

Nanoscience studies how materials behave at the near-atomic level ( $10^{-9}$  or one-billionth of a meter). Many intrinsic and functional properties of biological, chemical and physical materials and processes begin at this scale. Through nanoengineering, we can help you create processes that are sustainable and efficient. Our work assists industries specializing in health care, pharmaceuticals, environmental remediation, chemical detection, functional materials, energy, electronics and more.

## Research and Capabilities

### Environmental

- Environmental health and safety of nanomaterials
- Nanomaterials for environmental remediation and water purification
- Nanoparticle-cell interactions

### Materials

- Nanomaterials for extreme environments
- Nanomaterials for energy development
- Synthesis and evaluation of self-healing materials
- Nanostructured antifouling and responsive surfaces
- Nanocomposites
- Self and directed assembly of nanomaterials
- Nanomaterials for electro- and magneto-actuated assembly and manipulation
- Nanostructured chemical sensors

### Characterization and Processing

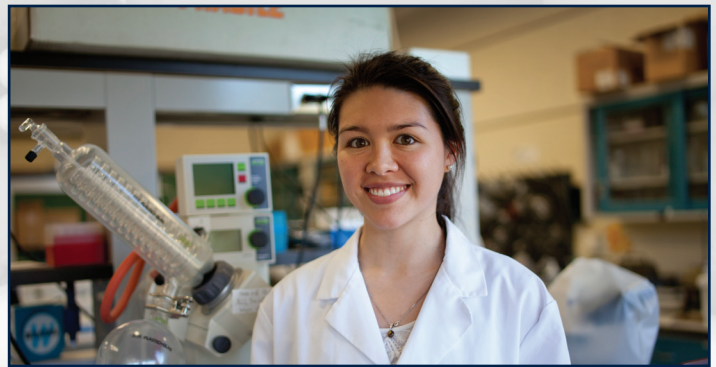
- Advanced imaging of nanomaterials and nanoparticles
- Fracture mechanics of nanomaterials
- Nanoscale thermal and electrical conductivity
- Thermomechanics of nanoscale features in microprocessing
- Nanoscale computation
- Nanoscale transport phenomena (nanofluidics)

### Health care/Pharmaceuticals

- Nano-scale disease therapeutics and diagnostics (nanotheranostics)
- Biomaterials and artificial tissue
- Point-of-care diagnostics and biosensing
- Electromagnetic-based physical nanotherapeutics
- Nanoscale biophysics
- 3-D in vitro cell culture

## Specialized Equipment

- 3-D printing
- Atomic force microscope (AFM)
- Energy dispersive x-ray spectroscopy (EDS)
- Field emission-scanning electron microscope (FE-SEM) with cryogenic capability
- Nano differential scanning calorimeter (DSC)
- Optical/fluorescence microscopy
- Static and dynamic light scattering (SLS, DLS)
- Transmission electron microscope with cryogenic capability (TEM)
- Ultraviolet-visible, fluorescence, and infrared spectroscopy
- X-ray Diffraction (XRD) system



## Specialized Laboratories

- Bionanotechnology
- Colloids and Interface
- Dynamics Photomechanics
- Electromagnetically Inspired Biomaterials and Biosystems
- Molecular Simulation
- Nanofluidics
- Pharmaceutical Engineering
- Sensors and Surfaces
- Sustainable and Environmental Technologies
- Thermomechanics and Tribology

## Our Partners

- Amgen
- BASF
- Cabot Corporation
- Ford Motor Company
- Gulf of Mexico Research Initiative
- Jenike & Johanson, Inc.
- National Institutes of Health
- National Science Foundation
- Naval Undersea Warfare Center
- Procter and Gamble
- Rhode Island Department of Transportation
- Rhode Island Space Grant Consortium



The college's Field Emission-Scanning Electron Microscope (FE-SEM) offers cryogenic capability.

