Smart and Connected Health (SCH)

PROGRAM SOLICITATION
NSF 16-601

REPLACES DOCUMENT(S):
NSF 13-543

National Science Foundation

Directorate for Computer & Information Science & Engineering
    Division of Computing and Communication Foundations
    Division of Computer and Network Systems
    Division of Information & Intelligent Systems

Directorate for Engineering

Directorate for Social, Behavioral & Economic Sciences

National Institutes of Health

    Eunice Kennedy Shriver National Institute of Child Health and Human Development

    National Cancer Institute

    National Human Genome Research Institute

    National Institute of Biomedical Imaging and Bioengineering

    National Institute on Aging

    Office of Behavioral and Social Sciences Research

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

    December 08, 2016

        Integrative (INT) Proposals

IMPORTANT INFORMATION AND REVISION NOTES

Revision Summary:

This is a revision of NSF 13-543, the solicitation for the Smart and Connected Health Program. The revision includes:

1. Revisions to the submission deadline;
2. Revisions to the project classes, specifically elimination of Exploratory Projects (EXP);
3. Revisions to the budget for Integrative projects (INT): INT projects will now be funded up to a total cost of $500,000 per year (including direct and indirect costs), compared with $370,000 in direct costs per year previously; INT projects will continue to be funded up to a 4-year period;
4. Revisions to the Program Description, with the addition of language to clarify that this program supports advancement of fundamental science through early-stage research, and thus clinical trials are not appropriate and will not be funded.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 16-1), which is effective for proposals submitted, or due, on or after January 25, 2016.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

    Smart and Connected Health (SCH)

Synopsis of Program:

    The goal of the Smart and Connected Health (SCH) Program is to accelerate the development and use of innovative approaches that would support the much needed transformation of healthcare from reactive and hospital-centered to preventive, proactive, evidence-based, person-centered and focused on well-being rather than disease. Approaches that partner technology-based solutions with biobehavioral health research are

supported by multiple agencies of the federal government including the National Science Foundation (NSF) and the National Institutes of Health (NIH). The purpose of this program is to develop next generation health care solutions and encourage existing and new research communities to focus on breakthrough ideas in a variety of areas of value to health, such as sensor technology, networking, information and machine learning technology, decision support systems, modeling of behavioral and cognitive processes, as well as system and process modeling. Effective solutions must satisfy a multitude of constraints arising from clinical/medical needs, social interactions, cognitive limitations, barriers to behavioral change, heterogeneity of data, semantic mismatch and limitations of current cyberphysical systems. Such solutions demand multidisciplinary teams ready to address technical, behavioral and clinical issues ranging from fundamental science to clinical practice.

Due in large part to advances in high throughput and connective computing, medicine is at the cusp of a sector-wide transformation that - if nurtured through rigorous scientific innovation - promises to accelerate discovery, improve patient outcomes, decrease costs, and address the complexity of such challenging health problems as cancer, heart disease, diabetes and neurological degeneration. These transformative changes are possible in areas ranging from the basic science of molecular genomics and proteomics to decision support for physicians, patients and caregivers through data mining to support behavior change through technology-enabled social and motivational support. In addition to these scientific discoveries, innovative approaches are required to address delivery of high quality, economically-efficient healthcare that is rapidly becoming one of the key economic, societal and scientific challenges in the United States.

The need for a significant healthcare transformation has been recognized by numerous organizations including the President's Council of Advisors on Science and Technology (PCAST), National Research Council (NRC), Institute of Medicine (IOM), Computing Community Consortium (CCC), and the National Academy of Engineering. Additionally, a congressionally mandated review of Networking and Information Technology Research and Development (NITRD) emphasized the critical role that networking and information technology will play in spurring innovation to solve the nation's most pressing challenges, beginning with health and healthcare. Several of these agencies explicitly encouraged the Department of Health and Human Services (e.g., NIH, Agency for Healthcare Research and Quality (AHRQ), Office National Coordinator for Health Information Technology (ONCHIT)) to work explicitly with the National Science Foundation to realize the scientific potential of digitally supported health and healthcare. Recommendations also called for joint funding between these agencies to conduct cross-cutting research into the social, cognitive, and behavioral processes underlying efficient use of the new technologies, and the analytic demands implied by the new large scale databases.

The purpose of this interagency program solicitation is the development of next generation health and healthcare research through high-risk, high-reward advances in the understanding of and applications in information science, technology, behavior, cognition, sensors, robotics, bioimaging, and engineering. Collaboration between academic, industry, non-profit and other organizations is strongly encouraged to establish better linkages between fundamental science, clinical practice and technology development, deployment and use. This solicitation is aligned with the visions (e.g., PCAST, NRC, IOM) calling for major changes in health and wellbeing as well as healthcare delivery and is aimed at the fundamental research to enable the change. Realizing the promise of disruptive transformation in health and healthcare will require well-coordinated, multi-disciplinary approaches that draw from the social, behavioral, and economic sciences, engineering, medicine, biology, and computer and information sciences.

One class of proposals will be considered in response to this solicitation, Integrative Projects (INT), with multi-disciplinary teams spanning 1 to 4 years.

