Dedicated to Excellence at Illinois

CNST nano@illinois Research Faculty Handbook
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Cover images clockwise from top left: (i) Metal nanoparticles formed inside protein crystals, creating composite materials with potentially bifunctional catalytic properties (Yi Lu, Chem. research group); (ii) Molecular dynamics simulation of energy dissipation from a carbon nanotube to a silicon dioxide substrate (Eric Pop, ECE research group); (iii) Interconnected array of GaAs solar microcells on a rubber substrate (John Rogers, MatSE research group); (iv) An integrated microfluidic device with nanophotonic sensors (Paul Kenis, ChBE research group).

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nano solutions for mega problems

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### Illinois Pedigree

**and its broad societal impact**

**Excellence in Science, Technology, and Engineering**

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<tr>
<th><strong>John Bardeen</strong></th>
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<th><strong>Nick Holonyak</strong></th>
<th><strong>Carl R. Woese</strong></th>
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</table>

- **Transistor***, and Superconductivity*
- **Integrated Circuit***
- **Magnetic Resonance Imaging***
- **Superfluidity**
- **Set research directions to test the foundations of quantum mechanics**
- **Light Emitting Diode**, and Compact Disc*
- **Phylogenetic Taxonomy of 16S ribosomal RNA**

**EXCELLENCE • INNOVATION • LEADERSHIP**

*Each of these discoveries has led to multi-billion dollar worldwide markets, 2010*

**and the tradition continues…**
Introduction

A collaborative scientific ecosystem at the nanoscale at the University of Illinois is a goal of the Center for Nanoscale Science and Technology (CNST), which continues to spearhead multidisciplinary efforts. Success is evident in the development of several multidisciplinary centers involving campus-wide faculty and integrating biology with engineering, materials science with medicine and agriculture, and molecular and cellular structures. Researchers and their collaborators at more than 45 departments and units across the campus are working to advance science at the nanoscale at Illinois—nano@illinois.

This *Nano Research Faculty Handbook* is a comprehensive representation of nano@illinois, where wide-ranging research is resulting in new materials, devices, and ideas with applications in agriculture, electronics, energy, environment, medicine, and other fields. Semiconductor based materials and device research leading to transformational discoveries such as the light emitting diode, worlds’ fastest transistors, quantum dot lasers, VCSELs, carbon nanotube and graphene based electronics, label-free biological detection, lab-on-chip technologies, cancer tumor detection, advanced drug and gene delivery, and soybean rust spore detection are just a few examples of innovation at Illinois.

The *Nano Research Faculty Handbook* features more than 150 researchers and their collaborators working at the micro and nanoscale in the areas of bionanotechnology, computational and theoretical nanotechnology, nanoelectronics and nanophotonics, nanomaterials and nanomechanics, MEMS/NEMS, societal and ethical implications of nanotechnology, and assessment. It also shows that nano@illinois contributes to all major scientific disciplines across the campus, the state of Illinois, the nation, and even globally through scientific and industrial partnerships and entrepreneurship.

We invite you to explore the many ways that excellence, innovation, and leadership—hallmarks of the scientific enterprise at Illinois—are represented in the CNST *Nano Research Faculty Handbook*.

*Rashid Bashir*

Co-Director, CNST
Abel Bliss Professor of Electrical and Computer Engineering and of Bioengineering
Director, Micro and Nanotechnology Laboratory

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Founding and Co-Director, CNST
Donald B. Willett Professor of Engineering
Dean, College of Engineering

*Irfan S. Ahmad*

Executive Director, CNST
Research Faculty, Department of Agricultural and Biological Engineering

May 2, 2011
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Acknowledgments

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Key to College Affiliation:

- College of Agricultural, Consumer, and Environmental Sciences
- College of Applied Health Sciences
- College of Education
- College of Engineering
- College of Liberal Arts and Sciences
- College of Medicine
- College of Veterinary Medicine
- Other

Key to Core Research Areas:

- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment

Departments/Units:

- ABE Agricultural and Biological Engineering
- AE Aerospace Engineering
- Ani. Sci. Animal Science
- BioE Bioengineering
- CB Comparative Biosciences
- CDB Cell and Developmental Biology
- CS Computer Science
- CEE Civil and Environmental Engineering
- Chem Chemistry
- ChBE Chemical and Biomolecular Engineering
- Crop Sci. Crop Sciences
- DBS Division of Biomedical Sciences
- EBI Energy Biosciences Institute
- ECE Electrical and Computer Engineering
- Entml Entomology
- Ind. Design Industrial Design
- ISGS Illinois State Geological Survey, Prairie Research Institute
- ISWS Illinois State Water Survey, Prairie Research Institute
- MatSE Materials Science and Engineering
- MechSE Mechanical Science and Engineering
- Med. Microbio Medical Microbiology
- Microbio. Microbiology
- Mol.&Int. Physl Molecular and Integrative Physiology
- NPRE Nuclear, Plasma, and Radiological Engineering
- NRES Natural Resources and Environmental Sciences
- OP Office of Provost
- OR Office of Research
- OTM Office of Technology Management
- OVCPE Office of Vice Chancellor for Research
- OVPR Office of Vice President for Research
- Pathobio. Pathobiology
- Physics Physics
- Pract.&Tech Practice and Technology
- SHS Speech and Hearing Science
Research Faculty: Profiles

John R. Abelson
Professor, Department of Materials Science and Engineering; Co-Director, Energy and Sustainability Engineering Initiative; College of Engineering

EDUCATION: Ph.D., Materials Science and Engineering, Stanford University

RESEARCH INTERESTS: Developing novel synthetic methods for thin film materials that are used in advanced microelectronic and energy applications.