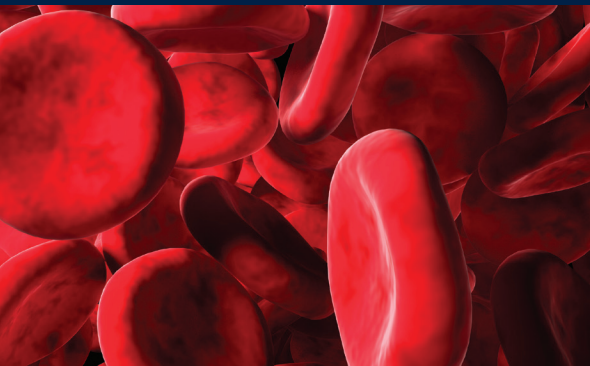
### Rhode Island Consortium for Nanoscience and Nanotechnology

Established by Congress, is a joint initiative between the University of Rhode Island and Brown University that focuses on enhancing Rhode Island's competitiveness in nanoscience and nanotechnology by fostering research collaboration, building infrastructure and promoting corporate investment. [uri.edu/nano](http://uri.edu/nano)

For more information, contact Geoffrey Bothun, Ph.D., Associate Professor & Director, Rhode Island Consortium for Nanoscience and Nanotechnology  
Department of Chemical Engineering  
[bothun@egr.uri.edu](mailto:bothun@egr.uri.edu) | 401.874.9518  
[egr.uri.edu](http://egr.uri.edu)

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To make big changes in health care, we must fully understand the human physiology. By combining expertise in electronics, sensors, chemistry and nanoparticles, researchers at the University of Rhode Island College of Engineering are innovating new ways to detect and treat illnesses.

### Our Capabilities

- Biosensors
- Biomaterials
- Biomedical image and signal analyses: algorithm and software development
- Customized assistive technologies
- Electrophysiological measurements and controls
- Embedded medical systems
- Microbial culture
- Microfluidics and lab-on-chip
- Medical devices: innovation, development and evaluation
- Mobile devices for biomedical applications
- Modeling and simulation of physiological systems
- Nanotechnologies for biomedical applications

### Specialized Equipment

- Microelectrode instrumentation for neurophysiology
- Development tools for embedded medical systems
- Instron material testing system

### Specialized Laboratories

- Assistive Technology Lab
- Biomaterials Lab
- Biomedical Instrumentation Lab
- Biomicrofluidic Lab
- Bionanotechnology Lab
- Electrophysiological Lab
- Multidisciplinary Biomedical Engineering Lab
- Neurorehabilitation Lab
- Pharmaceutical Engineering Lab
- R.I. Consortium for Nanoscience & Nanotechnology
- Thermomechanics and Tribology Lab

## Our Research

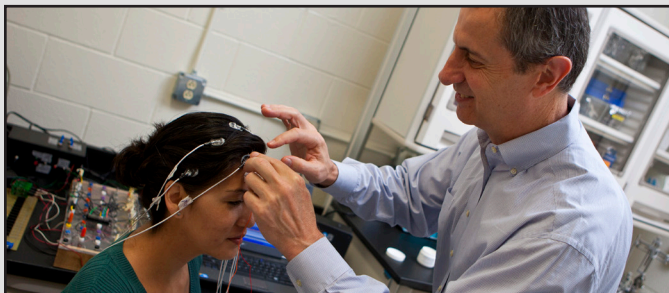
- Assistive technology
- Aerosol deposition patterns in the human respiratory tract
- Bioelectromagnetics
- Biomaterials
- Biomedical image analysis
- Biomedical instrumentation and signal processing
- Bionanotechnology
- Biotribology
- Body Area Sensor Networks
- Cardiac physiology and engineering
- Drug delivery
- Electrophysiology
- Embedded medical systems
- Environmental material deterioration and waste recovery
- Ecotoxicology
- Finite element method applications in biological tissues
- Flows near deformable boundaries in biology, medicine and biotechnology
- High-performance computational approaches for biological modeling
- Integrated models of propagation in actively deforming soft tissues
- Microfluidic technologies
- Modeling and simulation of physiological systems
- Nanomedicine
- Neuroengineering
- Neuromodulation
- Sleep apnea diagnostics
- Tissue engineering and regenerative medicine
- Wearable biosensors



Professor Ying Sun and his students develop cutting-edge assistive devices.

