Planning Meeting for the National NSF Workshop on Medical Device Innovation Using Cyber Physical Systems
July 18 - 19, 2012 • Arlington, VA

- Participants developed agenda topics and speakers for a full workshop on Medical Device Innovation, intended to be sponsored by the NSF in Spring 2013.

  - Clinical experts were invited to define healthcare challenges that can benefit from advanced CPS-enabled technologies.
  - CS&E experts were invited to describe emerging technologies that might exist in healthcare or be applicable to health care.
  - Meeting was convened under an NSF conference grant to Massachusetts General Hospital / P.I. Julian Goldman

NSF Conference Grant

Planning Committee:

o   Julian M. Goldman, MD, Mass General Hospital / MD PnP Research Program – Chair

o   John Baras, University of Maryland

o   Insup Lee, University of Pennsylvania

o   Patrick Lincoln, SRI International

o   Banu Onaral, Drexel University

o   Hunter Peckham, Case Western Reserve University Rick Satava, University of Washington

o   Janos Sztipanovits, Vanderbilt University

o   Ron Triolo, Case Western Reserve University

o   Government:

o   Helen Gill, NSF

o   Marc Rigas, NSF Kaiming Ye, NSF

o   Grace Peng, NIH/NIBIB James Luo, NIH/NIBIB Kamran Sayrafian, NIST Sandy Weininger, FDA

o   Staff:

o   Frankie King, Vanderbilt (VO)

o   Joan Stanley, NCO NRD

o   Sue Whitehead, Mass General Hospital (MD PnP)

Agenda
Day 1

Introduction
- Julian Goldman, Helen Gill

Vision of Full Workshop and Plan for Day 1 of this planning meeting
- Julian Goldman, Helen Gill

Clinical Challenges & Opportunities: Speakers & Q&A
- Harvey Rubin, Steve Schachter, David Swedlow, Perren Cobb, Cliff Dacso, Julian Goldman

New Enabling CPS Technologies: Speakers & Discussion
- John Hatcliff, Insup Lee, Pietro Valdastri, Arthur Erdman, Saibal Mukhopadhyay, Hunter Peckham, Dustin Tyler, Abhishek Murthy, William Bentley, Jeffrey Chalmers, Ron Triolo

Discussion to capture proposed goals, objectives, and topic areas for full workshop

Discussion to create breakout topic areas for Day 2

Agenda
Day 2

Three Breakout Groups meet in parallel :
- Health & Wellness, Telemonitoring
- Closed-loop Control Systems
- Reanimation, High Acuity Health Care, Surgery, Intensive Care

Report back on proposed goals, objectives, topics, speakers, invitees, content of full workshop

Recommendations for Workshop agenda, keynote speakers, session chairs, and implementation plan

Results: Three Key Workshop Topic Areas

Health & Wellness, Tele-monitoring

- Communication - moving data to analytics, analytics to control, then feeding back into wellness
- Controlling or changing behavior based on detection of abnormality or diversion from wellness , for both diagnostic and monitoring purposes
- Personal set of time data, could include what is normal for patient's age group or gender, epidemiologic patterns, etc.

Closed-loop Control Systems

- Both local and remote monitoring of a system; adjusting algorithms to affect outcomes
- More discussion needed on communications super-processing, future of sensing technologies

Reanimation, High Acuity Health Care, Surgery, Intensive Care

- Data streams and recommendation streams need to be integrated for faster care
- Must embrace applied mathematics and computational sciences to produce devices better at gathering data, detecting deviations on a trajectory, analyzing and reacting automatically
- Opportunity to leverage telemedicine, bringing this level of expertise to resource-poor settings, globally

Full Workshop Plan: Synergies

- Motivation for behavior modification & wellness management
- Data security and safety
- Monitoring, detection, and feedback
- "Phenomics," determining phenotypes
- Evolution of dynamic state trajectories
- Prediction of the attractors and the stable points with regard to diagnosis of phenotypes

- Integration of care from home to hospital to home
- Repair, adaptation, and regulation
- Complexity/Lack of knowledge
- Non-linearity of biological systems
- Trajectory of the system vs. robustness of the system
- Sensitivity in principal components
- Control
- Energy efficiency and electromagnetics

Full Workshop Plan

Proposed Agenda

- Concrete examples of relevant problems in healthcare that can be affected by CPS technologies

- Knowledgeable speaker presents each problem to the group of clinical and CPS experts

- Clinicians speak about clinical need, and how healthcare could be impacted with new capabilities

- Scientists discuss deployment challenges - regulatory, security, innovation and design issues

Invitees

- Clinicians

- Technology/CPS experts

- Selected industry participants

- Representatives from government agencies

Planning Meeting Participants July 18-19 2012

John Baras, U Maryland / ISR

Bill Bentley, U Maryland/Bioengineering

Jeff Chalmers, Ohio State

Perren Cobb, MD, MGH / Critical Care

Cliff Dacso, MD, Baylor College of Medicine

Arthur Erdman, U Minnesota

Julian Goldman, MD, MGH / Anesthesia

John Hatcliff, Kansas State U

Michael Kehoe, Mayo Clinic

Insup Lee, U Pennsylvania

Ken Lutchen, Boston University

Saibal Mukhopadhyay, Georgia Tech

Abhishek Murthy, SUNY Stony Brook

Jim Niemi, Wyss Institute

Arto Nurmikko, Brown

Banu Onaral, Drexel

Hunter Peckham, Case Western Reserve

Harvey Rubin, U Pennsylvania

Steve Schachter, MD, Beth Israel-Deaconess / Neurology

Scott Smolka, SUNY Stony Brook

David Swedlow, MD, 3xNell, LLC

Davood Tashayyod, Drexel

Ron Triolo, Case Western Reserve

Dustin Tyler, Case Western Reserve

Pietro Valdastri, Vanderbilt

David Wentzloff, U Michigan

Susan Whitehead, MGH / CIMIT

Representing Federal Agencies

Ted Baker, NSF / CISE

Helen Gill, NSF / CPS

Paul Jones, FDA / CDRH

Ernie Lucier, HCSS / NCO

James Luo, NIH / NIBIB

Grace Peng, NIH / NIBIB

Kamran Sayrafian, NIST

Al Wavering, NIST

Sandy Weininger, FDA / CDRH

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Mark Luker, NITRD Assoc Dir

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