NJIT Research Newsletter

Issue: ORN-2016-010

NJIT Research Newsletter includes ***Grant Opportunity Alerts,*** recent awards, and announcements of research related seminars, webinars and special events. The Newsletter is posted on the NJIT Research Website http://www.njit.edu/research/

Recent Research Grant and Contract Awards

Congratulations to faculty and staff on receiving research grant and contract awards!

PI: Sergio Adamovich (PI)
Department: Biomedical Engineering
Grant/Contract Project Title: Planning in Updating in Frontoparietal Networks
Funding Agency: NIH
Duration: 10/09/15-12/31/17

PI: Michel Boufadel (PI)
Department: Natural Resources Development and Protection
Grant/Contract Project Title: Workshop March 15th-17th
Funding Agency: FCC Group International
Duration: 03/01/16-08/31/16

PI: Haimin Wang (PI), Ju Jing (Co-PI) and Chang Liu (Co-PI)
Department: Center for Solar Terrestrial Research
Grant/Contract Project Title: Fine Structure and Dynamics of Erupting Magnetic Flux Ropes in Low Solar Atmosphere
Funding Agency: NASA
Duration: 03/01/16-12/01/16

PI: Tara Alvarez (PI)
Department: Biomedical Engineering
Grant/Contract Project Title: Functional Mechanism of Neural Control in Convergence Insufficiency
Funding Agency: NIH
Duration: 04/01/13-03/31/19

PI: Suzanne Berliner-Heyman (PI)
Department: Pre-College Programs
Grant/Contract Project Title: PSEG - SPARKS – SESP
Funding Agency: PSEG Foundation
Duration: 03/01/16-12/31/16

Events and Announcements

Event: NSF Webinar: WATCH - Privacy: Plural, Contextual, Contestable but not Unworkable
When: March 17, 2016: 12.00 PM – 1.00 PM
Where: http://www.nsf.gov/events/event_summ.jsp?cntn_id=137953&org=NSF
Brief Description: The scholarly literature presents a dizzying array of diverging definitions of privacy. Privacy is equally ambiguous in practice, where it is invoked to protect a wide range of interests based on an equally wide range of justifications. While the frequency and intensity of privacy debates are evidence of its salience to contemporary life, its contestability has intensely troubling practical consequences. Privacy is decreed too fickle and indeterminate to be advanced through legislative, regulatory, and technical means. Ambiguity becomes an excuse for disregarding privacy claims-despite visceral and broad appeal, and vociferous support. In this talk, I argue that privacy is an "essentially-contested concept," and that its contestability is a source of value and power that ought to be preserved. I then offer a multi-dimensional analytic of privacy that helps unpack privacy's meaning in specific contexts and contests. Using the analytic to explore privacy claims in high-profile privacy cases reveals the complex array of privacy concepts raised by technical change, and the sort of design and policy choices that can address them. Privacy's essential contestability is key to its ongoing relevance and utility in political and social life, but successfully leveraging it requires tools that ease privacy work by unpacking it's meaning in contexts.
Speaker Bio: Deirdre K. Mulligan is an Associate Professor in the School of Information at UC Berkeley, co-Director of the Berkeley Center for Law & Technology, Chair of the Board of Directors of the Center for Democracy and Technology, a Fellow at the Electronic Frontier Foundation, and Policy lead for the NSF-funded TRUST Science and Technology Center. Prior to joining the School of Information in 2008, she was a Clinical Professor of Law, founding Director of the Samuelson Law, Technology & Public Policy Clinic, and Director of Clinical Programs at the UC Berkeley School of Law (Boalt Hall). Mulligan's current research agenda focuses on information privacy and security, including exploring users' conceptions of privacy in the online environment and their relation to existing theories of privacy. Her book with Berkeley Prof. Kenneth Bamberger, Privacy on the Ground: Driving Corporate Behavior in the United States and Europe, from MIT Press can be found at: https://mitpress.mit.edu/books/privacy-ground.
Register: Please register at http://www.tvworldwide.com/events/nsf/160317/

Event: MIT Course: Multiscale Materials Design
When: June 20-24, 2016 in Cambridge, MA
Where: http://professional.mit.edu/programs/short-programs/multiscale-materials-design
Brief Description: As the demand for high-performance materials with superior properties, flexibility, and resilience grows, a new design paradigm from the molecular scale upwards has revolutionized our ability to create novel materials. This course covers the science, technology,

and state of the art in atomistic, molecular, and multiscale modeling, synthesis, and characterization. Through lectures and hands-on labs, participants will learn how superior material properties in nature and biology can be mimicked in bioinspired materials for applications in new technology. Bridging multiple hierarchies of length- and time-scales, this course trains participants in applications to polymers, metals, and ceramics, as well as composites. The course also covers sustainable infrastructure materials such as concrete and asphalt.

This course will focus on practical problem-solving computational tools paired with a detailed discussion of experimental techniques to probe the ultimate structure of materials, emphasizing tools to predict key mechanical properties. Case studies of molecular mechanics, bio-inspired composites, and dynamic fracture of composites and polymers will be presented and carried out by participants in computational labs. Simulation codes, algorithms, and details of the implementations of different simulation technologies, including validation, will be presented, including practical issues such as supercomputing (hardware and software), parallelization, graphics processing computing (GPU), and others. Specific focus is on structural polymers and composites, including innovative material platforms such as carbon nanotubes, graphene, and protein materials for bio-inspired materials. Participants will learn state-of-the-art techniques, such as molecular dynamics and coarse-graining, used to cover a range of length- and time-scales.