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Ilesanmi Adesida
Donald B. Willett Professor of Engineering; Professor, Departments of Electrical and Computer Engineering, and Materials Science and Engineering; Founding and Co-Director, CNST; Dean, College of Engineering

EDUCATION: Ph.D., Electrical Engineering, University of California, Berkeley

RESEARCH INTERESTS: Nanofabrication, electronic and transport properties of ultra-low dimensional semiconductor structures; high speed optoelectronic devices and integrated circuits; and radiation effects.

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Irfan S. Ahmad
Executive Director, Center for Nanoscale Science and Technology; Research Faculty, Department of Agricultural and Biological Engineering; Colleges of Engineering and of Agricultural, Consumer, and Environmental Sciences

EDUCATION: Ph.D., Agricultural Engineering, University of Illinois

RESEARCH INTERESTS: Bionanotechnology for agricultural and biological applications, nanosensors for precision agriculture, cancer nanomedicine, societal implications of nanotechnology, science and policy.

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Aleksei Aksimentiev
Assistant Professor, Department of Physics, College of Liberal Arts and Sciences

EDUCATION: Ph.D., Chemistry, Institute of Physical Chemistry, Warsaw, Poland

RESEARCH INTERESTS: Electronic recognition of DNA with synthetic nanopore sensors; nanomechanics of molecular motors; transport across cell membranes.

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Richard C. Alkire
Professor Emeritus, Department of Chemical and Biomolecular Engineering; Charles and Dorothy Prizer Chair, Colleges of Liberal Arts and Sciences and of Engineering

EDUCATION: Ph.D., University of California, Berkeley

RESEARCH INTERESTS: Enzyme catalysis, biological oxidation, cytochrome P450, metabolism, electrochemical engineering, electrodeposition, corrosion and etching, web-based collaborative tools.

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Leslie H. Allen
Associate Professor, Department of Materials Science and Engineering, College of Engineering

EDUCATION: Ph.D., Materials Science and Engineering, Cornell University

RESEARCH INTERESTS: Optical biosensors, photonics crystals, nanofabrication, finite difference time domain analysis, sensor design and instrumentation.

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Narayana R. Aluru
Professor, Department of Mechanical Science and Engineering, College of Engineering

**EDUCATION:** Ph.D., Civil Engineering, Stanford University

**RESEARCH INTERESTS:** Computational analysis and design of MEMS and NEMS.

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Robert S. Averback
Professor, Department of Materials Science and Engineering, College of Engineering

**EDUCATION:** Ph.D., Physics, Michigan State University

**RESEARCH INTERESTS:** Materials processes; irradiation effects in metals and oxide ceramics; forced atomic mixing; phase formation during severe plastic deformation; nanocrystalline materials; femtosecond laser irradiation; computer modeling.

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Ryan C. Bailey
Assistant Professor, Department of Chemistry, College of Liberal Arts and Sciences

**EDUCATION:** Ph.D., Chemistry, Northwestern University

**RESEARCH INTERESTS:** Refractory problems in the biomolecular sciences; multiparameter biological analysis; highly-multiplexed, label-free biosensors; multicomponent strategies for assessing tissue heterogeneity.

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**Key to Core Research Areas:**

- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment
Rashid Bashir
Abel Bliss Professor, Departments of Electrical and Computer Engineering and Bioengineering; Director, Micro and Nanotechnology Laboratory; Co-Director, CNST; College of Engineering

EDUCATION: Ph.D., Electrical Engineering, Purdue University

RESEARCH INTERESTS: BioMEMS, lab-on-a-chip, bionanotechnology, interfacing biology and engineering from molecular to tissue scale, and applications of semiconductor fabrication to biology, all applied to solve biomedical problems.

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Pascal Bellon
Professor, Department of Materials Science and Engineering, College of Engineering

EDUCATION: Ph.D., Materials Science, University Paris 6, France

RESEARCH INTEREStS: Sustained dynamical forcing of materials; plastic deformation; synthesis of nanostructured materials; imaging microscopy; advanced transmission electron microscopy; atom probe tomography.

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Alexey Bezryadin
Associate Professor, Department of Physics, College of Engineering

EDUCATION: Ph.D., Physics, Joseph Fourier University, Grenoble, France

RESEARCH INTERESTS: Low-dimensional nanoscale systems; quantum superconductor-insulator transitions; electronic properties of DNA molecules; macroscopic quantum tunneling and Little’s phase slips in superconducting nanowires; superconducting.

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Kaustubh Bhalerao
Associate Professor, Department of Agricultural and Biological Engineering, Colleges of Agricultural, Consumer, and Environmental Sciences and of Engineering

EDUCATION: Ph.D., Food, Agricultural and Biological Engineering, Ohio State University

RESEARCH INTERESTS: Bioinformatics for nanobiodevice design, transcription control circuits, and bioconjugation techniques, synthetic genetic circuits inside bacteria, bionanotechnology.