As detailed in this solicitation, appropriate scientific areas of investigations may be related to any of the participating funding organizations. Questions concerning a particular project's focus, direction and relevance to a participating funding organization should be addressed to the appropriate person found below and in the list of agency contacts found in section VIII of the solicitation.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- Wendy Nilsen, Program Contact: Directorate for Computer and Information Science and Engineering, Division of Information and Intelligent Systems, 1125, telephone: (703) 292-2568, email: wnilsen@nsf.gov

- Jack Brassil, Program Contact: Directorate for Computer and Information Science and Engineering, Division of Computer and Network Systems, 1175, telephone: (703) 292-8950, email: jbrassil@nsf.gov

- Georgia-Ann Klutke, Directorate for Engineering, Division of Civil, Mechanical and Manufacturing Innovation, telephone: (703) 292-2443, email: gaklutke@nsf.gov

- Soo-Siang Lim, telephone: (703) 292-7878, email: slim@nsf.gov

- Sylvia Spengler, Program Contact: Directorate for Computer and Information Science and Engineering, Division of Information and Intelligent Systems, 1125S, telephone: (703) 292-8930, email: sspengle@nsf.gov

- Jie Yang, Program Contact: Directorate for Computer and Information Science and Engineering, Division of Information and Intelligent Systems, 1125, telephone: (703) 292-4768, email: jyang@nsf.gov

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- Dmitry Maslov, Directorate for Computer and Information Science and Engineering, Computing and Communication Foundations, 1115, telephone: (703) 292-8910, email: dmaslov@nsf.gov

- Tatiana Korelsky, Directorate for Computer and Information Science and Engineering, Division of Information and Intelligent Systems, 1125, telephone: (703) 292-8930, email: tkorelsk@nsf.gov

- Tiffany Lash,Division of Discovery Science and Technology, National Institute of Biomedical Imaging and Bioengineering (NIBIB), NIH, telephone: (301) 451-4778, email: tiffany.lash@nih.gov

- Theresa Hayes Cruz, National Center for Medical Rehabilitation Research, Eunice Kennedy Shriver National Institute of Child Health and Human Development, NIH, telephone: (301) 496-9233, email: cruzth@mail.nih.gov

- Bradford Hesse, Health Communication and Informatics Research Branch, National Cancer Institute, NIH, telephone: (301) 594-9904, email: hesseb@mail.nih.gov

- Mary Rodgers, Division of Health Informatics Technologies, National Institute of Biomedical Imaging and Bioengineering (NIBIB), NIH, telephone: (301) 402-1337, email: mary.rodgers@nih.gov

- Anastasia L. Wise, Office of Population Genomics, National Human Genome Research Institute (NHGRI), NIH, telephone: (301) 443-0585, email: anastasia.wise@nih.gov

- Partha Bhattacharyya, National Institute on Aging, NIH, telephone: (301) 496-3131, email: bhattacharyyap@mail.nih.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.041 --- Engineering
- 47.070 --- Computer and Information Science and Engineering
- 47.075 --- Social Behavioral and Economic Sciences
- 93.172 --- National Human Genome Research Institute
- 93.286 --- National Institute of Biomedical Imaging and Bioengineering
- 93.396 --- National Cancer Institute
- 93.865 --- Eunice Kennedy Shriver National Institute of Child Health and Human Development
- 93.866 --- National Institute on Aging

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant or Cooperative Agreement or other funding mechanism (depending on the needs of the particular awarding agency)

Estimated Number of Awards: 8 to 16

per year, subject to the availability of funds.

Anticipated Funding Amount: $11,000,000 to $20,000,000

will be invested in proposals submitted to this solicitation in FY 2017, subject to the availability of funds.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in, the US acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or Co-PI: 2

An investigator may participate as Principal Investigator (PI), co-Principal Investigator (co-PI), Project Director (PD), Senior Personnel or Consultant in **no more than two** proposals submitted in response to this solicitation. **These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently**. In the event that an individual exceeds this limit, proposals received within the limit will be accepted based on earliest date and time of proposal submission (i.e., the first two proposals received will be accepted, and the remainder will be returned without review). **No exceptions will be made.**

Proposals submitted in response to this solicitation may not duplicate or be substantially similar to other proposals concurrently under consideration by NSF or NIH programs or study sections. Duplicate or substantially similar proposals will be returned without review. NIH will not accept any application that is essentially the same as one already reviewed within the past thirty-seven months (as described in the *NIH Grants Policy Statement*), except for submission:

- To an NIH Requests for Applications (RFA) of an application that was submitted previously as an investigator-initiated application but not paid;
- Of an NIH investigator-initiated application that was originally submitted to an RFA but not paid; or
- Of an NIH application with a changed grant activity code.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required

- **Preliminary Proposal Submission:** Not required

- **Full Proposals:**
  - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
  - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)

B. Budgetary Information

- **Cost Sharing Requirements:**

  Inclusion of voluntary committed cost sharing is prohibited.

- **Indirect Cost (F&A) Limitations:**

  For NSF, Grant Proposal Guide (GPG) Guidelines apply.

  For NIH, indirect costs on foreign subawards/subcontracts will be limited to eight (8) percent.

- **Other Budgetary Limitations:**

  Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

  December 08, 2016

  Integrative (INT) Proposals

Proposal Review Information Criteria

Merit Review Criteria:

National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions:

Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements:

Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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I. INTRODUCTION

Delivering high quality, economically-efficient healthcare is rapidly becoming one of the key economic, societal and scientific challenges in the United States as well as globally. Despite escalating costs, the Nation's healthcare system is underperforming, based on indicators such as infant mortality, life expectancy and life-long healthcare costs per capita. The aging population, the prevalence of chronic diseases, and scarce resources will further stress the system. We are facing a future of increasing healthcare needs and a widening gap to the numbers of informal and professional caregivers to provide it.

The U.S. healthcare system needs to be fundamentally transformed from reactive care to proactive and preventive care, from experience-based to evidence-based medicine, and from clinic-centered care to patient-centered care and wellness that extends to the home, workplace, and community. Such transformation is necessary to move the focus from disease to health and wellbeing at the individual, system, and organizational level.