Grant Opportunity Alerts

Keywords and Areas Included in Grant Opportunity Alerts**:**

NSF: Plant-Biotic Interactions; Cyber-Physical Systems (CPS); Science Learning+ Partnership Grants
NIH: The Application of Big Data Analytics to Drug Abuse Research (R01); Systems Biology of Aging (R01); High Impact, Interdisciplinary Science in NIDDK Research Areas (RC2); Emerging Questions in Cancer Systems Biology (U01)
Department of Defense/US Army/DARPA/ONR: Defense University Research Instrumentation Program (DURIP)
NASA: Early Career Faculty Award; Carbon Cycle Science

Grant Opportunities

National Science Foundation

Grant Program: Plant-Biotic Interactions
Agency: National Science Foundation NSF 16-551
RFP Website: http://www.nsf.gov/pubs/2016/nsf16551/nsf16551.htm
Brief Description: The Plant-Biotic Interactions (PBI) program supports research on the processes that mediate beneficial and antagonistic interactions between plants and their viral, bacterial, oomycete, fungal, plant, and invertebrate symbionts, pathogens and pests. This joint NSF-NIFA program supports projects focused on current and emerging model and non-model systems, and agriculturally relevant plants. The program's scope extends from fundamental mechanisms to translational efforts, with the latter seeking to put into agricultural practice insights gained from basic research on the mechanisms that govern plant-biotic interactions.

Projects must be strongly justified in terms of fundamental biological processes and/or relevance to agriculture and may be purely fundamental or applied, or include aspects of both perspectives. All types of symbiosis are appropriate, including commensalism, mutualism, parasitism, and host-pathogen interactions. Research may focus on the biology of the plant host, its pathogens, pests or symbionts, interactions among these, or on the function of plant-associated microbiomes. The program welcomes proposals on the dynamics of initiation, transmission, maintenance and outcome of these complex associations, including studies of metabolic interactions, immune recognition and signaling, host-symbiont regulation, reciprocal responses among interacting species and mechanisms associated with self/non-self recognition such as those in pollen-pistil interactions. Explanatory frameworks may include molecular, genomic, metabolic, cellular, network and organismal processes, with projects guided by hypothesis and/or discovery driven experimental approaches. Where appropriate, quantitative modeling in concert with experimental work is encouraged. Overall, the program seeks to support research that will deepen our understanding of the fundamental processes that mediate interactions between plants and the organisms with which they intimately associate and advance the application of that fundamental knowledge to benefit agriculture.

Awards: The estimated funding includes approximately $8.5M in FY 17 from NSF for new standard or continuing awards, and approximately $6M in FY 16 from USDA for new awards. Both estimates depend on availability of funds. USDA/NIFA will support projects for up to four years in duration. Although there are no formal upper or lower limits to award amounts, they typically range from $50,000 to $300,000 per year, with durations of two to four years (and five years for CAREER awards).

Letter of Intent: Not Required

Full Proposal Deadlines: June 6, 2016

Contacts:

- Michael L. Mishkind, Program Director, 685N, telephone: (703) 292-8413, email: mmishkin@nsf.gov
- Ann Lichens-Park, National Program Leader, telephone: (202) 401-6460, email: apark@nifa.usda.gov

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Grant Program: Cyber-Physical Systems (CPS)

Agency: National Science Foundation NSF 16-549

RFP Website: http://www.nsf.gov/pubs/2016/nsf16549/nsf16549.htm

Brief Description: Cyber-physical systems (CPS) are engineered systems that are built from, and depend upon, the seamless integration of computational algorithms and physical components. Advances in CPS will enable capability, adaptability, scalability, resiliency, safety, security, and usability that will far exceed the simple embedded systems of today. CPS technology will transform the way people interact with engineered systems – just as the Internet has transformed the way people interact with information. New smart CPS will drive innovation and competition in sectors such as agriculture, energy, transportation, building design and automation, healthcare, and manufacturing.

The December 2010 report of the President's Council of Advisors on Science and Technology (PCAST) titled *Designing a Digital Future: Federally Funded Research and Development in Networking and Information Technology* calls for continued investment in CPS research because of its scientific and technological importance as well as its potential impact on grand challenges in a number of sectors critical to U.S. security and competitiveness such as the ones noted above. These challenges and technology gaps are further described in a *CPS Vision*

Statement published in 2012 by the federal Networking and Information Technology Research and Development (NITRD) CPS Senior Steering Group.

Tremendous progress has been made in advancing CPS technology over the last five-plus years. We have explored foundational technologies that have spanned an ever-growing set of application domains, enabling breakthrough achievements in many of these fields. At the same time, the demand for innovation in these domains continues to grow, and is driving the need to accelerate fundamental research to keep pace.

Despite significant inroads into CPS technology in recent years, we do not yet have a mature science to support systems engineering of high-confidence CPS, and the consequences are profound. Traditional analysis tools are unable to cope with the full complexity of CPS or adequately predict system behavior. For example, as the Internet of Things (IoT) scales to billions of connected devices – with the capacity to sense, control, and otherwise interact with the human and physical world – the requirements for dependability, security, safety, and privacy grow immensely. One barrier to progress is the lack of appropriate science and technology to conceptualize and design for the deep interdependencies among engineered systems and the natural world. The challenges and opportunities for CPS are thus significant and far-reaching. New relationships between the cyber and physical components require new architectural models that redefine form and function. They integrate the continuous and discrete, compounded by the uncertainty of open environments. Traditional real-time performance guarantees are insufficient for CPS when systems are large and spatially, temporally, or hierarchically distributed in configurations that may rapidly change. With the greater autonomy and cooperation possible with CPS, greater assurances of safety, security, scalability, and reliability are demanded, placing a high premium on open interfaces, modularity, interoperability, and verification.