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Rohit Bhargava
Associate Professor, Department of Bioengineering, College of Engineering

EDUCATION: Ph.D., Macromolecular Science and Engineering, Case Western Reserve University

RESEARCH INTERESTS: Novel chemical imaging technology; tissue structure and cancer pathology; biological sensors; bionanotechnology, spectroscopic imaging; material and computational models.

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(217) 265-6596 • rxb@illinois.edu

Stephen G. Bishop
Professor, Department of Electrical and Computer Engineering, College of Engineering

EDUCATION: Ph.D., Physics, Brown University

RESEARCH INTERESTS: Optical and electrical characterization of crystalline and amorphous semiconductors and nanostructures; nanoelectronics, compound semiconductors; isoelectronic defects; photoluminescence, electron spin resonance.

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Key to Core Research Areas:
- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment
Stephen A. Boppart
Abel Bliss Professor, Departments of Electrical and Computer Engineering, and Bioengineering, and Internal Medicine, Colleges of Engineering and of Medicine

EDUCATION: Ph.D., Medical and Electrical Engineering, Massachusetts Institute of Technology; M.D., Harvard University

RESEARCH INTERESTS: Optical biomedical imaging; lasers in medicine and biology; optical coherence tomography; nonlinear microscopy; optical contrast and therapeutic nanoagents; molecular imaging; image-guided surgery; medical engineering, nanomedicine.

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Paul V. Braun
Professor, Department of Materials Science and Engineering, College of Engineering

EDUCATION: Ph.D., Materials Science and Engineering, University of Illinois

RESEARCH INTERESTS: Nano and microstructures; nanomaterials, self and directed assembly; photonic bandgap structures; conducting polymers; nanostructured ceramics; semiconductors; biomaterials and metals; liquid crystals.

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Raffi Budakian
Associate Professor, Department of Physics, College of Engineering

EDUCATION: Ph.D., Physics, University of California, Los Angeles

RESEARCH INTERESTS: Development of ultra sensitive spin detection techniques; single spin imaging; quantum readout; design and fabrication of micro-machined silicon cantilevers; imaging; electron nuclear double resonance.

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David G. Cahill
Professor and Head, Department of Materials Science and Engineering, College of Engineering

**EDUCATION:** Ph.D., Physics, Cornell University

**RESEARCH INTERESTS:** Thermal transport of materials; nanomaterials, thermal conductance of solid-solid and liquid-solid interfaces; nanoscale thermal transport; ultrafast laser metrology.

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104 S. Goodwin Avenue
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Ioannis Chasiotis
Associate Professor, Department of Aerospace Engineering, College of Engineering

**EDUCATION:** Ph.D., Aeronautics, California Institute of Technology

**RESEARCH INTERESTS:** Mechanical reliability, fracture, and fatigue of MEMS, NEMS and thin film electronic materials; failure mechanics; deformation and damage mechanics of polymer nanocomposites and soft nanophase materials, nanomechanics, and applications of scanning probe microscopy in mechanics and biology.

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Assistant Professor, Department of Physics, College of Engineering

**EDUCATION:** Ph.D., Physics, University of California, Berkeley

**RESEARCH INTERESTS:** Biophysical techniques; mechanism of molecular machines; mechano-chemical conversion; bionanotechnology, biological systems for single-molecule manipulation; quantitative analysis and modeling of collected data.

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**Key to Core Research Areas:**
- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment
Jianjun Cheng

Associate Professor, Department of Materials Science and Engineering, College of Engineering

EDUCATION: Ph.D., Materials Science, University of California, Santa Barbara

RESEARCH INTERESTS: Biomaterials and nanomedicine, development of polymeric nanoparticulate drug delivery systems for cancer therapy.

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Keh-Yung (Norman) Cheng

Professor Emeritus, Department of Electrical and Computer Engineering, College of Engineering

EDUCATION: Ph.D., Electrical Engineering, Stanford University

RESEARCH INTERESTS: Molecular beam epitaxy technology, optoelectronic and high speed devices, in-situ fabrication of nanostructures, and III-V MOSFETs, nanoelectronics and photonics.

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Hyungsoo Choi

Senior Research Scientist, Department of Electrical and Computer Engineering, College of Engineering

EDUCATION: Ph.D., Chemistry, Brown University

RESEARCH INTERESTS: Precursors for nanoscale materials synthesis; thin film and nanoparticle fabrication; electronic and optical materials; biodegradable micro and nano spheres/capsules for advance drug delivery.

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Abel Bliss Professor, Department of Electrical and Computer Engineering, College of Engineering

EDUCATION: Ph.D., Materials Science, University of Wisconsin-Madison

RESEARCH INTERESTS: Vertical cavity surface emitting lasers (VCELs), micro/nano cavity lasers, optoelectronic devices, oxidation of compound semiconductors, hybrid heterogenous integration, nano-processing fabrication, photonic crystals materials, Si-based optoelectronics, and high bandwidth communication systems, nanophotonics.

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Shun Lien Chuang
Robert C. MacClinchie Distinguished Professor, Department of Electrical and Computer Engineering, College of Engineering

EDUCATION: Ph.D., Electrical Engineering, Massachusetts Institute of Technology

RESEARCH INTERESTS: Photonics, optoelectronics, nanophotonics, semiconductor device physics, semiconductor lasers, nanolasers, surface plasmonics, modulators, and photodetectors, quantum electronics, electro-magnetics, and fiber optical sensors.