The need for a significant healthcare transformation has been recognized by numerous organizations and captured in a number of reports. For example, two influential 2010 reports from the President's Council of Advisors on Science and Technology (PCAST), *Realizing the Full Potential of Health Information Technology to Improve Healthcare for Americans: The Path Forward* http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-health-it-report.pdf and *Designing a Digital Future: Federally Funded Research and Development in Networking and Information Technology* http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-nitrd-report-2010.pdf describe near-term requirements as well as longer visions of the future healthcare. Similar visions for future healthcare and the need for further research have been identified in the 2009 National Research Council (NRC) report, *Computational Technology for Effective Health Care* http://www.nap.edu/catalog.php?record_id=12572, the 2011 Institute of Medicine (IOM) report *Digital Infrastructure for the Learning Health System* http://www.nap.edu/catalog.php?record_id=12912, the 2010 CCC white paper *Information Technology Research Challenges for Healthcare: From Discovery to Delivery* http://www.cra.org/ccc/docs/init/Information_Technology_Research_Challenges_for_Healthcare.pdf, and the 2005 joint National Academy of Engineering and IOM report, *Building a Better Delivery System* http://www.nap.edu/catalog.php?record_id=11378.

One unifying theme of these visions involves technology enabling optimized care decisions by bringing all relevant evidence pertaining to the particular patient to the point of care anywhere and anytime and in user-appropriate forms for all members of the care team, including the patient. The technical challenges include normalization and harmonization of electronic health records (EHRs); extraction and representation of data, information, and knowledge from diverse unstructured sources; large-scale data collection and predictive modeling; and new approaches for protecting privacy and security. Socio-cultural, economic, legal, political, and ethical challenges can amplify or mitigate technical challenges of achieving this vision.

Medical errors, operational inefficiencies and resulting adverse events are symptoms of the incomplete application of sound scientific and engineering principles to the design, implementation, operation, performance measurement, and optimization of healthcare systems, including human factors and usability considerations, workflow, and communication subsystems in many providers' facilities. Application of proven engineering systems analysis and optimization techniques can help improve information flow, minimize the frequency and the severity of these events, and improve operational effectiveness and efficiency of healthcare systems. A system rather than subsystem view will be necessary to achieve significant and lasting improvements.

Another emerging theme involves enabling individuals to participate in their own care in order to achieve this transformation. Among the key components that improve a person's outcomes and quality of life are self-efficacy and social support, both of which may be enhanced by improved access to and use of health information, enabled by advances in sensors, computing, networking, and communication technology. Also key to patient participation in health/healthcare is an understanding of the socio-cultural, behavioral and economic factors underlying the acceptance and impact of technological advances. The goal of this solicitation is to create the advances in sociotechnical design, and in human system integration, that will ultimately produce scalable solutions that integrate well within hospital workflows and patients' lives.

Major issues in current healthcare are the variability and limited frequency of measurements and the lack of baseline data for each particular individual. For example, applying population norms to a specific individual is often inappropriate because of individual deviations from the mean in genetic or family background, socioeconomic status or medical history. One way to overcome the challenges associated with infrequent, clinic-based measurements is to replace them by unobtrusive, continuous sensing, monitoring and assessment, thereby creating individualized baselines. For this approach to work, these signals must be brought together in meaningful ways for the users of those data. Thus, this solicitation calls for the research into the data visualization, intelligent integration, and computer-human interaction needed to create smart and connected interfaces for shared decision-making. The emphasis will be to identify ways of combining these signals to create better cognitive support for physicians, patients, and their caregivers.

Another key component of the healthcare transformation involves care for individuals with impaired functions, e.g., those with neurodegenerative diseases and aging populations. These issues may be addressed by novel devices and intelligent systems that relieve caregiver burden and improve quality of life by allowing the affected individuals to live more independently.

This solicitation is aligned with the visions (e.g., PCAST, NRC, IOM) calling for major changes in health and wellbeing as well as healthcare delivery and is aimed at the fundamental research to enable the change. Realizing the promise of disruptive transformation in health and healthcare will require well-coordinated, multi-disciplinary approaches that draw from the social, behavioral, and economic sciences, engineering, medicine, biology, and computer and information sciences.

II. PROGRAM DESCRIPTION

Consistent with the PCAST vision, the solicitation aims to complement the long-standing disease and application-focused research efforts with fundamental, innovative, and exploratory research that draws from multiple domains of science and engineering including social, behavioral, and economic sciences. Proposals can address computational, algorithmic, systemic, and device level issues, as well as models of uptake, diffusion, and use of the resulting solutions among different demographic and social groups, as well as the role of appropriate incentives, the risk of potential disparities, and the associated legal and ethical considerations. Accordingly, this interagency solicitation represents the collaboration of the National Science Foundation and the National Institutes of Health.

The work to be funded by this solicitation must relate to a key health problem and/or must make a fundamental contribution to engineering, computer and information sciences, or social, behavioral and economic sciences. Traditional disease-centric medical, clinical, pharmacological, biological or physiological studies and evaluations are outside the scope of this solicitation. The research teams must include members with appropriate and demonstrable expertise in the major areas involved in the work. This solicitation aims to support research activities that complement rather than duplicate the core programs of the NSF directorates and the National Institutes of Health, and the research efforts supported by other agencies such as the Agency for Healthcare Research and Quality, and the National Institute of Standards and Technology.