The goal of the CPS program is to develop the core system science needed to engineer complex cyber-physical systems that people can use or interact with and depend upon. Some of these may require high-confidence or provable behaviors. The program aims to foster a research community committed to advancing research and education in CPS and to transitioning CPS science and technology into engineering practice. By abstracting from the particulars of specific systems and application domains, the CPS program seeks to reveal cross-cutting fundamental scientific and engineering principles that underpin the integration of cyber and physical elements across all application sectors. To expedite and accelerate the realization of cyber-physical systems in a wide range of applications, the CPS program also supports the development of methods, tools, and hardware and software components based upon these cross-cutting principles, along with validation of the principles via prototypes and testbeds. We have also seen a convergence of CPS technologies and research thrusts that underpin Smart & Connected Communities (S&CC) and the Internet of Things (IoT). These domains offer new and exciting challenges for foundational research and provide opportunities for maturation at multiple time horizons.

In 2016, NSF is working closely with multiple agencies of the federal government, including the U.S. Department of Homeland Security (DHS) Science and Technology Directorate (S&T); the U.S. Department of Transportation (DOT) Federal Highway Administration (FHWA), and through FHWA, the U.S. DOT Intelligent Transportation Systems (ITS) Joint Program Office (JPO); the National Aeronautics and Space Administration (NASA) Aeronautics Research Mission Directorate (ARMD); several National Institutes of Health (NIH) institutes and centers [including the National Institute of Biomedical Imaging and Bioengineering (NIBIB), Office of Behavioral and Social Sciences Research (OBSSR), National Cancer Institute (NCI), and National Center for Advancing Translational Sciences (NCATS)]; and the U.S. Department of Agriculture-National Institute of Food and Agriculture (USDA-NIFA, hereafter referred to as NIFA). Key goals are to

identify basic CPS research directions that are common across multiple application domains, along with opportunities for accelerated transition to practice.
Three classes of research and education projects – differing in scope and goals – will be considered through this solicitation:

- **Breakthrough** projects must offer a significant advance in fundamental CPS science, engineering and/or technology that has the potential to change the field. This category focuses on new approaches to bridge computing, communication, and control. Funding for Breakthrough projects may be requested for a total of up to $500,000 for a period of up to 3 years.
- **Synergy** projects must demonstrate innovation at the intersection of multiple disciplines, to accomplish a clear goal that requires an integrated perspective spanning the disciplines. Funding for Synergy projects may be requested for a total of $500,001 to $1,000,000 for a period of 3 to 4 years.
- **Frontier** projects must address clearly identified critical CPS challenges that cannot be achieved by a set of smaller projects. Funding may be requested for a total of $1,000,001 to $7,000,000 for a period of 4 to 5 years.

Awards: Approximately 10 Breakthrough projects, 20 Synergy projects, and 2 Frontier projects are anticipated, subject to receipt of sufficient meritorious proposals. Anticipated Funding Amount: $34,000,000
Letter of Intent: Not Required
Full Proposal Submission Due Date: May 24, 2016 - June 07, 2016
Contacts:

- David Corman, Program Director, CISE/CNS, 1175, telephone: (703) 292-8754, email: dcorman@nsf.gov
- Radhakisan Baheti, Program Director, ENG/ECCS, 525, telephone: (703) 292-8339, email: rbaheti@nsf.gov
- Sankar Basu, Program Director, CISE/CCF, telephone: (703) 292-7843, email: sabasu@nsf.gov

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Grant Program: Science Learning+ Partnership Grants
Agency: National Science Foundation NSF 16-548
RFP Website: http://www.nsf.gov/pubs/2016/nsf16548/nsf16548.htm
Brief Description: Within the National Science Foundation (NSF) context, **Science Learning+** is a strand within project type 3, Research in Service to Practice, of the **Advancing Informal STEM Learning (AISL)**program (NSF 15-593).

Science Learning+ is an open call for proposals for Partnership Grants through an international partnership between the NSF and the Wellcome Trust with the UK Economic and Social Research Council (ESRC).

The aims of Science Learning+ are to strengthen the research and knowledge base; bridge the practice and research gap; and/or share knowledge and experience in informal science, technology, engineering and mathematics (STEM) experiences. Furthermore, the initiative seeks to support practice-based research which falls within or across the following priority areas: understanding learning; engagement in STEM; skills development; equity; diversity; access to informal learning settings; and measurement of outcomes.

Proposals must address at least one priority area and include: collaborations between at least one organization in the US and one in the UK/Republic of Ireland. In addition, the proposal should include a substantive research program, not solely a public engagement activity; genuine partnerships between researchers and practitioners of STEM engagement; experts from more

than one STEM area; and more than one informal STEM learning location, platform, or environment. Proposers should submit a single, comprehensive proposal with two budget components, one for US activities and one for UK/Republic of Ireland activities, to NSF.
Awards: Total anticipated funding: $12 million/£7.5 million; that amount includes approximately $6,000,000 from NSF, dependent upon availability of appropriations, for new standard or continuing awards and up to £3,750,000 from the Wellcome Trust and ESRC.
Letter of Intent: Not Required
Full Proposal Submission Due Date: June 14, 2016
Contacts:

- Catherine Eberbach, telephone: (703) 292-4960, email: ceberbac@nsf.gov
- Ellen McCallie, telephone: (703) 292-5115, email: emccalli@nsf.gov
- Mat Hickman, Wellcome Trust, telephone: +44 (0)20 7611 8825, email: m.hickman@wellcome.ac.uk
- Ann Jeffcott, ESRC, telephone: +44 (0)17 9341 3023, email: ann.jeffcott@esrc.ac.uk

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National Institutes of Health

Grant Program: The Application of Big Data Analytics to Drug Abuse Research (R01)
Agency: National Institutes of Health PAR-16-119
RFP Website: http://grants.nih.gov/grants/guide/pa-files/PA-16-119.html
Brief Description: The purpose of this FOA is to address the multitude of challenges in analyzing and integrating the diverse data types acquired from drug addiction research. In particular, NIDA is interested in harnessing Big Data analytics to gain new knowledge related to the neurobiological and behavioral changes occurring due to drug use and addiction.