## Our Partners

- BioPac
- Brain Vision
- Cognionics
- Critical Path Institute / PSTC
- Cyberonics
- Electrical Geodesics Inc.
- Guger Technologies
- Massachusetts General Hospital
- Medtronic
- National Institutes of Health
- National Science Foundation
- Natus – Grass Technologies
- Naval Undersea Warfare Center
- Neuroscience Tools
- Nunnery Orthotic & Prosthetic Technologies
- Phillips
- Providence VA Medical Center
- Rhode Island Hospital
- Samsung
- Stanford Hospital



Associate Professor Walt Besio patented sensors that can predict seizures.

For more information, contact Ying Sun, Ph.D., Professor  
 Department of Electrical, Computer, and Biomedical Engineering  
[sun@ele.uri.edu](mailto:sun@ele.uri.edu) | 401.874.2515 | [egr.uri.edu](http://egr.uri.edu)

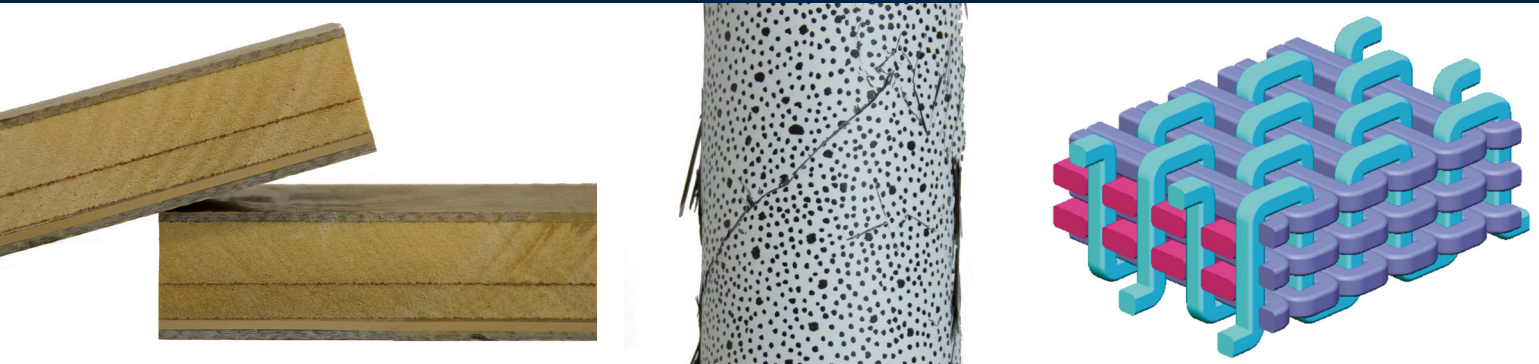
HR

Sat

BP

RR

Timer



Composite materials are wide spread in today's structural applications because they offer high strength to weight ratios, improved corrosion resistance and reduced maintenance costs. Due to the breadth of uses, these materials are often subjected to extreme conditions. At the University of Rhode Island College of Engineering, we excel at studying how composite materials behave in these extreme environments.

