National Science Foundation

NSF-Ireland Partnership: Sensors and Sensor Networks

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Partnership Pending Proposals: Sensors and Sensor Networks

- Three (3) partnership proposals in the area of “Sensors and Sensor Networks” are currently pending at NSF
- At NSF, these proposals are currently scheduled for peer review by panels to be convened by NSF
  - A proposal on environmental sensors will be reviewed by a panel to be convened by Dr. Paul Bishop (ENG)
  - Another proposal on environmental sensors will be reviewed by a panel to be convened by Dr. Clark Liu (ENG)
  - A proposal on geosensors will be reviewed by a panel to be convened by Dr. Kandace Binkley (GEO)

New Proposals: Sensors and Sensor Networks

- New partnership proposals may still be submitted.
- For NSF, these proposals should be submitted to the appropriate "standing programs" or "solicitations," by the posted deadlines for each of those programs or solicitations.
- Among the relevant Program Directors (examples) are:
  - Dr. Paul Bishop (CBET/ENG) – environmental (nano implications)
  - Dr. Clark Liu (CBET/ENG) – environmental
  - Dr. Leon Esterowitz (CBET/ENG) – biomedical
  - Dr. Alex Simonian (CBET/ENG) - biosensing
  - Dr. Shih-Chi Liu (CMMI/ENG) – civil infrastructure
  - Dr. Suhada Jayasuriya (ECCS/ENG) – nuclear
  - Dr. Maria Burka (CBET/ENG) – chemical processes
  - Dr. Zeev Rosenzweig (CHE/MPS) - chemical
  - Dr. Kandance Binkley (GEO) – geo

New Proposals:
Sensors and Sensor Networks

Program: Environmental Implications of Emerging Technologies

Program Director: Paul Bishop (ENG)

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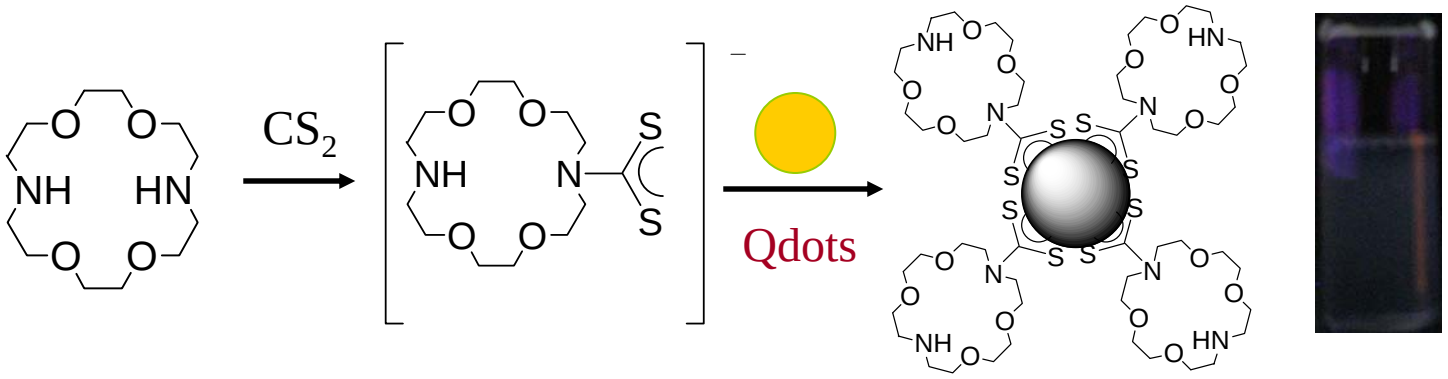
Current areas of support include:

- **Understanding and mitigating how new developments in nanotechnology will interact with the environment**
- **Sensor and sensor network technologies as they relate to the measurement of these environmental implications**

A Simple Strategy for Quantum Dot Assisted Selective Detection of Cadmium Ions

PI: Swadeshmukul Santra
University of Central Florida



Core/shell CdS:Mn/ZnS Qdots

Scheme showing synthesis of Cd ion selective ligand conjugated Qdots

- Qdots were synthesized using AOT/heptane/water water-in-oil micro-emulsion system
- Cd^{2+} ion selective MCCL (i.e. 1,10-diaza-18-crown-6) were directly attached to the Qdot surface via zero-length covalent coupling using CS_2
- MCCL quenched Qdot luminescence via electron transfer process
- MCCL to Qdot electron transfer process is reversible