Types of research and experimental approaches that are being sought to achieve the objectives:

Analyses may involve one or more data sets or knowledge sources, but should address fundamental research questions associated with substance abuse research and also develop computation tools (e.g. aggregated datasets, standards, analytic software) facilitating future analyses of substance abuse research data. Primary data may be of multiple types and formats, and available through sources which include, but is not limited to, large databases and repositories of existing data, publicly available information (e.g., Twitter data), images, videos, EHR records and free text from published manuscripts. Applications are encouraged across the entire range of science supported by NIDA, from basic biological and neurological mechanisms to new techniques for epidemiological surveillance to health services research to complex, multi-level approaches. Applicants are encouraged to collaborate with investigators holding private data sets, use innovative statistical strategies to link datasets, or utilize public use and administrative data readily available. Supported efforts may include the activities necessary to accomplish analyses, such as locating, verifying and evaluating data sets and preparing them for semantic and computational interoperability. Any interoperable databases, standards or software produced are recommended to be made open-source and freely available to the research community while adhering to privacy and ethics concerns.

Because the nature of this funding opportunity requires the combined application of deep domain knowledge of drug abuse research with the computational analytics of Big Data science, proposed projects are recommended to involve a multidisciplinary team that applies an integrative, quantitative, computational analytics approach including quantitatively trained researchers in the field of data science, mathematics, statistics, engineering, computer science or bioinformatics.

Examples of research topics include but are not limited to:

- Translational integration between animal and human research data by using dimensionality reduction such as principal component or factor analysis;
- Development of software able to analyze large, complex datasets commonly acquired during drug abuse research (e.g. longitudinal analysis of calcium imaging data over the temporal course of self-administration; analysis of temporal geospatial data from mHealth studies);
- Dimensionality reduction allowing visualization of high-dimensional data;
- Considering the results and relationships of individual studies within the broader context of all work relevant to a particular knowledge base;
- Developing reference databases and atlases with utility for drug abuse research;
- Expanding on findings conducted with grand mean or within animal averaging by using single trial analyses or other high-resolution investigations of research data;
- Investigating individual variability on self-administration behavioral data to explore resilience and vulnerability factors;
- Automated analysis and machine learning classification of "big behavioral data," such as multiple camera and long-term video monitoring of naturalistic behaviors (e.g. in the home cage setting), recording of ultrasonic vocalizations or other behavioral measures;
- Analysis of electronic health record (EHR) data to identify patterns in health care data that could identify those at risk for developing substance misuse or substance use disorders or those at risk of relapsing (e.g. integration of EHRs with administrative data to examine the impact of the design or performance of the service delivery system on patient outcomes);
- Developing methods to integrate and analyze multiple sources of health data (i.e., EHR, mobile device, etc.)

Awards: Application budgets are not limited but need to reflect the actual needs of the proposed project.
Letter of Intents: 30 days prior to the application due date.
Deadline: Standard dates apply, by 5:00 PM local time of applicant organization. All types of non-AIDS applications allowed for this funding opportunity announcement are due on these dates.
Applicants are encouraged to apply early to allow adequate time to make any corrections to errors found in the application during the submission process by the due date.

Grant Program: Systems Biology of Aging (R01)
Agency: National Institutes of Health RFA-AG-17-004
RFP Website: http://grants.nih.gov/grants/guide/rfa-files/RFA-AG-17-004.html
Brief Description: The molecular basis of aging has been examined using numerous methods and organisms. Lifespan has been a surrogate for aging, and remains useful as a binary endpoint of the aging process ("alive versus dead" in place of quantifiable losses of function over time or advent and progression of diseases). In this approach, an underlying assumption is that factors which influence lifespan will also influence aging, although the converse is not always true (some losses of function in aging apparently do not directly impact lifespan, and not all aging-related diseases are considered fatal). As a result of these studies on regulation of lifespan in diverse organisms, we have substantial information about individual gene-products, noncoding RNA, biochemical pathways, environmental factors and cell biological mechanisms that impact aging. We do not have similar levels of insight into the ways these factors interact to cause (or

retard) aging in any organism. In addition, the focus to date has been on the conserved genes and pathways and their impact on lifespan across a range of organisms whose lifespans vary widely. Despite this, we have relatively little insight into the biological processes that result in those characteristic mean and maximum lifespans, whether those are lifespans of closely related or evolutionarily distant species. While the focus on conserved pathways is believed to be critically important for the translational potential of studies in animal models of human aging, casting a wider net to understand fundamental aspects of aging biology – irrespective of conserved genes and pathways – can also provide new insights and suggest new ways to alter the rate of aging. Systems biology of aging, using newly constructed networks rather than previously described networks or networks based – for example – on protein-protein interactions curated from the literature, is a highly 'agnostic' approach to uncover novel interactions and emergent properties of networks, and to generate new hypothesis about fundamental processes of aging.