### Our Capabilities

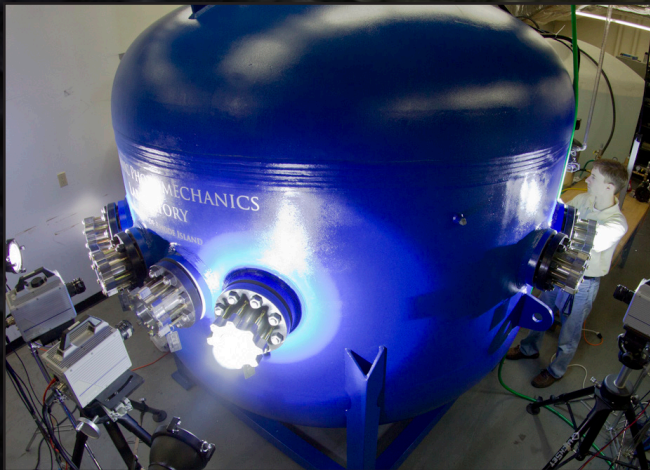
- Analysis of Fiber-Reinforced Composites
- Blast Mitigation
- Bridge Engineering
- Computational Mechanics
- Conversion Coating Setup
- Corrosion Measurement Systems
- Damage Evolution Following High Velocity Impact
- Electrochemical Impedance Spectroscopy
- Environmental Effects
- Fatigue and Failure Analysis
- Fracture Mechanics
- Hydrogen Embrittlement Testing
- Impact Mechanics and Elasticity
- Nano Materials
- Optical Methods
- Quantify Uncertainties of Composites
- Seismic and Structural Reliability
- Stress Corrosion Testing
- Thermal Analysis

### Our Research

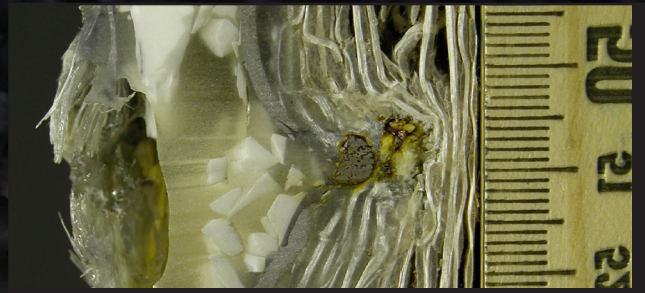
- Adhesive Bonding
- Chromate Replacement Technology
- Corrosion Mechanisms and Resistant Coatings
- Degradation of Materials
- Development and Characterization of Composite Max Phase Materials
- Failure Analysis
- Forensic Engineering
- High Temperature Dynamic Response of Layered Aerospace Structures
- Implosion of Composite Vessels
- Response of Composite Structures to Blast and Ballistic Loadings
- Surface Chemistry and Microstructural Analysis
- Seismic Vibration Analysis Implosion
- Surface Treatment for Paint Adhesion
- Thin Film Sensors
- Wave Propagation Analysis

## Specialized Equipment

- Asphalt Testing Equipment
- Ballistics Chamber
- Crafford Laser Star Laser Welding System
- Defractometer
- Digital Image Correlation Equipment
- High Pressure Underwater Experiment Environment
- High temperature Strain Testing Fixtures to 1300C
- Imacon high speed digital cameras making 200 million frames per second at 1280x1024 resolution
- Imacon 468 MkII High Speed Camera
- Instron Drop Weight Machine
- MTS and Instron Materials Testing Systems
- Perkin Elmer Multitechnique Analyzer with ESCA, SMS and Auger Spectroscopy
- Photo Lithography Capability to 1um
- Photron SA1.1 High Speed Cameras
- Scanning Electronic Microscope
- Shock Tube for Blast Loading
- Software (Abaqus, Matlab, iSIGHT, SigmaScan, SigmaPlot, SolidWorks)
- Split Hopkinson Bars
- Sputter Machine
- Thin Film Glancing Angle X-ray Diffractometer
- Transmission Electron Microscope
- UMIS III Nanoindentation System



Our high-pressure tank accommodates underwater explosions research.



A bullet striking a Kevlar-Ceramic composite.