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James J. Coleman
Intel Endowed Chair and Professor; Departments of Electrical and Computer Engineering, and Materials Science and Engineering; College of Engineering

EDUCATION: Ph.D., Electrical Engineering, University of Illinois

RESEARCH INTERESTS: Semiconductor lasers, optoelectronics, epitaxial growth, quantum dots, and nanostructures, metalorganic chemical vapor deposition (MOCVD), high brightness lasers, nanophotonics.

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Key to Core Research Areas:
- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment
Brian T. Cunningham
Professor, Departments of Electrical and Computer Engineering and Bioengineering, College of Engineering

**EDUCATION:** Ph.D., Electrical and Computer Engineering, University of Illinois

**RESEARCH INTERESTS:** Optical biosensors, photonics crystals, nanofabrication, finite difference time domain analysis, sensor design and instrumentation, nanomedicine.

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Lizanne DeStefano
Professor, Quantitative and Evaluative Research Methodologies, Department of Educational Psychology, College of Education

**EDUCATION:** Ph.D., Educational Psychology, University of Pittsburgh

**RESEARCH INTERESTS:** Assessment of nanotechnology centers. Large-scale, multi-site initiatives; special populations, students with disabilities, and under-represented groups; participatory designs and qualitative and quantitative methods; technical and policy issues.

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Shen J. Dillon
Assistant Professor Department of Materials Science and Engineering, College of Engineering

**EDUCATION:** Ph.D., Materials Science and Engineering, Lehigh University

**RESEARCH INTERESTS:** Linking atomic-scale processes in ceramic materials to the micro- and nano structural levels and bulk properties. Role of microstructure, defects, and interfaces in electrochemical intercalation and materials for energy storage.

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William H. and Janet G. Lycan Professor of Chemistry, Department of Chemistry, College of Liberal Arts and Sciences

EDUCATION: Ph.D., Chemistry, Stanford University

RESEARCH INTERESTS: Energy transfer and chemical energy generation and storage, using femtosecond (10-15 s) spectroscopic techniques; multidimensional vibrational spectroscopy with high time and space resolution; shock compression science.

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Professor, Department of Physics, College of Engineering

EDUCATION: Ph.D., Physics, Stanford University

RESEARCH INTERESTS: Physics of colossal magnetoresistance; manganite films; single-crystal tunneling structures; planar tunneling junctions; colossal magnetoresistance spin-valves grown by molecular beam epitaxy; magnetotransport effects.

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James Economy
Founder Professor of Engineering; Professor, Department of Materials Science and Engineering; College of Engineering

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RESEARCH INTERESTS: Synthesis of high performance aromatic copolypesters, design of new types of adsorption systems, and development of novel ceramic and metal matrix composites.

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Key to Core Research Areas:
- Bionanotechnology
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- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment
J. Gary Eden
Gilmore Family Endowed Professorship in Electrical and Computer Engineering; Professor, Department of Electrical and Computer Engineering; College of Engineering

**EDUCATION:** Ph.D., Electrical Engineering, University of Illinois

**RESEARCH INTERESTS:** Plasma displays and spectroscopic diagnostics. Visible and ultraviolet lasers and laser spectroscopy, short wavelength photophysics, ultrafast laser spectroscopy, microdischarge and microresonator devices, laser magnetometry, nanophotonics.

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Timothy M. Fan
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Milton Feng
Nick Holonyak Jr. Chair and Professor, Department of Electrical and Computer Engineering, College of Engineering

**EDUCATION:** Ph.D., Electrical Engineering, University of Illinois

**RESEARCH INTERESTS:** High speed microelectronics devices and ICs for wireless and optoelectronics: optoelectronic IC, monolithic microwave and millimeter wave IC, advanced analog to digital IC, RF-MEMS, advanced SiGe HBT ICs, light emitting transistor, III-V MOSFET, and THz devices, nanoelectronics, nanophotonics.

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Assistant Professor, Department of Crop Sciences, College of Agricultural, Consumer, and Environmental Sciences

EDUCATION: Ph.D., Agronomy, Purdue University

RESEARCH INTERESTS: Soil nutrient bioavailability and cycling, evaluation of conventional and alternative management practices that render greater fertilizer use efficiency, effect of soil water stress and other environmental stresses on nutrient uptake, crop development, and yield, bionanotechnology.

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Placid M. Ferreira
Professor and Head, Department of Mechanical Science and Engineering, College of Engineering

EDUCATION: Ph.D., Industrial Engineering, Purdue University

RESEARCH INTERESTS: Industrial automation, particularly computer-controlled machine tools, nanopositioning and nanosensing, computational geometry and solid modeling for automated process planning and the discrete-event control of large-scale, flexibly automated systems, nanomanufacturing.

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EDUCATION: Ph.D., Geology, State University of New York, Stony Brook

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Key to Core Research Areas:
- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment
Jonathan B. Freund  
Professor, Department of Mechanical Science and Engineering, College of Engineering  

**EDUCATION:** Ph.D., Mechanical Engineering, Stanford University  

**RESEARCH INTERESTS:** Aerodynamic sound, compressible turbulence, numerical methods, large-scale parallel computing, molecular dynamics simulation of nanometer scale flows and heat transfer in solids, nanocomputation.  

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Phillipe H. Geubelle  
Professor, Department of Aerospace Engineering, College of Engineering  

**EDUCATION:** Ph.D., Aeronautics, California Institute of Technology  

**RESEARCH INTERESTS:** Theoretical and computational solid mechanics, (dynamic) fracture mechanics; multiscale modeling of complex materials, computational aeroelasticity, massively parallel computing, solid mechanics issues in manufacturing, computational design of novel materials.  