The major goals of this FOA are to employ systems biology to generate new insights about the molecular mechanisms of aging, preferably at the network level of emergent properties, and also to understand the changes in relationships among network components that impact lifespan. By "emergent properties" we mean unique properties arising from the complexity of multiple and multiply interacting components which are linked in the aging network. By 'relationships' we mean these as generally understood to be nodes and edges in networks, but also in feedback loops of the sort elaborated extensively in studies of gene regulatory networks in developmental processes. It is important that the focus of applications should be on emergent properties and/or changing relationships of an aging network. Under this FOA, Saccharomyces cerevisiae or Caenorhabditis elegans are the experimental organisms to be used for these studies. Applicants must use the multiple PD/PI model for applications submitted to this FOA: the contact PD/PI must be an expert in systems biology and other PD/PI(s) should have expertise in the biology of aging and/or necessary high-throughput technologies using the laboratory organism for study (S. cerevisiae or C. elegans, only).

The choice to restrict studies under this FOA to Saccharomyces cerevisiae or Caenorhabditis elegans is based on two considerations: 1. Demonstration projects in the systems biology of aging were successful in validating an approach to network construction and hypothesis generation under a previously issued FOA, RFA-AG-12-011. That FOA was restricted to Saccharomyces cerevisiae because it is a single-celled organism and thus avoids issues of tissue aging. However the scope and scale of work needed to complete network construction was beyond the resources of that FOA. 2. S. cerevisiae and C. elegans are laboratory organisms for which there are in-place genetic tools for gene disruption as well as multiple alleles that increase lifespan, high-throughput technologies for single-cell and single-worm analysis in gene expression, RNA analysis, epigenetics and proteomics, and established interventions affecting lifespan which are necessary to permit a systems biology approach to aging. If the goals of this FOA are met, then the systems biology approaches developed under this FOA could be extended to other organisms, but for purposes of this FOA only two laboratory organisms may be used.

Awards: Application budgets are limited to a maximum of $600,000 per year direct costs (including subcontracts and fees).

Letter of Intents: September 7, 2016

Deadline: October 7, 2016, by 5:00 PM local time of applicant organization. All types of non-AIDS applications allowed for this funding opportunity announcement are due on this date.

No late applications will be accepted for this Funding Opportunity Announcement.

Applicants are encouraged to apply early to allow adequate time to make any corrections to errors found in the application during the submission process by the due date.

Grant Program: High Impact, Interdisciplinary Science in NIDDK Research Areas (RC2)
Agency: National Institutes of Health PAR-16-126
RFP Website: http://grants.nih.gov/grants/guide/pa-files/PAR-16-126.html
Brief Description: The mission of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) is to conduct and support medical research and research training and to disseminate science-based information on diabetes and other endocrine and metabolic diseases; digestive diseases, nutritional disorders, and obesity; and kidney, urologic, and hematologic diseases, to improve people's health and quality of life. To that end, the NIDDK, through extramural grants programs of its Programmatic Divisions, supports a broad range of biomedical research. Previous research has enormously increased our understanding of the molecular, cellular and behavioral bases of disease and our approaches to health care. The most recent advances in technology and science create numerous opportunities for the public and private sectors to accelerate discoveries for the prevention, diagnosis and treatment of disease. The high complexity of the technologies and data systems required for this type of research, and the requirements for large interdisciplinary teams significantly limit progress and prevent private sector investments and expansions.

The purpose of the High Impact, Interdisciplinary Science grants program is to support high impact ideas that may lay the foundation for new fields of investigation within the mission of NIDDK. The interdisciplinary approach encouraged by this FOA could be used to generate a research resource for the broader community, which may include discovery-based or hypothesis-generating science. The interdisciplinary research team should be able to provide an integrative plan of working together to effectively address the complex challenge at hand. This program will support research projects that accelerate critical breakthroughs, early and applied research on cutting-edge technologies, and new approaches to improve the synergy and interactions among multi and interdisciplinary research teams. This FOA seeks novel approaches in areas that address specific knowledge gaps, scientific opportunities, new technologies, data generation, or research methods that will advance the area in significant ways designed to accelerate scientific progress in understanding, treatment and prevention of diseases within the mission of NIDDK.

Scope and Specific Requirements

The scope of this FOA includes, but is not limited to, the following:

- Groundbreaking, innovative, high impact and cross-cutting research projects that will improve and accelerate biomedical research.
- Basic, clinical and translational projects that could fundamentally enhance the research enterprise and that require the participation, interaction, coordination and integration of activities carried out in multiple research laboratories.
- Creation of large scale unique resources, accelerated application of high throughput, and other novel technologies.
- Deployment of critical infrastructure, resources, tools, and methodologies that substantially accelerate collaborative, multi and interdisciplinary basic, translational, and/or clinical research.
- Implementation of large scale research projects that are carried out using new and creative collaborative agreements and partnerships.
- Discovery-based and hypothesis-generating science.
- Creative approaches to overcome barriers to basic, translational, or clinical research using novel tools, technologies, and services.

RC2 projects are ***not intended to support:***

- Traditional investigator-initiated and highly focused studies (best supported by the R01 or P01 mechanisms).
- Research that is a logical extension of ongoing work.
- Core (or related) services to supplement the budgets of existing R01-type efforts.
- Groups of investigators at the same institution who would normally interact and collaborate in the absence of a collaborative grant.

Prior Consultation with NIDDK

Consultation with NIDDK staff at least **3 months (and preferably 6 months)** prior to the application due date (including resubmission applications) is strongly encouraged for submission of the High Impact, Interdisciplinary Science in NIDDK Research (RC2) application. If requested, NIDDK staff will consider whether the proposed RC2 meets the goals and mission of the Institute; whether it addresses one or more high priority research areas; and whether the application is best fit to the RC2 activity code. NIDDK staff will not evaluate the technical and scientific merit of the proposed project; technical and scientific merit will be determined during peer review using the review criteria indicated in this FOA. During the consultation phase, if the proposed project does not meet NIDDK's programmatic needs or is not appropriate for this FOA, applicants will be strongly encouraged to consider other Funding Opportunities.