## Specialized Laboratories

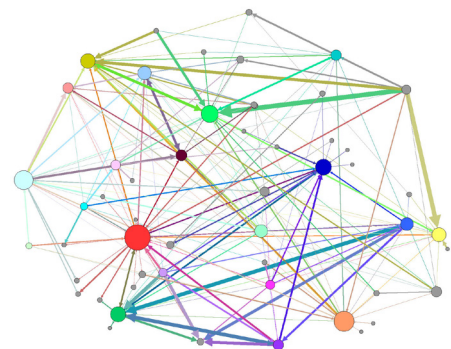
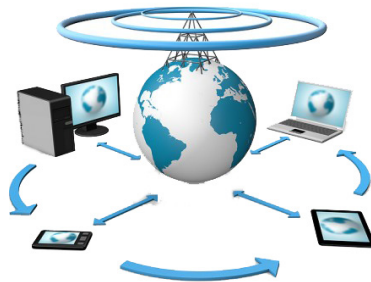
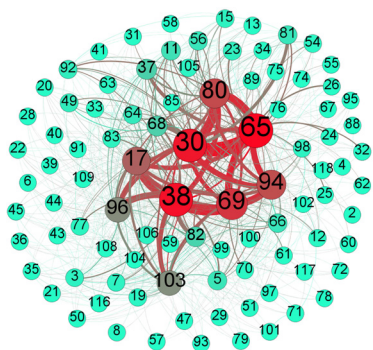
- Additive Manufacturing Laboratory
- Corrosion and Surfaces Laboratory
- Creep Testing Laboratory
- Dynamic Photomechanics Laboratory (DPML)
- High Strain Rate Testing Laboratory
- Mechanics of Materials Laboratory (MMRL)
- Sensors and Surface Technology Laboratory
- Thin Film Surface Analysis Laboratory
- Ultrafine Grain Manufacturing Facilities Laboratory
- Waterjet Research Laboratory
- Wave Tank

## Our Partners

- Air Force Research Laboratory
- Air Force Office of Scientific Research
- Army Research Office
- Center of Excellence in Undersea Technology
- Chemical Grouting Company
- Lawrence Livermore National Laboratory
- Mesoscribe Technologies
- National Aeronautics and Space Administration
- National Science Foundation
- Navy Undersea Warfare Center
- Navy Materials Science Corporation
- Office of Naval Research
- Parsons Infrastructure and Technology Group
- Pratt & Whitney
- RI Department of Transportation
- Rolls Royce Aerospace
- Synergy Corporation
- TPI Composites
- United States Air Force
- United Technologies
- U.S. Department of Homeland Security

For more information, contact Arun Shukla, Ph.D.  
Simon Ostrach Professor Mechanical, Industrial & Systems Engineering  
Department of Mechanical, Industrial & Systems Engineering  
shuklaa@egr.uri.edu | 401.874.2283 | egr.uri.edu

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Computer networks control vital business processes whether it's an automated manufacturing process, corporate payroll or processing credit card transactions. Beyond that, the Internet era ushered in the need to maintain social media reputations. At the University of Rhode Island College of Engineering, our faculty are finding new ways to protect computer networks, manage online reputations and ensure data privacy.

### Our Capabilities

#### Discover, analyze and visualize vulnerabilities in

- Smart grid
- Complex systems
- Wireless networks
- Cyber-physical systems
- Online social media

#### Develop defense solutions through

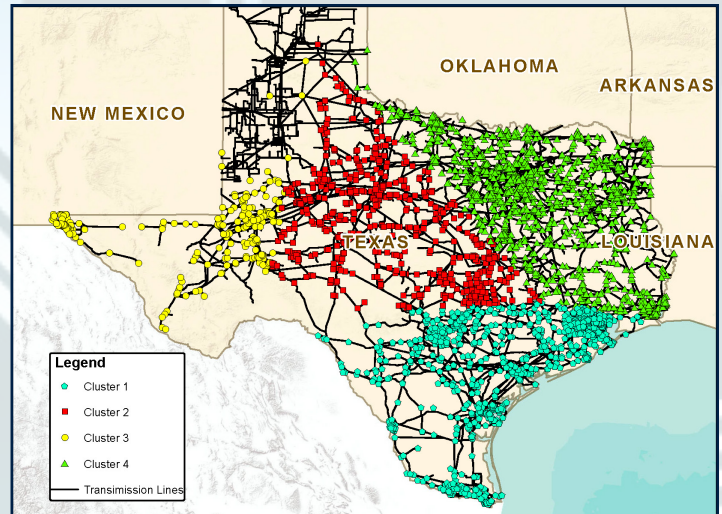
- Information security technology
- Trust management solutions
- Security Intelligence with Big Data
- Quantitative privacy/security evaluation