[Address and contact information]  

Matthew W. Gilbert  
Assistant Professor, Department of Electrical and Computer Engineering, College of Engineering  

**EDUCATION:** Ph.D., Electrical Engineering, Stanford University  

**RESEARCH INTERESTS:** New optical and logic nanodevices; utilizing collective motion of charge carriers; quasiparticles in nanostructures, nanoelectronics.  

[Address and contact information]
Martha U. Gillette
Center for Advanced Study Professor, Alumni Professor of Cell and Developmental Biology; Departments of Molecular and Integrative Physiology, Cell and Developmental Biology, and Bioengineering; School of Molecular and Cellular Biology; Colleges of Liberal Arts and Sciences and of Engineering

EDUCATION: Ph.D., Zoology, University of Toronto, Canada

RESEARCH INTERESTS: Nanoscale investigations of neuronal and glial cell development and function; development of complex, 3-D microenvironments that promote neuronal differentiation and function, novel substrates that shape neuronal development, non-invasive imaging of cellular dynamics, bionanotechnology.

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Gregory S. Girolami
Professor, Department of Chemistry, College of Liberal Arts and Sciences

EDUCATION: Ph.D., University of California, Berkeley

RESEARCH INTERESTS: Synthesis, properties, and reactivity of new inorganic, organometallic, and solid state species; mechanistic studies of organometallic reactions; chemical vapor deposition of thin films from designed molecular precursors.

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Assistant Professor, Department of Electrical and Computer Engineering, College of Engineering

EDUCATION: Ph.D., Physics, Stanford University

RESEARCH INTERESTS: Light and lasers for sensing and measurement, communication, and data processing; modeling individual lasers and photodetectors; photonics-based sensors; instrumentation and integrated circuits, nanophotonics.

2254 Micro and Nanotechnology Laboratory, MC-249
208 N. Wright Street
Urbana, Illinois 61801
(217) 244-0799 • lgoddard@illinois.edu

Key to Core Research Areas:
- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment
Steve Granick

Founder Professor, Department of Materials Science and Engineering, College of Engineering

**EDUCATION:** Ph.D., Physical Chemistry, University of Wisconsin-Madison

**RESEARCH INTERESTS:** Soft materials—fluid membranes, liposomes, polymers, colloids, and other structured liquids, and present focus on their behavior at surfaces, nanomaterials.

1022 Frederick Seitz Materials Research Laboratory
104 S. Goodwin Avenue
Urbana, Illinois 61801
(217) 333-5720 • sgranick@illinois.edu

Laura H. Greene

Professor, Department of Physics, College of Engineering

**EDUCATION:** Ph.D., Physics, Cornell University

**RESEARCH INTERESTS:** Electron materials; superconductors; tunneling spectroscopy.

1021 Frederick Seitz Materials Research Laboratory, MC-230
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Urbana, Illinois 61801
(217) 333-7315 • lhgreene@illinois.edu

Dominique J. Griffon

Associate Professor, Veterinary Clinical Medicine and Bioengineering, Colleges of Veterinary Medicine and of Engineering

**EDUCATION:** Ph.D., University of Helsinki, Finland

**RESEARCH INTERESTS:** Orthopedic surgery, orthopedic application of biomaterials and surgical models.

108 Small Animal Clinic, MC-004
108 W. Hazelwood Drive
Urbana, Illinois 61802
(217) 244-1208 • dgriffon@illinois.edu

Martin Gruebele

James R. Eiszner Endowed Chair in Chemistry, Professor of Physics and Center for Biophysics and Computational Biology, College of Liberal Arts and Sciences

**EDUCATION:** Ph.D., University of California, Berkeley

**RESEARCH INTERESTS:** Engaged in experiments and computational modeling to study a broad range of fundamental problems in chemical and biological physics.

A220 Chemical and Life Sciences Laboratory
600 S. Mathews Avenue
Urbana, Illinois 61801
(217) 333-1624 • gruebele@scs.illinois.edu
Taekjip Ha
Professor, Department of Physics; Co-Director, Center for the Physics of Living Cells, College of Engineering

EDUCATION: Ph.D., Physics, University of California, Berkeley

RESEARCH INTERESTS: Helicases that unzip DNA; DNA recombination; single-molecule fluorescence spectroscopy and microscopy; magnetic and optical tweezers.

133 Loomis Laboratory
1110 W. Green Street
Urbana, Illinois 61801
(217) 265-0717 • tjha@illinois.edu

William S. Hammack
Professor, Department of Chemical and Biomolecular Engineering, Colleges of Liberal Arts and Sciences and of Engineering

EDUCATION: Ph.D., University of Illinois

RESEARCH INTERESTS: Explaining engineering and technology to the public; enhancing engineering awareness.

203 Roger Adams Lab
600 S. Mathews Avenue
Urbana, Illinois 61801
(217) 244-4146 • whammock@illinois.edu

Brendan A. Harley
Assistant Professor, Department of Chemical and Biomolecular Engineering, Colleges of Liberal Arts and Sciences and of Engineering

EDUCATION: Sc.D., Massachusetts Institute of Technology

RESEARCH INTERESTS: Study of the mechanism of organ regeneration and wound healing by quantifying individual cell behavior within well-characterized collagen scaffolds, bionanotechnology, nanomedicine.