Addressing the challenges will require fundamental research and the development of new tools and methods across many dimensions, some of which are called for below:

1. Digital Health Information Infrastructure: Pursue fundamental research to enable interoperable, distributed, federated, and scalable digital infrastructure, languages, and tools for effective sharing and use of electronic health record data, data representation for such including semantic metadata, and networked applications that access such data. Investigate aspects of a continuously extensible universal exchange language for current and future health and wellness data originating from diverse sources in multiple formats, supporting both syntax and semantics. Advance data methods for controlling and maintaining data integrity, provenance, security, privacy and reliability of original as well as aggregated data, providing trustworthy patient identification and authentication and access control protocols, and maintaining sensitivity to the legal, cultural and ethical issues associated with universally accessible digital health data (e.g., EHR) in the U.S. Advance systems methods for measuring and optimizing operations to improve quality and productivity of healthcare delivery systems. Explore the societal impacts of increasing medical/health information availability and use.

2. From Data to Knowledge to Decisions: Investigate methods and algorithms for aggregation of multi-scale clinical, biomedical, contextual, and environmental data about each patient (e.g., in EHRs, personal health records - PHR, etc.), and unified and extensible metadata standards, and decision support tools to facilitate optimized patient-centered, evidence-based decisions. Integrate patient information with delivery systems performance and economic models to support operations management decisions. Develop robust knowledge representations and reasoning algorithms to support inferences based on individual or population health data, multiple sources of potentially conflicting information while complying with applicable policies and preferences. Develop innovative technology for the secondary use of health data to support assisted and automated discovery of reliable knowledge from aggregated population health records and predictive modeling and simulation of health and disease at multiple levels from cellular to individuals/patients to populations, along with robust validation and integration of empirical data into the models. Develop understanding of how families, communities, informal caregivers, professional medical teams and patients interpret care and treatment. Increase understanding of issues (technological, behavioral, socio-economic, value-driven actions, ethical, systemic) that interfere with patients' collaboration in care teams, adherence to treatment and wellness regimens. Promote a new science of computer human interaction around networked information technologies in healthcare to improve situational awareness in care teams, while diminishing the negative influences of reminder fatigue, information overload, and informational conflict.

3. Empowering Individuals: Investigate underlying socio-economic and behavioral principles underlying patient participation in healthcare and wellness. Develop new approaches to empowering patients and healthy individuals to participate in their own health and treatment such as custom-educating, accessing and visualizing health data and knowledge, understanding how people participate in their own health treatment depending on socio-economic status, gender and ethnicity, and how different forms of education and presentation of data will contribute to better health care by teams, including patients, caregivers, and providers. Develop quantitative, predictive models of patients and individuals, including the understanding of how patients and caregivers understand "empowerment", when and where it is desirable, and the limits of such empowerment. Develop novel user-tailored and context-aware human-computer interfaces for a variety of tasks including patient, family and caregiver access to EHRs and PHRs. Examine how technology can contribute to shifting of public and private incentives toward patient-centric goals.

4. Sensors, Devices and Robotics: Investigate protocols and interface standards to enable interoperable, temporally synchronized, medical prosthetic and embedded devices and those devices for continuous capture, storage, and transmission of physiological state and environmental data. Develop and evaluate assistive technology systems and devices for improved health and healthcare; such systems might incorporate sensory inputs and computational intelligence ranging from internal and external sensors, wearable prosthetics, and cognitive orthotics to surgical-assist robots and social robots. Investigate sensors, analysis tools, and activators needed to assess and limit adverse environmental effects on health and wellbeing. Develop simulation and modeling methods and software tools that aid in the design and evaluation of sophisticated medical devices and how they communicate to medical information systems in the clinic, home, and in and around the person.

These research areas are clearly not mutually exclusive and the proposed projects may address several of these. Proposals of collaborative projects with partners outside of the U.S. are also encouraged. In those cases, NSF and NIH may support the U.S. collaborator, including foreign travel to the collaborating partner(s).

NSF supports investigation of fundamental research questions with broadly applicable results. SCH supports research with humans for evaluation. Because advancing fundamental science is early-stage research, clinical trials are not appropriate and will not be funded. Research that is advanced to a stage that requires clinical trials should be submitted to agencies whose mission is to improve health.

Project Class

Proposals submitted to this solicitation must be consistent with the project class defined below:

Integrative projects (INT) undertake research addressing key application areas by solving problems in multiple scientific and engineering domains, incorporating at least two out of the three areas of CISE, ENG, and SBE. These projects are expected to advance understanding about how technology and engineering, combined with advancements in computer, behavioral and social science, would support transformations in healthcare and improve quality of life. Projects with this broader scope are expected to include several students and postdocs. INT project descriptions must be comprehensive and well-integrated, and should make a convincing case that the collaborative contributions of the project team will be greater than the sum of each of their individual contributions. Collaborations with researchers in the health application domains are required. Such collaborations typically involve multiple institutions but are not required to be so organized. Since the successes of collaborative research efforts are known to depend on thoughtful collaboration mechanisms that regularly bring together the various participants of the project, a Collaboration Plan is **required** for each INT proposal. INT projects will be funded up to a 4-year period up to a total of $500,000 per year. It is expected that few awards will be made at the upper end of this range. The proposed budget should be commensurate with the corresponding scope of work. Rationale must be provided to explain why a budget of the requested size is required to carry out the proposed work.

III. AWARD INFORMATION

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds. An estimated 8 to 16 projects will be funded, subject to availability of funds. Up to $20,000,000 will be invested in proposals submitted to this solicitation, subject to availability of funds.