New Proposals:
Sensors and Sensor Networks

Program: Environmental Engineering

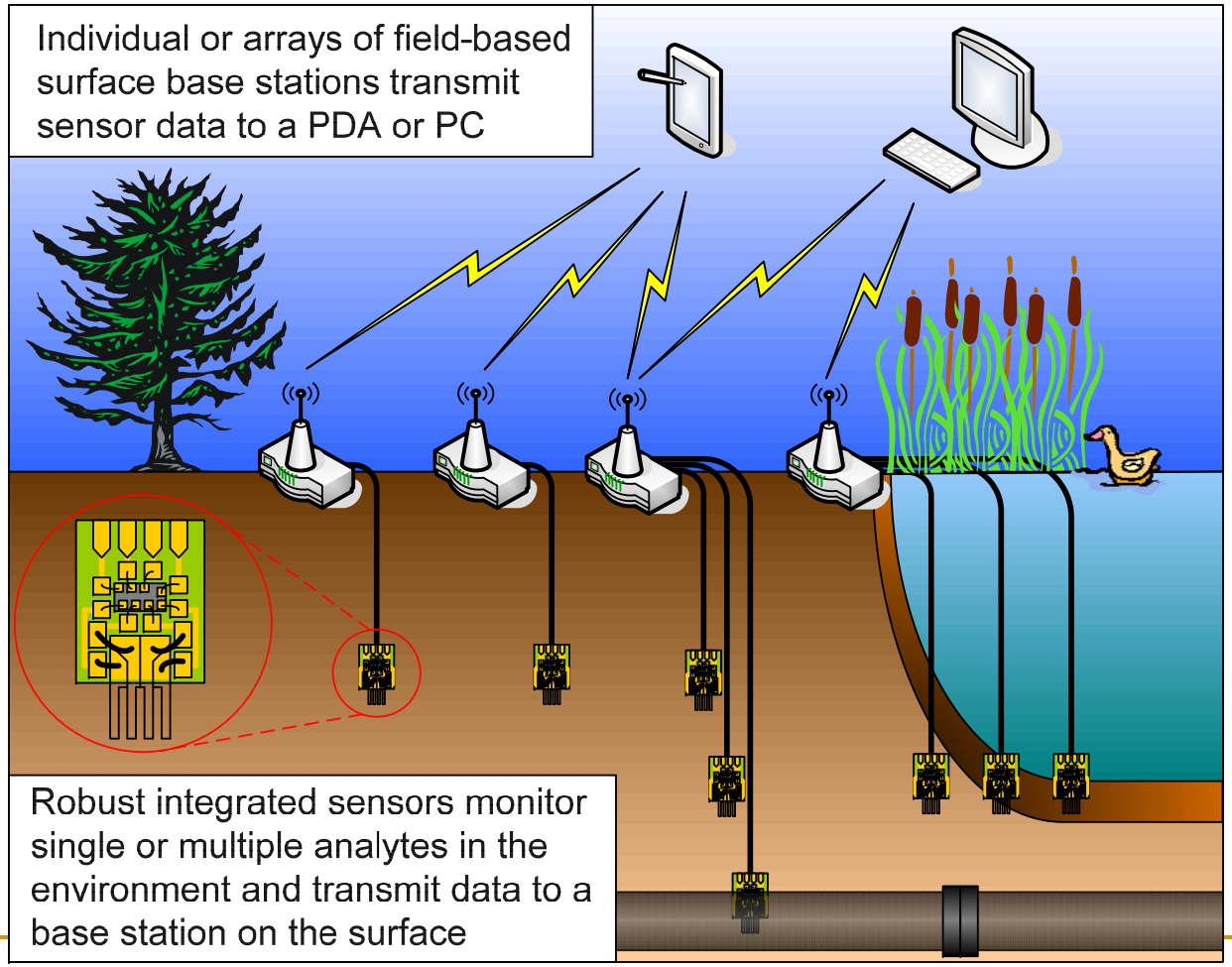
Program Director: Clark Liu (ENG)

ccliu@nsf.gov (703) 292-4480

Current areas of support include research on new and improved sensors of environmental conditions.