110 Roger Adams Laboratory, MC-712, Box C-3
600 S. Mathews Avenue
Urbana, Illinois 61801
(217) 244-7112 • bharley@illinois.edu

Paul J. Hergenrother
Professor, Department of Chemistry, College of Liberal Arts and Sciences

EDUCATION: Ph.D., Chemistry, University of Texas- Austin

RESEARCH INTERESTS: Synthetic organic chemistry; chemical biology; biochemistry; novel anti-cancer targets; novel targets for drug-resistant bacteria; treatment of diseases including cancer, neurodegeneration, and drug-resistant bacteria, bionanotechnology, nanomedicine.

261 Roger Adams Laboratory
600 S. Mathews Avenue
Urbana, Illinois 61801
(217) 333-0363 • hergenro@illinois.edu
Marie-Claude C. Hofmann

Associate Professor, Comparative Biosciences, College of Veterinary Medicine

**EDUCATION:** Ph.D, University of Lausanne, Switzerland

**RESEARCH INTERESTS:** Stem cells; self-renewal and differentiation; intracellular signaling pathways; spermatogonial stem cells; tissue regeneration.

3633 Basic Sciences Building
2001 South Lincoln Avenue
Urbana, Illinois 61802
(217) 333-6742 • mhofmann@illinois.edu

Nick Holonyak, Jr.

John Bardeen Endowed Chair and Professor, Departments of Electrical and Computer Engineering and Physics, College of Engineering

**EDUCATION:** Ph.D., Electrical Engineering, University of Illinois

**RESEARCH INTERESTS:** Semiconductors—device physics, crystal growth and junction formation, diffused Si devices, luminescence, light emitting diodes (LED’s), heterojunctions, lasers, tunnel diodes, compound semiconductors, quantum well heterostructures, superlattices, quantum well lasers, impurity—induced layer disordering, Al-based III-V native oxides and their use in heterostructures devices.

2102 Micro and Nanotechnology Laboratory, MC-249
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Urbana, Illinois 61801
(217) 333-4149 • nholonya@illinois.edu

K. Jimmy Hsia

Professor, Department of Mechanical Science and Engineering; Director, Global Enterprise for Micro-Mechanics and Molecular Medicine (GEM4), College of Engineering

**EDUCATION:** Ph.D., Mechanical Engineering, Massachusetts Institute of Technology

**RESEARCH INTERESTS:** Cracks in brittle materials; mechanics of materials; micro and nano mechanics; biomechanics; machinability of polymers reinforced with carbon nanotubes, nanomechanics, bionanotechnology.

234 Mechanical Engineering Building
1206 W. Green Street
Urbana, Illinois 61801
(217) 333-2321 • kjhsia@illinois.edu
Kuang-Chien Hsieh
Professor, Department of Mechanical Science and Engineering; Director, Global Enterprise for Micro-Mechanics and Molecular Medicine (GEM⁴), College of Engineering

EDUCATION: Ph.D., Metallurgical Engineering, University of Illinois

RESEARCH INTERESTS: Semiconductor materials/devices processing and characterization.

2114 Micro and Nanotechnology Laboratory, MC-249
208 N. Wright Street
Urbana, Illinois 61801
(217) 244-1806 • khsieh@illinois.edu

Michael F. Insana
Professor and Head, Department of Bioengineering, College of Engineering

EDUCATION: Ph.D., Medical Physics, University of Wisconsin, Madison

RESEARCH INTERESTS: Medical imaging systems development for breast cancer, vascular disease, and kidney disease applications. Ultrasonics, signal processing, signal detection, elasticity imaging, soft tissue biomechanics, polymer mechanics, complex system modeling.

Bioengineering Department
1270 Digital Computer Laboratory, MC-278
1304 W. Springfield
Urbana, Illinois 61801
(217) 333-1867 • mfi@illinois.edu

Kanti Jain
Professor, Department of Electrical and Computer Engineering, College of Engineering

EDUCATION: Ph.D., Electrical and Computer Engineering and Physics, University of Illinois

RESEARCH INTERESTS: Energy-smart buildings; optoelectronic envelope technologies; excimer laser processing technologies for displays and microelectronics, smart skins, large-area, integrated, distributed, multifunctional sensors; ultra-high-resolution lithography technologies for nanoscale devices, opto-electronics, micro-optics, and photonic circuits, and micro and nano fabrication technologies.

132 Everitt Laboratory, MC 702
1406 W. Green Street
Urbana, Illinois 61801
(217) 333-5990 • kjain@illinois.edu
Eric Jakobsson
Professor Emeritus, Department of Molecular and Integrative Physiology, College of Liberal Arts and Sciences

EDUCATION: Ph.D., Physics, Dartmouth College

RESEARCH INTERESTS: Computational biochemistry; biomolecular function; bioinformatics.

4021 Beckman Institute
405 N. Matthews Avenue
Urbana, Illinois 61801
(217) 244-2896 • jake@ncsa.illinois.edu

Iwona M. Jasiuk
Professor, Departments of Mechanical Science and Engineering and Bioengineering, College of Engineering

EDUCATION: Ph.D., Theoretical and Applied Mechanics, Northwestern University

RESEARCH INTERESTS: Structure and behavior of man-made and biological materials; properties of composites made with nano-sized particles.