All awards under this solicitation made by NSF will be as grants or cooperative agreements or other contract vehicles as determined by the supporting agency. All awards under this solicitation made by NIH will be as grants or cooperative agreements. One size of projects are expected to be funded under this solicitation:

> Integrative (INT) projects: Multidisciplinary teams of investigators may propose projects with funding up to $500,000 total cost per year for up to four years.

Scientists from all disciplines are encouraged to participate. Projects will be awarded depending on the availability of funds and with consideration for creating a balanced overall portfolio.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

> Proposals may only be submitted by the following:
>
> - Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in, the US acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
> - Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

Who May Serve as PI:

> There are no restrictions or limits.

Limit on Number of Proposals per Organization:

> There are no restrictions or limits.

Limit on Number of Proposals per PI or Co-PI: 2

> An investigator may participate as Principal Investigator (PI), co-Principal Investigator (co-PI), Project Director (PD), Senior Personnel or Consultant in **no more than two** proposals submitted in response to this solicitation. **These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently**. In the event that an individual exceeds this limit, proposals received within the limit will be accepted based on earliest date and time of proposal submission (i.e., the first two proposals received will be accepted, and the remainder will be returned without review). **No exceptions will be made.**
>
> Proposals submitted in response to this solicitation may not duplicate or be substantially similar to other proposals concurrently under consideration by NSF or NIH programs or study sections. Duplicate or substantially similar proposals will be returned without review. NIH will not accept any application that is essentially the same as one already reviewed within the past thirty-seven months (as described in the *NIH Grants Policy Statement*), except for submission:
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> - To an NIH Requests for Applications (RFA) of an application that was submitted previously as an investigator-initiated application but not paid;
> - Of an NIH investigator-initiated application that was originally submitted to an RFA but not paid; or
> - Of an NIH application with a changed grant activity code.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (http://www.nsf.gov/publications/pub_summ.jsp?

). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. Chapter II, Section D.5 of the Grant Proposal Guide provides additional information on collaborative proposals.

See Chapter II.C.2 of the GPG for guidance on the required sections of a full research proposal submitted to NSF. Please note that the proposal preparation instructions provided in this program solicitation may deviate from the GPG instructions.

The following information SUPPLEMENTS (not replaces) the guidelines provided in the NSF Grant Proposal Guide (GPG).

Proposal Titles: Proposal titles must begin with **SCH**, followed by a colon, then **INT**, followed by a colon and the title of the project (i.e., **SCH: INT: Title**). If you submit a proposal as part of a set of collaborative proposals, the title of the proposal should begin with SCH followed by a colon, the project class followed by a colon, then "Collaborative Research" followed by a colon, and the title. For example, if you are submitting a collaborative set of proposals for an INT project, then the title of each would be **SCH: INT: Collaborative Research: Title.**

Proposals from PIs in institutions that have RUI (Research in Undergraduate Institutions) eligibility should have a proposal title that begins with SCH, followed by a colon, then the project class followed by a colon, then "RUI" followed by a colon, then "Collaborative Research" (if applicable) followed by a colon, and then the title, for example, **SCH: INT: RUI: Collaborative Research: Title.**

Project Summary (1 page limit): At the beginning of the Overview section of the Project Summary enter the title of the SCH project, the name of the PI and the lead institution. Provide a summary description of the SCH project, including its transformative research and education goals, and the community (communities) that will be impacted by its results.

Project Description: There is a 15 page limit for all proposals. Within the project description, include a plan to evaluate the technologies developed, which could include results from applications of that technology to specific domains, efficacy studies, assessments of learning and engagement, and other such activities. The **Evaluation Plan** should be appropriate for the size and scope of the project.

Please note that the Collaboration Plan must be submitted as a Supplementary Document for this solicitation; see guidance below.

Proposal Budget: It is expected that the principal investigators and other team members for each funded project will attend an SCH Principal Investigators' (PI) meeting annually to present project research findings and capacity building or community outreach activities. Requested budgets should include funds for travel to this event.

Supplementary Documents: Supplementary documents are limited to the specific types of documentation listed in the GPG, with the following exceptions:

(1) Collaboration Plan. Proposals **must** include a Collaboration Plan. **The Collaboration Plan must be submitted as a Supplementary Document and cannot exceed two pages.** *Proposals that do not include a properly-labeled and complete Collaboration Plan will be returned without review*. The Collaboration Plan must be labeled "Collaboration Plan" and must include: 1) the specific roles of the collaborating PIs, Co-PIs, other Senior Personnel and paid consultants at all organizations involved; 2) how the project will be managed across institutions and disciplines; 3) identification of the specific collaboration mechanisms that will enable cross-institution and/or cross-discipline scientific integration (e.g., workshops, graduate student exchange, project meetings at conferences, use of videoconferencing and other communication tools, software repositories, etc.), and 4) specific references to the budget line items that support these collaboration mechanisms.

(2) Human Subjects Protection. Proposals involving human subjects should include a supplementary document of no more than two pages in length summarizing potential risks to human subjects; plans for recruitment and informed consent; inclusion of women, minorities, and children; and planned procedures to protect against or minimize potential risks.

(3) Vertebrate Animals. Proposals involving vertebrate animals should include a supplementary document of no more than two pages in length that addresses the following points:

  a. Detailed description and justification of the proposed use of the animals, including species, strains, ages, sex, and number to be used;

  b. Information on the veterinary care of the animals;

  c. Description of procedures for minimizing discomfort, distress, pain, and injury; and

  d. Method of euthanasia and the reasons for its selection.

(4) Data Management Plan. All proposals must include a supplementary document no more than two pages in length labeled "Data Management Plan". This supplementary document should describe how the proposal will conform to NSF policy on the dissemination and sharing of research results.