Proposed Field Array of Microsensors

PIs: Ian Papautsky
Paul Bishop
University of Cincinnati



New Proposals:
Sensors and Sensor Networks

Program: Biophotonics, Advanced Imaging, and Sensing for Human Health (BISH)

Program Director: Leon Esterowitz (ENG)

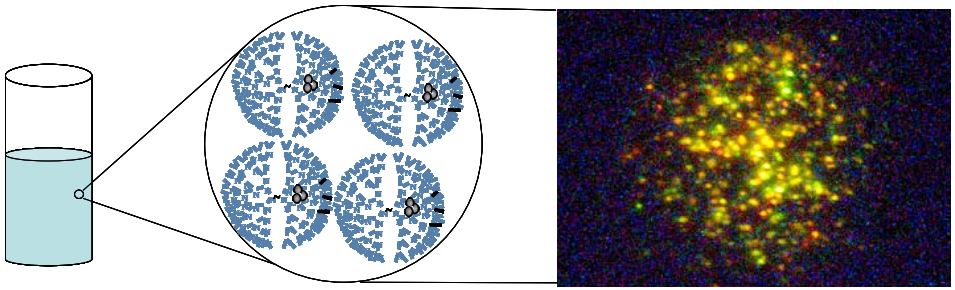
esterow@nsf.gov (703) 292-7942

The BISH program supports innovative research on biophotonic, imaging, and sensing technologies for applications in human health.

Genetic Optimization of Ultrabright Ag Nanodot Biolabels

PIs: Robert Dickson, Georgia Tech & Yih-Ling Tzeng, Emory University

Dendrimer encapsulated Ag nanodots – Idealized single biolabels



- **Emission from sub-nm, 2-8 atom Ag nanocluster**
- **Water soluble due to protective poly(amidoamine) dendrimer encapsulation**
- **Greatly reduced blinking on single molecule level**
- **Individual nanodots easily observed with weak Hg lamp excitation (>20x brighter than organic dyes)**
- **Multicolored and incredibly photostable – outstanding single molecule labeling potential**
- **Conjugatable to proteins**

New Proposals:
Sensors and Sensor Networks

Program: Biosensing and Bioengineering

Program Director: Alex Simonian (ENG)

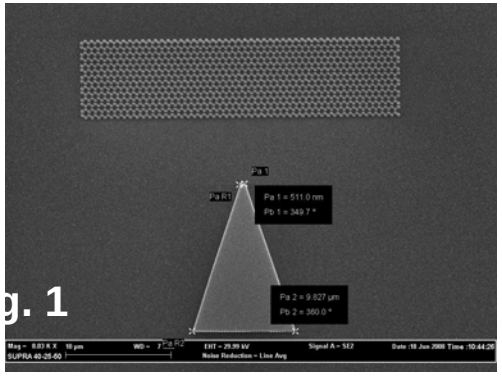
asimonia@nsf.gov (703) 292-4826

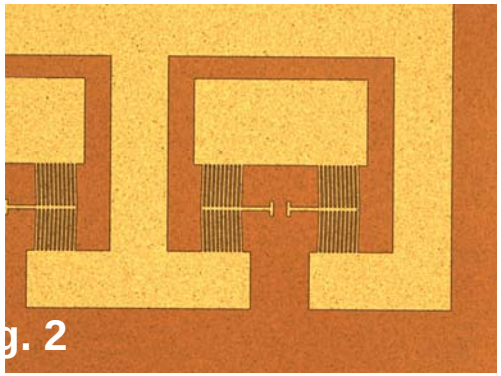
This program primarily supports fundamental and applied research with applications in biomedical, energy, environmental, and security needs.

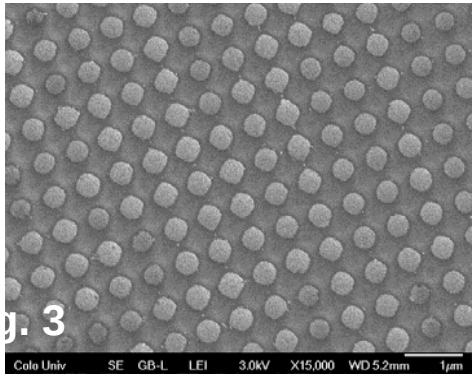
The range includes, but is not limited to, biosensors based on micro- and nanostructures, cell-based sensors, novel biorecognition elements, and bioinspired approaches.