122 Mechanical Engineering Building
1206 W. Green Street
Urbana, Illinois 61801
(217) 333-9259 • ijasiuk@illinois.edu

Elizabeth H. Jeffery
Professor, Department of Food Science and Human Nutrition; Interim Assistant Dean, Office of Research; College of Agricultural, Consumer, and Environmental Sciences

EDUCATION: Ph.D., Biochemistry, University of London, U.K.

RESEARCH INTERESTS: Functional foods; anticarcinogens, detoxification enzymes; mechanism of regulation of detoxification enzymes by dietary components.

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(217) 333-3820 • ejeffery@illinois.edu

Harley T. Johnson
Associate Professor of Mechanical Science and Engineering, College of Engineering

EDUCATION: Ph.D., Engineering, Brown University

RESEARCH INTERESTS: Micro and nanomechanics of electronic materials; mechanics of nanostructures; materials behavior in microelectrochemical systems (MEMS).

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Shiv G. Kapoor
Grayce Wicall Gauthier Chair; Director, the Center for Machine Tools
Systems Research; Professor, Department of Mechanical Science and
Engineering; College of Engineering

EDUCATION: Ph.D., Mechanical Engineering, University of Wisconsin-
Madison

RESEARCH INTERESTS: Modeling and analysis of machining processes and
machine tool systems; development of mechanistic process models for machining processes.

4416 Mechanical Engineering Laboratory, MC-244
1206 W. Green Street
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(217) 333-3432 • sgkapoor@illinois.edu

John A. Katzenellenbogen
Swanlund Chair, Professor, Department of Chemistry, College of
Liberal Arts and Sciences

EDUCATION: Ph.D., Harvard University

RESEARCH INTERESTS: Organic and inorganic chemistry, biochemistry, molecular biology, radiochemistry.

461B Roger Adams Laboratory
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Paul J. Kenis
Professor, Department of Chemical and Biomolecular Engineering and Bioengineering, Colleges of Liberal Arts and Sciences and of Engineering

EDUCATION: Ph.D., University of Twente, The Netherlands

RESEARCH INTERESTS: Microchemical systems: microreactors, micro fuel cells, and microfluidic tools; microchemical systems, microreactors and microfuel cells, and microfluidic tools.

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Key to Core Research Areas:
- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment
Kyekyoon (Kevin) Kim  
Professor, Department of Electrical and Computer Engineering, College of Engineering  

**EDUCATION:** Ph.D., Applied Physics, Cornell University  

**RESEARCH INTERESTS:** Thin films and nanostructures for energy production, lighting, and display; precision micro/nanospheres for controlled release, tissue engineering, and cell encapsulation; bionanotechnology; nanoagriculture and food; high-power electronic devices based on nitride semiconductors.  

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William P. King  
Abel Bliss Professor, Department of Mechanical Science and Engineering, College of Engineering  

**EDUCATION:** Ph.D., Mechanical Engineering, Stanford University  

**RESEARCH INTERESTS:** Nanomanufacturing using industrial materials, glass, plastic, rubber, ceramic, and metal.  

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Jozef L. Kokini  
Bingham Professor of Food Engineering, Department of Food Science and Human Nutrition; Director, Illinois Agricultural Experiment Station, and Associate Dean for Research; College of Agricultural, Consumer, and Environmental Sciences  

**EDUCATION:** Ph.D., Chemical Engineering, Carnegie Mellon University  

**RESEARCH INTERESTS:** Rheological properties of foods; food nanotechnology; structure, texture, flavor relationships; developing bioactive nutraceuticals.  

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**Key to Core Research Areas:**
- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment
Hyunjoon Kong
Assistant Professor, Department of Chemical and Biomolecular Engineering, Colleges of Liberal Arts and Sciences and of Engineering

EDUCATION: Ph.D., Macromolecular Science and Engineering, University of Michigan

RESEARCH INTERESTS: Molecular, nano- and micro-scale design of bioinspired materials to reproduce structure and function of natural extracellular matrices; engineering cellular niches to regulate the growth, lineage, and death of stem and progenitor cells; development of novel tools for analysis of cell and engineered extracellular matrices.

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Schuyler S. Korban
Professor, Department of Natural Resources and Environmental Sciences, College of Agricultural, Consumer, and Environmental Sciences

EDUCATION: Ph.D., Horticulture, University of Nebraska

RESEARCH INTERESTS: Plant functional genomics; plant-based vaccines; gene expression and regulation; gene transfer; disease resistance; flowering and fruiting; DNA methylation; phytoremediation.

310 Edward Madigan Research Laboratory, MC-051
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Mary L. Kraft
Assistant Professor, Department of Chemical and Biomolecular Engineering, Affiliate Department of Chemistry, and the Center for Biophysics and Computational Biology, Colleges of Liberal Arts and Sciences and of Engineering

EDUCATION: Ph.D., Chemistry, University of Illinois

RESEARCH INTERESTS: Steady-state cell membrane organization; relationship between membrane organization and disease; intracellular vesicle transport.

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David M. Kranz
Phillip A. Sharp Professor, Department of Biochemistry, College of Liberal Arts and Sciences

EDUCATION: Ph.D., University of Illinois

RESEARCH INTERESTS: Molecular Immunology, protein dynamics, protein structure, receptor biochemistry.

