ten UC campuses in a wide variety of ambitious and innovative programs that range from competitively-awarded research projects undertaken by individual scholars to collaborative research groups that bring together scholars from every campus. Projects encompass compelling research questions that engage traditions that have been at the heart of the humanities for millennia and innovative, interdisciplinary projects that join humanities research to every area of intellectual inquiry in the university. Indeed, both the UC Humanities Research Institute and many of our campus-based centers are known for interdisciplinary endeavors that attract not only humanities and social science scholars but also colleagues from science, engineering, medicine, law, education, and agriculture. UCHRI, as well as humanities scholars throughout the UC system, have been national and international leaders in the development of the digital humanities and the digital arts. We also have been leaders in developing public humanities programs and partnerships with cultural institutions that have contributed to public policy debates and made vital contributions to the culture and society of the State of California and beyond. In proposing innovative structures to identify, extend and sustain the most cutting edge work anywhere in the humanities today, this proposal also identifies contemporary grand challenges we aim to support: the changing interface between the human and natural worlds; the urgency of ethically addressing ongoing questions of human difference and diversity; and the evolving role of the humanities in data-driven environments, including the contributions of the digital to effective humanistic learning and that of the humanities to compelling digital education. The UC Humanities Network thus exemplifies of the power of the University of California to leverage the resources and excellence of individual campuses to create a multi-campus network in which the whole is greater than the sum of its parts. We fully represent the power of ten.

UC Solar Institute

Host Campus: Merced
Lead Investigator: Roland Winston Award Type: Multi-year Program Award
Collaborating Sites: Berkeley, Davis, Irvine, Los Angeles, Riverside, Santa Barbara, Santa Cruz
Start Date: 1/1/2015 *End Date*: 12/31/2018 *Amount*: $2,634,787

Abstract:
UC Solar is a multi-disciplinary research institute made up of faculty and students from nine participating UC campuses—Merced, Berkeley, Santa Barbara, Davis, San Diego, Riverside, Santa Cruz, Irvine and Los Angeles. Headquartered at UC Merced and led by Professor Roland Winston, UC Solar develops technologies that make solar energy systems more efficient, more affordable, and easier to integrate, while educating and developing tomorrow's solar energy leaders and entrepreneurs. Every generation is faced with new challenges. One of our generation's greatest challenges is the displacement of fossil fuels with clean, renewable energy. Solar is our most abundant and reliable form of renewable energy, and it has the potential to meet most, if not all, of our energy needs. Each day we increase our ability to convert sunlight into electricity and thermal energy, while lowering the cost of doing so. Has it taken significant effort to get to this point? Yes. Is there still progress that can be made? Yes. Is the day upon us when solar energy systems are as ubiquitous as cell phones and automobiles? Not yet, but that day can be seen on the horizon. But the more we embrace solar energy, the more we understand where the challenges and opportunities for innovation lie. For solar energy to reach its full potential: system costs must continue to decline; the environmental impacts of manufacturing and disposal must be minimized; the effects of intermittency must be reduced; and the impact of large-scale solar resources on the energy grid must be understood. These opportunities form the basis of the UC Solar research agenda, and will continue to do so for the foreseeable future. UC Solar's value proposition is as follows: bring together the best solar scientists in the UC system to engage with energy stakeholders worldwide and develop solutions that can be brought to the marketplace quickly and integrated seamlessly. The initial MRPI award has encouraged faculty collaboration, enhanced scholarship, and gained the UC worldwide recognition for its solar energy research efforts (see Attachment E). It has also garnered the attention of state and federal agencies that award center-level grant funding, which is the key to the institute's long term sustainability. A four-year MRPI renewal is requested in the amount of $775k per year ($3.1M total), so that this critical work can continue and the UC can lead the way to a solar energy future for California and the world.

UC Collaboratory for Ethnographic Design

Host Campus: San Diego
Lead Investigator: Elana Zilberg Award Type: Two-year Planning/Pilot Award
Collaborating Sites: Berkeley, Davis, Irvine, Los Angeles, Santa Cruz
Start Date: 1/1/2015 *End Date*: 3/31/2017 *Amount*: $279,858

Abstract:
With a planning award from the Multicampus Research Program and Initiatives office, we propose to establish a cross-UC Collaboratory for Ethnographic Design, with the aim of making the University of California an international hub for innovation in ethnographic research. Networking the already strong repository of ethnographers across our campuses, we seek to strengthen our individual research, resulting in a greater number of influential publications and external grants; draw in more scholars innovating with ethnographic methods; increase the UC's capacity to train students in this methodology by collaboratively developing curricula; foster ethnography centers across UC campuses that would serve as sites for regular workshops; and develop new modes of ethnographic practice adapted to current conditions and pressing matters of public concern that would be of use both beyond the UC system and beyond the traditional homes of ethnographic methodology, e.g. in sciences, public policy, NGO work, or industry. A planning award would enable the first stage of this project. Our group currently comprises faculty and graduate students from six UC campuses, all committed to exploring the possibilities of ethnographic practice. Across two years, we propose to hold four workshop practicums in which we would share research models, develop familiarity with each others' research, and open avenues for new ethnographic approaches to themes of contemporary concern in California and beyond. At the same time, we would increase our infrastructure for the planning, conduct, and dissemination of research. Our planning award tenure would culminate in a public workshop to tie the Collaboratory for Ethnographic Design into ethnographic centers outside our university. We intend to establish the University of California as a premier site for developing and testing genre-defining models for contemporary ethnographic practice.