NIRT: Active Nanostructure Enabled On-Chip Spectroscopy System

PI: Won Park, University of Colorado







Ultimate goal: On-chip spectroscopy system for cancer detection

(1) *Tunable nanostructure for focusing and frequency selection:* Fabricated tunable photonic crystal structure for focusing and spectroscopy (Fig. 1). Also fabricated mechanical actuators (Fig. 2) for mechanical tuning. Currently working on optimizing mechanical flexibility for stable operation.

(2) *New nanostructure design based on nanoclusters*: Demonstrated high-quality periodic array of nanoclusters by template-directed self-assembly (Fig. 3). The new design provides strong magnetic response at optical frequencies.

(3) *Nanoprobes for biomarker detection*: Demonstrated synthesis of nanoprobes and DNA conjugation, Demonstrated detection of point mutation both in solution and in cells, Achieved enhanced sensitivity by scattering measurements.

New Proposals:
Sensors and Sensor Networks

Program: Sensors and Sensing Systems (SSS)

Program Director: Shih C. Liu (ENG)

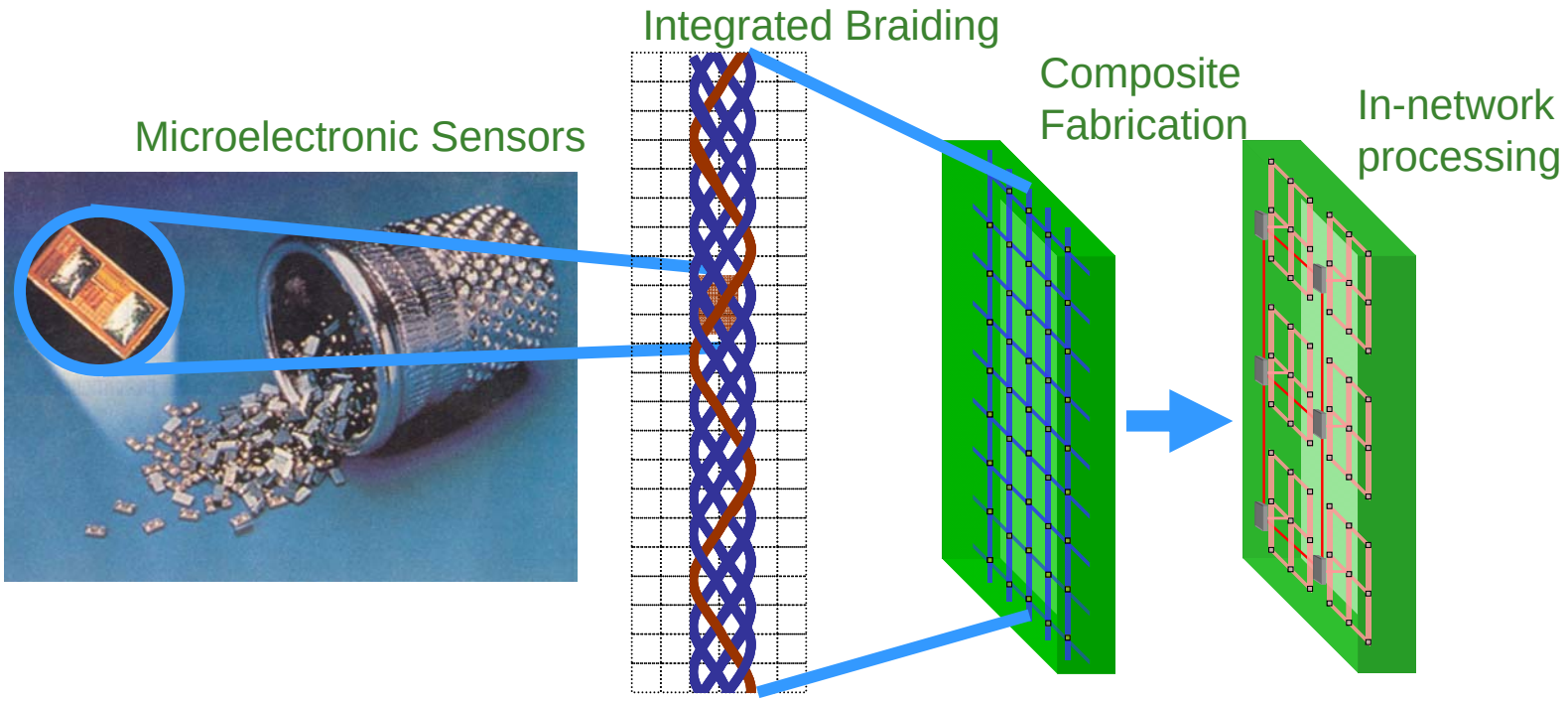
sliu@nsf.gov (703) 292-8360

The SSS program supports research on methods to acquire and use sensor data on civil, mechanical, and manufacturing systems. The program supports fundamental research on advanced actuators, sensors, wireless sensor networks, new materials and concepts for sensing applications, power generation and energy supply for sensors and sensing systems. Also of interest is research on the strategic incorporation of sensors into both natural and engineered systems to achieve effective data acquisition and on processing and transmission of sensor data.