### Our Research

- Smart Grid
- Cyber Security in Digital Manufacturing
- Trust Management
- Data and Information Security
- Trustworthy Social Computing
- Trustworthy Biomedical Cyber-Physical Systems
- Wireless Network Security and Reliability
- Security in cognitive radio networks

## Specialized Equipment & Software

- Arc GIS/visualization tool set
- Integrated FPGA design and simulation tool set
- Network simulation and analysis environment
- Proprietary Online rating analysis tool
- PSCAD/EMTDC tool set



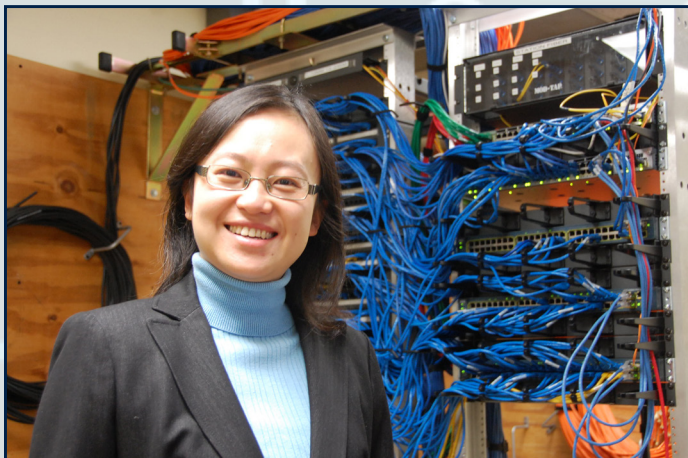
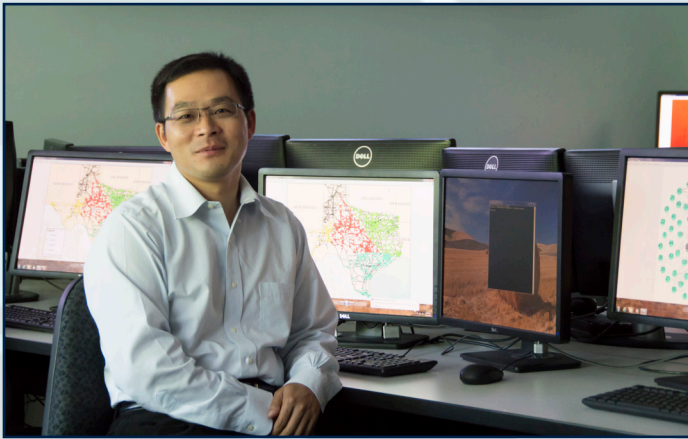
Computer models like the one above of the electric grid allow us to identify weak points in networks.

## Specialized Laboratories

- Computational Intelligence and Self-Adaptive Systems Laboratory
- Network Security and Trust Laboratory
- Digital Forensics and Cyber Security Center

## Our Partners

- Adaptive Methods
- Army Research Office
- DARPA
- mZeal Communications
- NASA
- National Science Foundation
- Utilidata



Associate Professors Haibo He, top, and Yan Sun seek to keep critical networks secure.