See Chapter II.C.2.j of the GPG for full policy implementation.

For additional information on the Dissemination and Sharing of Research Results, see: http://www.nsf.gov/bfa/dias/policy/dmp.jsp.

For specific guidance for Data Management Plans submitted to the Directorate for Computer and Information Science and Engineering (CISE) see: http://www.nsf.gov/cise/cise_dmp.jsp.

(5) Documentation of Collaborative Arrangements of Significance to the Proposal through Letters of Collaboration:

There are two types of collaboration, one involving individuals/organizations that are included in the budget, and the other involving individuals/organizations that are not included in the budget. Collaborations that are included in the budget should be described in the Project Description. Any substantial collaboration with individuals/organizations not included in the budget should be described in the Facilities, Equipment and Other Resources section of the proposal (see GPG Chapter II.C.2.i). In either case, whether or not the collaborator is included in the budget, **a letter of collaboration from each named participating organization other than the**

submitting lead, non-lead, and/or subawardee institutions must be provided at the time of submission of the proposal. Such letters simply confirm the commitment to collaborate, as illustrated in the recommended format provided in the GPG. They must explicitly state the nature of the collaboration, appear on the organization's letterhead and be signed by the appropriate organizational representative. These letters must not otherwise deviate from the restrictions and requirements set forth in the GPG, Chapter II.C.2.j.

Please note that letters of support may not be submitted. Such letters do not document collaborative arrangements of significance to the project, but primarily convey a sense of enthusiasm for the project and/or highlight the qualifications of the PI or co-PI. **Reviewers will be instructed not to consider these letters of support in reviewing the merits of the proposal.**

(6) List of Project Personnel and Partner Institutions (Note - In collaborative proposals, only the lead institution should provide this information)

Provide current, accurate information for all personnel and institutions involved in the project. NSF staff will use this information in the merit review process to manage conflicts of interest. The list should include all PIs, Co-PIs, Senior Personnel, paid/unpaid Consultants or Collaborators, Subawardees, Postdocs, and project-level advisory committee members. This list should be numbered and include (in this order) Full name, Organization(s), and Role in the project, with each item separated by a semi-colon. Each person listed should start a new numbered line. For example:

1. Mary Smith; XYZ University; PI
2. John Jones; University of PQR; Senior Personnel
3. Jane Brown; XYZ University; Postdoc
4. Bob Adams; ABC Inc.; Paid Consultant
5. Mary White; Welldone Institution; Unpaid Collaborator
6. Tim Green; ZZZ University; Subawardee

In addition, upload the following information where relevant to the Supplementary Documents Section:

(7) Postdoctoral Mentoring Plan (if applicable)

Each proposal that requests funding to support postdoctoral researchers must include, as a supplementary document, a description of the mentoring activities that will be provided for such individuals. Please be advised that if required, FastLane will not permit submission of a proposal that is missing a Postdoctoral Researcher Mentoring Plan. See Chapter II.C.2.j (http://www.nsf.gov/pubs/policydocs/pappguide/nsf13001/gpg_2.jsp#IIC2j) of the GPG for further information about the implementation of this requirement.

(8) Other Specialized Information

RUI Proposals: PIs from predominantly undergraduate institutions should include a Research in Undergraduate Institutions (RUI) Impact Statement and Certification of RUI Eligibility in this Section.

Single Copy Documents

Collaborators and Other Affiliations Information:

For this solicitation, the *Collaborators & Other Affiliations* information specified in the *GPG* should be submitted using the spreadsheet template found at: http://www.nsf.gov/cise/collab/ . For each proposal, a completed spreadsheet for each PI, co-PI, or senior personnel must be uploaded directly into Fastlane in .xls or .xlsx format as a "Collaborator and Other Affiliations" Single Copy Document. NSF staff use this information in the merit review process to help manage reviewer selection; the spreadsheet will ensure the Collaborator and Other Affiliations information has a common, searchable format.

Note the distinction to (6) above for Supplementary Documents: the listing of all project participants is collected by the project lead and entered as a Supplementary Document, which is then automatically included with all proposals in a project. The Collaborators and Other Affiliations are entered for each participant within each proposal and, as Single Copy Documents, are available only to NSF staff. Collaborators and Other Affiliations due to participants listed on (6) that are not PIs, co-PIs, or senior personnel can be uploaded under Additional Single Copy Documents using Transfer File.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Indirect Cost (F&A) Limitations:

For NSF, Grant Proposal Guide (GPG) Guidelines apply.

For NIH, indirect costs on foreign subawards/subcontracts will be limited to eight (8) percent.

Other Budgetary Limitations:

Budgets should include travel funds to attend one SCH Principal Investigators' meeting annually for the project principal investigators and other team members as appropriate from all collaborating institutions.