Self-Monitoring Structural Composite Materials with Integrated Sensing Networks

PI: Sia Nemat-Nasser, David Meyer, David R. Smith
University of California – San Diego

- **Embed sensors and microcontrollers** within fiber braids and weaves used in composite fabrication
- Form networks of interacting sensor nodes to enable structural health monitoring



New Proposals:
Sensors and Sensor Networks

Solicitation: Domestic Nuclear Detection Office/ National Science Foundation Academic Research Initiative (ARI)

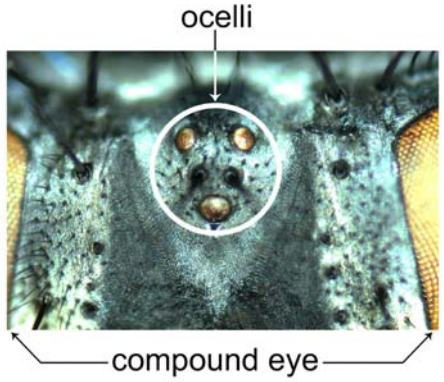
Program Director: Sudhada Jayasuriya (ENG)

sjayasur@nsf.gov (703) 292-7014

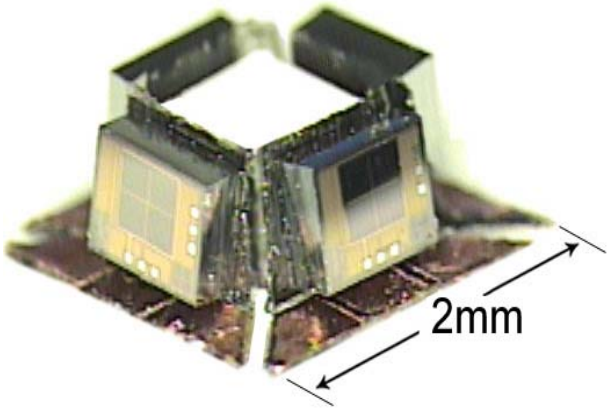
- **Joint NSF-DHS program**
- **Supports research on detection systems, individual sensors or other research that is potentially relevant to the detection of nuclear weapons, special nuclear material, radiation devices and related threats**
- **Solicitation is posted, deadline is April 1, 2009**
- **Typical grant size is $1-2 million over 4 years**

Insect Inspired Attitude Sensors for Automatic Control of a Flying Robotic Insect

PI: R. Wood, Harvard University

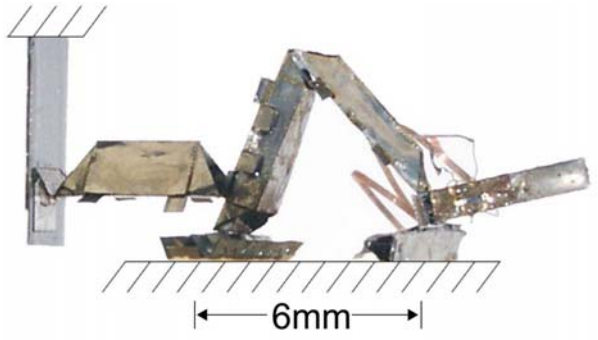


(a)



(b)

(c)



(d)

Novel insect-inspired attitude estimation sensors. The ocelli of a Calliphora (a) is a simple photoreceptor-based orientation sensor that can be recreated with discrete bare-die photodiodes (b). The mechanoreceptor-based halteres of Dipteran insects (c) can be recreated with micromechanical structures similar to the transmission of the robotic fly (d).