**The University of Rhode Island  
Digital Forensics & Cyber Security Center**  
The center brings together experts from across campus focused on securing computing systems and networks. The center supports state, national, and international public welfare through education, research, training, and service in forensic investigations and securing information systems. The center is a recognized national leader in providing a strong, cutting-edge, comprehensive program in both fields. [dfcsc.uri.edu](http://dfcsc.uri.edu)

For more information, contact Haibo He, Ph.D., Associate Professor  
Department of Electrical, Computer & Biomedical Engineering  
[he@ele.uri.edu](mailto:he@ele.uri.edu) | 401.874.5844 | [egr.uri.edu](http://egr.uri.edu)

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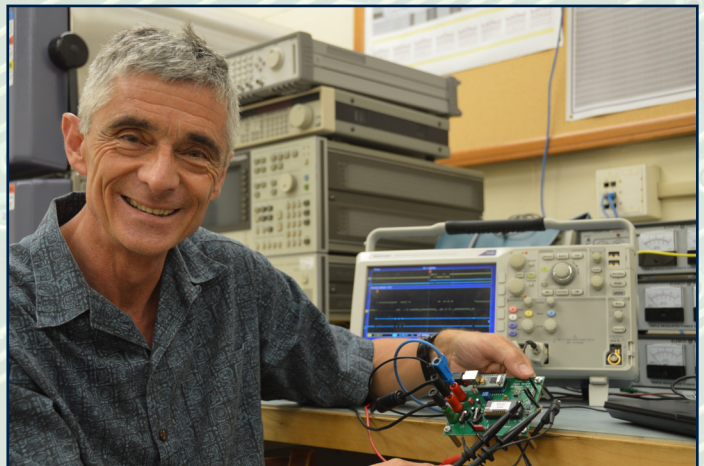
Sensors are widely used throughout our world and their uses expanding every day. They have expanded beyond the traditional fields of temperature, pressure and flow measurement to myriad uses in automobiles, airplanes, robotics, manufacturing, the home and the environment. Researchers at the University of Rhode Island are making significant strides in the development and use of sensors in medicine, environmental monitoring, explosives detection, jet engine health monitoring and disease detection to name just a few areas.

### Research and Capabilities

- Biosensors for disease biomarkers
- CCD image sensors
- Chemical sensors for trace detection of explosives
- Data acquisition and signal processing
- Environmental sensors for trace detection of pollutants
- Fiber optic sensors (single point and distributed)
- Lab-on-a-chip/lab-on-paper sensors
- MEMs based chemical sensors
- Microelectrodes
- Microfluidics
- Miniature acoustic archival fish tagging
- Mobile structural monitoring
- Multi-modal sensor data analysis
- Novel materials for sensors
- Physical sensors for temperature, strain, pressure, heat flux
- Reliability analysis of sensors
- Sensor characterization
- Sensor fabrication
- Sensors for high temperature and pressure environments
- Underwater acoustic sensors

## Specialized Equipment

- Atomic Force Microscopes
- Characterization tool set for optical/microwave sensors/components
- Environmental Scanning Electron Microscope
- Exposure and Alignment Tool for Lithography -1 um resolution
- Field Emission Scanning Electron Microscope
- Large-chamber sputtering machines (6)
- Mobile Structural Monitoring and Remote Testing (SMART) Laboratory
- Surface Analyzer (SIMS, ESCA and Auger)
- Transmission Electron Microscope
- UMIS III nano indentation tool
- X-ray diffraction



Professor Godi Fischer is developing sensors that can attach to fish.

## Specialized Laboratories

- Next Generation Sensing Technology Lab
- Optics and Lasers Research Lab
- Sensors Fabrication and Testing Laboratory
- Surface Technology Laboratory



Professor Otto Gregory, left, shows U.S. Senator Jack Reed a sensor under development for the U.S. Department of Homeland Security.

## Our Partners

- Checon Corporation
- General Dynamics
- Image Acoustics, Inc.
- NASA
- National Science Foundation
- Naval Undersea Warfare Center
- Pratt & Whitney
- Raytheon
- Rolls Royce
- Sensata Technologies, Inc.
- Strain Measurement Devices Inc.
- U.S. Air Force
- U.S. Army
- U.S. Department of Homeland Security
- Vishay Measurements Group

For more information, contact Otto Gregory, Ph.D., Distinguished Professor  
Department of Chemical Engineering  
gregory@egr.uri.edu | 401.874.2085  
egr.uri.edu