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

    December 08, 2016

        Integrative (INT) Proposals

D. FastLane/Grants.gov Requirements

For Proposals Submitted Via FastLane:

> To prepare and submit a proposal via FastLane, see detailed technical instructions available at: https://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

> Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: http://www.grants.gov/web/grants/applicants.html. In addition, the NSF Grants.gov Application Guide (see link in Section V.A) provides instructions regarding the technical preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

> **Submitting the Proposal:** Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

Proposers that submitted via FastLane are strongly encouraged to use FastLane to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in the GPG as Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: http://www.nsf.gov/bfa/dias/policy/merit_review/.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014-2018*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

NSF's mission calls for the broadening of opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and

supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (GPG Chapter II.C.2.d.i. contains additional information for use by proposers in development of the Project Description section of the proposal.) Reviewers are strongly encouraged to review the criteria, including GPG Chapter II.C.2.d.i., prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
   a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
   b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

In general, group and multi-institutional proposals requiring significant resources to generate effects are expected to show their potential for novel functionalities and features, user-friendliness, interoperability, scaling, extensibility, and durability, patient-centeredness, machine learning, and direct application to advancing the nation's health. These proposals should, as appropriate, include active participation from healthcare professionals, client groups, technology vendors, and potential commercial enterprises or application beneficiaries. The proposals will also be evaluated based on:

Infrastructure planning and software sharing: Per NSF policy, the dissemination plan for using and sharing the technological products of this research, with appropriate timelines, will be assessed for its potential effectiveness and impact on other projects and the SCH overall. For NSF, reviewers will also be instructed to evaluate the proposed activities, their utility to the proposed research, and the SCH goals more broadly.

Survivability: Credibility of the plan for continuing the development and transferring the artifacts and know-how after the expiration of research funding including steps toward commercialization and translation to the bedside.

Impact: Potential for general impact on the development of techniques, environments or paradigms that will advance the provision of a system with patient-centered, evidence-based, prevention-focused and/or personalized care.

Collaboration and Management: The extent to which the group is integrated, has a common focus and the quality of management and collaboration plans.

Education and Training: The degree to which research and education are integrated and activities involve participation and training of students. Reviewers will assess the potential for involvement of motivated populations of young researchers in advancing health

through science, technology, and behavior.

Subsequent to the uniform panel reviews, a process of selection by the supporting agencies will be conducted. When considering their funding choices appropriate to the interests and goals described in the solicitation, each agency may apply and prioritize the criteria to highlight the specific objectives of their programs and activities, although all of the following are considered by each of the supporting agencies when applicable.

Additional NIH Review Criteria

The mission of the NIH is to support science in pursuit of knowledge about the biology and behavior of living systems and to apply that knowledge to extend healthy life and reduce the burdens of illness and disability. In their evaluations of scientific merit, reviewers will be asked to consider the following criteria that are used by NIH:

Overall Impact. Reviewers will provide an overall impact/priority score and criterion scores to reflect their assessment of the likelihood for the project to exert a sustained, powerful influence on the research field(s) involved, in consideration of the following five core review criteria, and additional review criteria (as applicable for the project proposed).

Significance. Does the project address an important problem or a critical barrier to progress in the field? If the aims of the project are achieved, how will scientific knowledge, technical capability, and/or clinical practice be improved? How will successful completion of the aims change the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field?

Investigator(s). Are the PD/PIs, collaborators, and other researchers well suited to the project? If Early Stage Investigators or New Investigators, do they have appropriate experience and training? If established, have they demonstrated an ongoing record of accomplishments that have advanced their field(s)? If the project is collaborative or multi-PD/PI, do the investigators have complementary and integrated expertise; are their leadership approach, governance and organizational structure appropriate for the project?

Innovation. Does the application challenge and seek to shift current research or clinical practice paradigms by utilizing novel theoretical concepts, approaches or methodologies, instrumentation, or interventions? Are the concepts, approaches or methodologies, instrumentation, or interventions novel to one field of research or novel in a broad sense? Is a refinement, improvement, or new application of theoretical concepts, approaches or methodologies, instrumentation, or interventions proposed?

Approach. Are the overall strategy, methodology, and analyses well-reasoned and appropriate to accomplish the specific aims of the project? Are potential problems, alternative strategies, and benchmarks for success presented? If the project is in the early stages of development, will the strategy establish feasibility and will particularly risky aspects be managed? If the project involves clinical research, are the plans for 1) protection of human subjects from research risks, and 2) inclusion of minorities and members of both sexes/genders, as well as the inclusion of children, justified in terms of the scientific goals and research strategy proposed?

Environment. Will the scientific environment in which the work will be done contribute to the probability of success? Are the institutional support, equipment and other physical resources available to the investigators adequate for the project proposed? Will the project benefit from unique features of the scientific environment, subject populations, or collaborative arrangements? Where applicable, the following items will also be considered:

Protections for Human Subjects. For research that involves human subjects but does not involve one of the six categories of research that are exempt under 45 CFR Part 46, the committee will evaluate the justification for involvement of human subjects and the proposed protections from research risk relating to their participation according to the following five review criteria: 1) risk to subjects, 2) adequacy of protection against risks, 3) potential benefits to the subjects and others, 4) importance of the knowledge to be gained, and 5) data and safety monitoring. For research that involves human subjects and meets the criteria for one or more of the six categories of research that are exempt under 45 CFR Part 46, the committee will evaluate: 1) the justification for the exemption, 2) human subjects involvement and characteristics, and 3) sources of materials. For additional information on review of the Human Subjects section, please refer to the Human Subjects Protection and Inclusion Guidelines.

Inclusion of Women, Minorities, and Children. When the proposed project involves clinical research, the committee will evaluate the proposed plans for inclusion of minorities and members of both genders, as well as the inclusion of children.

Vertebrate Animals. The committee will evaluate the involvement of live vertebrate animals as part of the scientific assessment according to the following five points: 1) proposed use of the animals, and species, strains, ages, sex, and numbers to be used; 2) justifications for the use of animals and for the appropriateness of the species and numbers proposed; 3) adequacy of veterinary care; 4) procedures for limiting discomfort, distress, pain and injury to that which is unavoidable in the conduct of scientifically sound research including the use of analgesic, anesthetic, and tranquilizing drugs and/or comfortable restraining devices; and 5) methods of euthanasia and reason for selection if not consistent with the AVMA Guidelines on Euthanasia. For additional information, see http://grants.nih.gov/grants/olaw/VASchecklist.pdf.