Awards: The number of awards is contingent upon NIH appropriations and the submission of a sufficient number of meritorious applications.

Letter of Intents: Six weeks prior to the application due date.

Deadline: June 1, 2016; November 1, 2016; June 1, 2017; November 1, 2017; June 1, 2018; November 1, 2018, by 5:00 PM local time of applicant organization. All types of non-AIDS applications allowed for this funding opportunity announcement are due on these dates.

Applicants are encouraged to apply early to allow adequate time to make any corrections to errors found in the application during the submission process by the due date.

Grant Program: Emerging Questions in Cancer Systems Biology (U01)
Agency: National Institutes of Health PAR-16-131
RFA-CA-15-014 U54 Specialized Center- Cooperative Agreements
RFA-CA-15-015 U24 Resource-Related Research Projects – Cooperative Agreements
RFP Website: http://grants.nih.gov/grants/guide/pa-files/PAR-16-131.html

Brief Description: The CSBC initiative is intended to promote further development of the field of cancer systems biology. The CSBC is designed to foster collaborations between cancer systems biologists and those in other communities, such as cancer biology and oncology, immunology, synthetic biology and population science.

CSBC overall organization: The CSBC will consist of U54 CSBC Research Centers (RFA-CA-15-014), U01 CSBC Research Projects (encouraged under this FOA), and a U24 Coordinating Center (RFA-CA-15-015) that will coordinate activities between the CSBC and a related program, the Physical Sciences in Oncology Network (PS-ON). All parts will be governed by the CSBC Steering Committee with representatives from the funded CSBC Research Centers and Research Projects, the CSBC/PS-ON Coordinating Center and NCI Program staff. Applicants are encouraged to read RFA-CA-15-015 for more information regarding the role of the CSBC/PS-ON Coordinating Center. The CSBC will function as a collaborative network allowing Research Centers and Projects to cross-test ideas, integrate diverse data sets, and validate (or refute) theoretical, experimental, or clinical models.

Governance of the CSBC: The CSBC program will be governed by the CSBC Steering Committee. This governance extends to CSBC Research Projects (see Section VI: Terms and Conditions of Cooperative Agreement.)

Evaluation of the Program: CSBC awardees (including Research Projects awardees) will be required to participate in an external evaluation process of the CSBC program coordinated by NCI Program Staff (see Section VI: Terms and Conditions of Cooperative Agreement.)

Scope and Objectives of CSBC Research Projects

Applicants responding to this FOA should propose only one single, cohesive project that is based upon a systems biology approach to cancer research. This approach should include explicit integration of experimental biology and computational or mathematical modeling to build, test and/or validate hypotheses or ideas.

The following examples list cancer areas that are appropriate for this FOA and poised to benefit from a cancer systems biology approach. Note that the list is non-inclusive and is not meant to restrict the scope of investigator-initiated research topics.

- *Dynamics of cell-cell interactions:* The reciprocal relationship between cancer cells, the host immune system and the tumor microenvironment evolves during cancer progression. How these dynamic and unstable interactions prevent or drive tumor initiation and progression is not well understood. Projects may focus on predictive and testable hypotheses of how dynamic cell-cell (tumor-tumor, tumor-immune, tumor-stroma, immune-stroma, etc.) communication affects cancer processes (e.g. cancer development and progression, tumor evolution and/or response to therapy).
- *Integration of information across temporal and spatial scales:* State-of-the-art quantitative measurement technologies have facilitated collection of chemical, molecular, structural, interactome, and localization data within and across cell populations in the tumor microenvironment. Systems analyses and network reconstruction using single scale data (i.e. gene, mRNA, protein, metabolite, cell) do not necessarily predict behavior at another scale and translating information across space and time remains a challenge. Therefore, research projects addressing how information networks and mechanistic insights at one scale coordinate, integrate, and/or translate into tumor behaviors at lower or higher scales are warranted.
- *Tumor behaviors reflecting single cell characteristics:* Advanced quantitative single-cell measurement technologies at the genomic, epigenomic, transcriptomic and protein level of individual cells have provided significant insights into tumor heterogeneity and clonal evolution during tumor initiation, development, and adaptation in response to therapy. However, how single cells or single clones contribute to tumor biology is not well understood. Proposed research projects may attempt, for example, to explain how variations in single cell or single clone molecular characteristics or network dependencies contribute to immune system modulation or microenvironmental remodeling.
- *Systems-level analyses of the role of the microbiome in cancer:* How the human microbiota contributes to the pathogenesis of specific cancers likely reflects the interplay among the microbiome, other environmental exposures (i.e. diet, drugs, co-infection), and the underlying host genetic and/or phenotypic heterogeneity. Efforts are warranted towards mechanistic models of host-microbiome interaction in tumor initiation, progression, or treatment. For instance, Research Projects may incorporate microbe-associated peptides, ligands, or small molecules into cancer systems biology models that predict host cell survival, death or response to treatment. In addition to other mechanistic studies, systems models that address the adaptive capabilities of the microbiota to alter their host niche (e.g. microbe regulation of inflammasome signaling in intestinal epithelial cells) are encouraged.
- *The combination of systems and synthetic biology for understanding disease mechanisms in cancer:* Multivariate systems biology model predictions could be tested using synthetic

biology approaches that engineer multiple controllable cellular components. Research Projects may focus on the development and/or employment of synthetic biology tools (such as engineered circuits, networks, cells) for the purposes of populating, training, or testing cancer systems biology models. Projects utilizing cancer systems biology approaches to inform synthetic biology tool design for the ultimate purpose of studying the mechanism of cancer-related processes are also encouraged. Studies should be completed in cancer-relevant experimental models, such as cancer cell lines, genetically engineered animal models, or patient-derived xenografts.

