National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230

NSF 14-096

Dear Colleague Letter - Submission of I/UCRC Proposals in Response to NSF 13-594 in Areas Related to Medical Cyber-Physical Systems (CPS)

Date: June 10, 2014

Dear Colleagues:

The National Science Foundation (NSF) Industry/University Cooperative Research Centers (I/UCRC) Program has for over 30 years fostered long-term partnerships among academe, industry, and government in various technology sectors through center-scale activities. These partnerships developed through the cooperative execution of precompetitive research, strengthen the U.S. innovation ecosystem and competitiveness. Precompetitive research conducted by I/UCRCs addresses application-inspired fundamental topics that industry recognizes as longer term challenges; industry members benefit from collaboration with academic partners in the definition and execution of the corresponding research. NSF provides catalyzing investment to the centers, which are primarily supported by industrial members and other stakeholders. The research carried out at each center is of interest to both the center faculty and the center's industry members. I/UCRCs contribute to the nation's research infrastructure base and enhance the intellectual capacity of the engineering and science workforce through the integration of research and education. As appropriate, I/UCRCs establish international collaborations to advance these goals within the global context.

Cyber-Physical Systems (CPS) are smart networked systems with embedded sensors, processors and actuators that are designed to sense and interact with the physical world (including the human users), and support real-time, guaranteed performance in safety-critical applications. In CPS systems, the joint behavior of the "cyber" and "physical" elements of the system is critical - computing, control, sensing and networking are deeply integrated into every component, and the actions of components and systems must be carefully orchestrated. CPS are increasingly prevalent in many of the systems with which we interact on a daily basis, including medical devices, intelligent transportation systems, manufacturing systems, and energy systems. Foundational precompetitive research in CPS is important to develop breakthroughs that enable secure and safe designs that meet critical performance guarantees. The I/UCRC model in which industry members pool and apply their funds to center projects that address shared research challenges can be enabling to such nascent fields by leveraging the investment and reducing the risk for each participating member organization.

Through this Dear Colleague Letter (DCL), to foster collaborations between industry and academe in the field of medical CPS, including security NSF welcomes and encourages proposals in response to NSF 13-594 in this area. CPS research is revealing numerous opportunities and challenges in medicine and biomedical engineering. Potential areas of precompetitive research that are of interest include, but are not limited to:

- Intelligent operating rooms and hospitals;
- Image-guided surgery and therapy;
- Fluid flow control for medicine and biological assays;
- Physical and neural prostheses;
- Networked medical devices and systems that may be dynamically reconfigured, distributed, and

interacting with patients and caregivers in complex environments. Examples include infusion pumps for sedation, ventilators and oxygen delivery systems for respiration support, medical simulators, and a variety of sensors to monitor patient condition that are used in many operating rooms;
- Methodologies for the design, development, and operation of safe, secure, certifiable and reliable medical CPS, including novel software and hardware capabilities for access control, device authorization, data security and privacy, "black box" recording, and entire system analysis;
- Cognition and neuroscience capabilities for understanding and exploiting the fundamental principles of human motor functions in engineered systems such as brain machine interfaces, therapeutic and entertainment robotics, orthotics and exoskeletons, and prosthetics. Examples include optimal filtering, stochastic control algorithms, and large-scale probabilistic computing structures in dealing with uncertainty; and
- Innovative designs and architectures for biocompatible and implantable devices.

Examples include "smart skin," minimally-invasive embedded devices, health-sensing patches, robotic prosthetics, artificial retina, ingestible endoscopy capsules, and "band-aid" cardiographs to overcome wiring and form-factor complexities.

The above list is provided for illustrative purposes only. Any precompetitive research areas that enhance the translation of basic research in cyber-physical systems, engineering processes and software for medical and healthcare applications would he considered.

Please contact one of the following program officials if you have questions about this 1/UCRC funding opportunity:

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Sincerely,

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