Biohazards. Reviewers will assess whether materials or procedures proposed are potentially hazardous to research personnel and/or the environment, and if needed, determine whether adequate protection is proposed.

Budget and Period of Support
Reviewers will consider whether the budget and the requested period of support are fully justified and reasonable in relation to the proposed research.

For those proposals that are selected for funding consideration by participating NIH Institutes, the NIH will ask the applicant(s) to resubmit the proposal in an NIH-approved format directly to the Center for Scientific Review (CSR) at the NIH. Each of these NIH applications will be accompanied by a cover letter that associates the application with SCH. Applicants will not be allowed to increase the proposed budget or change the scientific content of the application in the resubmission to the NIH. These NIH applications, along with the summary statements generated based on the review, will be entered into the NIH IMPAC-II system.

Additional Joint NSF and NIH Review Criteria:

NSF and NIH Plans for Data Management and Sharing of the Products of Research.

Consistent with NSF policy, the required Data Management and Sharing of Products of Research Plans that are described below will be evaluated as part of the proposal review process.

Data Management Plan. Per NSF policy, all SCH proposals must have a Data Management Plan. Proposals must include a supplementary document of no more than two pages labeled "Data Management Plan". This supplement should describe how the proposal will manage its data and share research results and may include:

1. the types of data, samples, physical collections, software, curriculum materials, and other materials to be produced in the

course of the project;

2. the standards to be used for data and metadata format and content (where existing standards are absent or deemed inadequate, this should be documented along with any proposed solutions or remedies);

3. policies for access and sharing including provisions for appropriate protection of privacy, confidentiality, security, intellectual property, or other rights or requirements;

4. policies and provisions for re-use, re-distribution, and the production of derivatives; and

5. plans for archiving data, samples, and other research products, and for preservation of access to them.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review and special interagency considerations.

All proposals will have a NSF-led peer review with agency representatives from NSF and NIH. These peer reviews yield the reviews, panel summary and NIH score for each proposal.

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

NIH:

For those proposals that are selected for potential funding by participating NIH Institutes, the PI will be required to resubmit the proposal in an NIH-approved format directly to the Center for Scientific Review (http://www.csr.nih.gov/) of the NIH. PIs invited to resubmit to NIH will receive further information on resubmission procedures from NIH. An applicant will not be allowed to increase the proposed budget or change the scientific content of the proposal in the resubmission to the NIH as an NIH application. Indirect costs on any foreign subawards/subcontracts will be limited to eight (8) percent. These NIH applications will be entered into the NIH IMPAC II system. The results of the review will be presented to the involved Institutes' National Advisory Councils for the second level of review. Subsequent to the Council reviews, NIH Institutes will make their funding determinations and selected awards will be made. Subsequent grant administration procedures for NIH awardees, including those related to New and Early Stage Investigators (http://www.niaid.nih.gov/researchfunding/grant/Pages/aag.aspx), will be in accordance with the policies of NIH. Applications selected for NIH funding will use the NIH funding mechanisms.

Proposals that are funded by NIH are expected to be renewed as competing continuing applications. PIs should contact their NIH Program Officer for additional information. For information purposes, NIH PIs may wish to consult the NIAID web site, "All about Grants," which provides excellent generic information about all aspects of NIH grantsmanship, including competitive renewals (http://www.niaid.nih.gov/researchfunding/grant/Pages/aag.aspx).

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process).

B. Award Conditions

An NSF award consists of: (1) the award notice, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the

award notice; (4) the applicable award conditions, such as Grant General Conditions (GC-1)*; or Research Terms and Conditions* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award notice. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

Special Award Conditions:

NIH Award Conditions: Contact the cognizant NIH organization program officer for additional information.

Special Award Conditions: Attribution of support in publications must acknowledge the joint program, as well as the funding organization and award number, by including the phrase, "as part of the NSF/NIH Smart and Connected Health Program."

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

NSF:

Additional data may be required for NSF sponsored Cooperative Agreements.

Proposals which are initially funded by NSF at a level of $500,000 of total costs per year for three or more years will be evaluated based on the proposed work plan by teams of experts periodically through the term of the project to determine performance levels. Funding for the balance of the project term may be revised based on this evaluation. All publications, reports, data and other output from all awards must be prepared in digital format and meet general requirements for storage, indexing, searching and retrieval.

NIH:

Contact the cognizant organization program officer for additional information.

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- Wendy Nilsen, Program Contact: Directorate for Computer and Information Science and Engineering, Division of Information and Intelligent Systems, 1125, telephone: (703) 292-2568, email: wnilsen@nsf.gov

- Jack Brassil, Program Contact: Directorate for Computer and Information Science and Engineering, Division of Computer and Network Systems, 1175, telephone: (703) 292-8950, email: jbrassil@nsf.gov

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- Partha Bhattacharyya, National Institute on Aging, NIH, telephone: (301) 496-3131, email: bhattacharyyap@mail.nih.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on NSF's website.

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this mechanism. Further information on Grants.gov may be obtained at http://www.grants.gov.

Main Websites for the Participating Agencies:

NATIONAL SCIENCE FOUNDATION

http://www.nsf.gov

NATIONAL INSTITUTES OF HEALTH

http://nih.gov/

PUBLIC BRIEFINGS

One or more collaborative webinar briefings with question and answer functionality will be held prior to the first submission deadline date. Schedules will be posted on the sponsor solicitation web sites.

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