- *Hierarchical models of cancer:* In addition to integrating data across molecular, genetic, protein and cellular scales, systems biology approaches could be utilized to bridge and/or inform models at the organ, patient, and population level. Examples include using mechanistic systems biology predictions to inform pharmacokinetic models in patients or utilizing computational, mathematical or statistical formalisms to bridge a mechanistic systems biology model at one scale and a population-level model at the other. Applicants may propose projects to address technical challenges involved in linking models and data across these cancer-related hierarchical scales.

Systems biology aided clinical trial design: Precision medicine requires integrating patient-specific characteristics with knowledge gained in pre-clinical studies, such as, but not limited to, differences in multicellular or multiclonal drug response, staggered temporal dosing schedules, and/or dynamic prediction of effective combination therapies. Research projects that utilize systems biology approaches and culminate in informing clinical trial designs (to be supported under another mechanism) are appropriate under this FOA. For example, projects might utilize cancer systems biology approaches to perform *in silico* clinical trials whose outcome determines optimal patient populations for clinical trials.

Awards: Application budgets are not limited but need to reflect the actual needs of the proposed project.

Letter of Intents: 30 days prior to the application due date.

Deadline: June 24, 2016; November 18, 2016; June 23, 2017; November 24, 2017; June 22, 2018; November 23, 2018, by 5:00 PM local time of applicant organization. All types of applications allowed for this funding opportunity announcement are due on these dates.

Applicants are encouraged to apply early to allow adequate time to make any corrections to errors found in the application during the submission process by the due date..

Department of Defense/US Army/DARPA/ONR

Grant Program: Fiscal Year 2016 Defense University Research Instrumentation Program (DURIP)

Agency: AFOSR - Department of Defense AFOSR PA-AFRL-AFOSR-2016-0001

RFP Website: http://www.arl.army.mil/www/pages/8/2016_DURIP_Ann.pdf

Brief Description: The Department of Defense (DoD) announces the Fiscal Year 2017 Defense University Research Instrumentation Program (DURIP). DURIP is designed to improve the capabilities of accredited United States (U.S.) institutions of higher education to conduct research and to educate scientists and engineers in areas important to national defense, by providing funds for the acquisition of research equipment or instrumentation. For-profit organizations are not eligible for DURIP funding. This announcement seeks proposals from universities to purchase equipment and instrumentation in support of research in areas of interest to the DoD. DoD interests include the areas of research supported by the Army Research Office (ARO), the Office of Naval Research (ONR), and the Air Force Office of Scientific Research

(AFOSR), hereafter generally referred to collectively as "we, our, us, or administering agency." Each administering agency will make grant awards to fund the purchase of research equipment or instrumentation costing $50,000 or more that cannot typically be purchased within the budgets of single-investigator awards. We generally cannot make any individual award that exceeds more than $1,500,000 in DoD funding unless your proposal qualifies for an exception. We intend to award approximately $47 million this competition, subject to availability of funds. DURIP awards are typically one year in length. DURIP is part of the University Research Initiative (URI). All the application forms you need are available electronically on Grants.gov. We will not provide paper copies of this announcement, or accept paper applications. All applications must be submitted electronically through Grants.gov.
Awards: Up to $1,500,000.
Deadline: Aug 26, 2016 Your proposal must be received no later than Friday, August 26, 2016 at 11:59 PM Eastern Daylight time to be considered INQUIRIES AND QUESTIONS DEADLINE Friday, August 12, 2016.

NASA

Grant Program: Research Opportunities in Space and Earth Sciences 2016 (ROSES–2016) Early Career Faculty Award
Agency: NASA NNH16ZDA001N ECF
RFP Website:
https://nspires.nasaprs.com/external/viewrepositorydocument/cmdocumentid=498142/solicitationId=%7BAA23F9FA-2CA3-8811-55BA-678534C1B9FE%7D/viewSolicitationDocument=1/ST-REDDI-2016%20Appendix%20B1%20-%20ECF16%20final%202-11-16.pdf
https://nspires.nasaprs.com/external/solicitations/summary.do?method=init&solId={68C12087-132D-3814-9A87-5323BCE6CAB6}&path=init
Brief Description: This ROSES NRA (NNH16ZDA001N) solicits basic and applied research in support of NASA's Science Mission Directorate (SMD). This NRA covers all aspects of basic and applied supporting research and technology in space and Earth sciences, including, but not limited to: theory, modeling, and analysis of SMD science data; aircraft, scientific balloon, sounding rocket, International Space Station, CubeSat and suborbital reusable launch vehicle investigations; development of experiment techniques suitable for future SMD space missions; development of concepts for future SMD space missions; development of advanced technologies relevant to SMD missions; development of techniques for and the laboratory analysis of both extraterrestrial samples returned by spacecraft, as well as terrestrial samples that support or otherwise help verify observations from SMD Earth system science missions; determination of atomic and composition parameters needed to analyze space data, as well as returned samples from the Earth or space; Earth surface observations and field campaigns that support SMD science missions; development of integrated Earth system models; development of systems for applying Earth science research data to societal needs; and development of applied information systems applicable to SMD objectives and data. Awards range from under $100K per year for focused, limited efforts (e.g., data analysis) to more than $1M per year for extensive activities (e.g., development of specialized science experimental hardware). The funds available for awards in each program element offered in this NRA range from less than one to several million dollars, which allow selection from a few to as many as several dozen proposals, depending on the program objectives and the submission of proposals of merit. Awards will be made as

grants, cooperative agreements, contracts, and inter- or intraagency transfers, depending on the nature of the work proposed, the proposing organization, and/or program requirements. The typical period of performance for an award is three years, but some programs may allow up to five years and others specify shorter periods. Organizations of every type, domestic and foreign, Government and private, for profit and not-for-profit, may submit proposals without restriction on teaming arrangements. Note that it is NASA policy that all investigations involving non-U.S. organizations will be conducted on the basis of no exchange of funds. Electronic submission of proposals is required by the respective due dates for each program element and must be submitted by an authorized official of the proposing organization. Electronic proposals may be submitted via the NASA proposal data system NSPIRES or via Grants.gov. Every organization that intends to submit a proposal in response to this ROSES NRA must be registered with NSPIRES; organizations that intend to submit proposals via Grants.gov must be registered with Grants.gov, in addition to being registered with NSPIRES. Such registration must identify the authorized organizational representative(s) who will submit the electronic proposal. All principal investigators and other participants (e.g., co-investigators) must be registered in NSPIRES regardless of submission system. Potential proposers and proposing organizations are urged to access the system(s) well in advance of the proposal due date(s) of interest to familiarize themselves with its structure and enter the requested information. Details of the solicited programs are given in the Appendices of this ROSES NRA. Names, due dates, and links for the individual calls are given in Tables 2 and 3 of this ROSES NRA. Interested proposers should monitor http://nspires.nasaprs.com/ or subscribe to the electronic notification system there for additional new programs or amendments to this ROSES NRA through February 2017, at which time release of a subsequent ROSES NRA is planned. A web archive (and RSS feed) for amendments, clarifications, and corrections to this ROSES NRA will be available at: http://nasascience.nasa.gov/researchers/sara/grant-solicitations/roses-2016/ Frequently asked questions about ROSES-2016 will be on the web at http://science.nasa.gov/researchers/sara/faqs/. Further information about specific program elements may be obtained from the individual Program Officers listed in the Summary of Key Information for each program element in the Appendices of this ROSES NRA and at http://science.nasa.gov/researchers/sara/program-officers-list/. Questions concerning general ROSES NRA policies and procedures may be directed to Max Bernstein, Lead for Research, Science Mission Directorate, at sara@nasa.gov.

Award: The typical annual award value is $200K; smaller amounts may be proposed. The amount in any year may not exceed $220K and is subject to a maximum limit of $600K for three years. All amounts must be justified.

Proposal Deadline: April 1, 2016.

Grant Program: Research Opportunities in Space and Earth Sciences 2016 (ROSES–2016) Carbon Cycle Science

Agency: NASA NNH16ZDA001N CARBON

RFP Website:

https://nspires.nasaprs.com/external/solicitations/summary.do?method=init&solId={BDFEB327-957C-2DA8-CFB4-AABEA9A38D57}&path=open

Brief Description: This National Aeronautics and Space Administration (NASA) Research Announcement (NRA), Research Opportunities in Space and Earth Sciences (ROSES) –2016, solicits basic and applied research in support of NASA's Science Mission Directorate (SMD). ROSES is an omnibus NRA, with many individual program elements, each with its own due dates

and topics. All together these cover the wide range of basic and applied supporting research and technology in space and Earth sciences supported by SMD.

Awards range from under $100K per year for focused, limited efforts (e.g., data analysis) to more than $1M per year for extensive activities (e.g., development of specialized science experimental hardware). The funds available for awards in each program element offered in this NRA range from less than one to several million dollars, which allow selection from a few to as many as several dozen proposals, depending on the program objectives and the submission of proposals of merit. Awards will be made as grants, cooperative agreements, contracts, and inter- or intraagency transfers, depending on the nature of the work proposed, the proposing organization, and/or program requirements. The typical period of performance for an award is three years, but some programs may allow up to five years and others specify shorter periods. Organizations of every type, domestic and foreign, Government and private, for profit and not-for-profit, may submit proposals without restriction on teaming arrangements. Note that it is NASA policy that all investigations involving non-U.S. organizations will be conducted on the basis of no exchange of funds.

Details of the solicited program elements are given in the Appendices of this NRA. Proposal due dates are given in Tables 2 and 3 of this NRA, which will be posted at http://nspires.nasaprs.com/ and for which links are provided below. Interested proposers should monitor http://nspires.nasaprs.com/ or subscribe to the SMD electronic notification system there for additional new program elements or amendments to this NRA through February 2017, at which time release of a subsequent ROSES NRA is planned. A web archive (and RSS feed) for amendments, clarifications, and corrections to ROSES-2016 will be available at: http://nasascience.nasa.gov/researchers/sara/grant-solicitations/roses-2016/. This NRA will be available upon its release at http://solicitation.nasaprs.com/ROSES2016.

Within DOE's Office of Science, the Climate and Environmental Sciences Division (CESD) seeks to advance a robust predictive understanding of Earth's climate and environmental systems and to inform the development of sustainable solutions to the nation's energy and environmental challenges (http://science.energy.gov/~/media/ber/pdf/CESD-StratPlan-2012.pdf). Among CESD's goals, the following three pertain to the Terrestrial Ecosystems Science (TES) program and to this solicitation:

- Develop, test, and simulate process-level understanding of terrestrial ecosystems.
- Advance fundamental understanding of coupled biogeochemical processes in complex subsurface environments to enable systems-level environmental prediction and decision support.
- Synthesize new process knowledge to advance next-generation, integrated models of the human-Earth system.

TES seeks to improve the representation of terrestrial ecosystem processes that in turn can be incorporated into the land component of Earth system models, thereby improving the quality of climate model projections and providing the scientific foundation needed to inform DOE's energy decisions. TES seeks to focus its research on ecosystems that are globally important, climatically sensitive, and comparatively understudied or underrepresented in Earth system models.

Award: Various.

Proposal Deadline: June 15, 2016.