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(217) 244-2821 • d-kranz@illinois.edu

Mark S. Kuhlenschmidt
Professor and Assistant Department Head, Pathobiology; Professor, Center for Zoonoses Research; College of Veterinary Medicine

EDUCATION: Ph.D., University of Pittsburgh School of Medicine

RESEARCH INTERESTS: Microbial adhesion, infectious diseases and complex carbohydrate biochemistry.

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2001 S. Lincoln Avenue
Urbana, Illinois 61802
(217) 333-9039 • kuhlensc@illinois.edu

Linda S. Kull
Research Specialist, National Soybean Research Laboratory, College of Agricultural, Consumer, and Environmental Sciences

EDUCATION: Ph.D., Plant Pathology, University of Illinois

RESEARCH INTERESTS: Soybean production research, including breeding and genetics, disease and pest resistance, yield enhancement, weeds research, agronomics, and variety evaluations.

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(217) 265-4066 • lkull@illinois.edu

Paul G. Kwiat
Professor, Department of Physics, College of Engineering

EDUCATION: Ph.D., University of California, Berkeley

RESEARCH INTERESTS: AMO/quantum physics.

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(217) 333-9116 • kwiat@illinois.edu
Kris N. Lambert
Associate Professor, Nematology, Department of Crop Sciences, College of Agricultural, Consumer, and Environmental Sciences

EDUCATION: Ph.D., University of California, Berkeley


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1102 S. Goodwin Avenue
Urbana, Illinois 61801
(217) 265-5165 • knlamber@illinois.edu

Jean-Pierre Leburton
Gregory Stillman Professor, Departments of Electrical and Computer Engineering and Physics, College of Engineering

EDUCATION: Ph.D., University of Liege, Belgium

RESEARCH INTERESTS: Theory of semiconductor devices, modeling and simulation of nanostructures, electronic and optical properties of heterostructures and low dimensional systems, transport in quantum structures and carbon-based nanostructures, electronic properties, charging effects in quantum dots and nanocrystals, spin effects in nanostructures, quantum computation and quantum information processing, bionanotechnology.

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Urbana, Illinois 61801
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Deborah E. Leckband
Reid T. Millner Professor; Professor, Departments of Chemical and Biomolecular Engineering, and Bioengineering; Colleges of Liberal Arts and Sciences and of Engineering

EDUCATION: Ph.D., Cornell University

RESEARCH INTERESTS: Biologically active scaffolds; biological compatibility of materials.

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600 S. Matthews Avenue
Urbana, Illinois 61801
(217) 244-0793 • leckband@illinois.edu

Key to Core Research Areas:
- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment
Jennifer A. Lewis
Hans Thurnauer Professor; Professor, Departments of Materials Science and Engineering and Chemical and Biomolecular Engineering; Director, Frederick Seitz Materials Research Laboratory; Colleges of Engineering and of Liberal Arts and Sciences

EDUCATION: Sc.D., Massachusetts Institute of Technology

RESEARCH INTERESTS: Directed and self-assembly of soft materials, design of functional materials with controlled composition and architecture on multiple length scales using colloidal science, microfluidics, and direct writing approaches for printed electronics, photovoltaics, and tissue engineering devices.

212A Ceramics Building
105 S. Goodwin Avenue
Urbana, Illinois 61801
(217) 244-4973 • jalewis@illinois.edu

Xiuling Li
Assistant Professor, Department of Electrical and Computer Engineering, College of Engineering

EDUCATION: Ph.D., University of California, Los Angeles

RESEARCH INTERESTS: Area of semiconductor nanostructured materials and devices. Nanotechnology, metalorganic chemical vapor deposition (MOCVD), semiconductor nanostructure growth and fabrication, semiconductor nanoelectric and nanophotonic devices.

2262 Micro and Nanotechnology Laboratory, MC-249
208 N. Wright Street
Urbana, Illinois 61801
(217) 265-6354 • xiuling@illinois.edu

Yu-Feng F. Lin
Hydrogeologist, Illinois State Water Survey; Founding Director, ESRI–GIS Development Center, Prairie Research Institute; Adjunct Faculty, Department of Natural Resources and Environmental Sciences, College of Agricultural, Consumer, and Environmental Sciences

EDUCATION: Ph.D., Geological Engineering, University of Wisconsin-Madison

RESEARCH INTERESTS: Hydrological cycle and interactions; sustainable hydrological and geological environment; GIS-assisted estimation for groundwater recharge and discharge; groundwater flow modeling; nanotechnology applications in hydrology field measurement; antibiotic resistance genes transport in groundwater.

2204 Griffith Drive
Champaign, Illinois 61820-7495
(217) 333-0235 • yfliin@illinois.edu
G. Logan Liu
Assistant Professor, Departments of Electrical and Computer Engineering and Bioengineering, College of Engineering

EDUCATION: Ph.D., Electrical and Computer Engineering, University of California-Berkeley and San Francisco

RESEARCH INTERESTS: Study of how electrons, photons and ions commute between solid-state nanoscale electronic/photonic systems and soft-state nanoscale biomolecular systems. Hybrid nanobionics with potential applications in healthcare, renewable energy, and environment protection.

3104 Micro and Nanotechnology Laboratory, MC-249
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Yi Lu
Jay and Ann Schenck Professor, Departments of Chemistry, Biochemistry, Bioengineering, and Department of Materials Science and Engineering; Colleges of Liberal Arts and Sciences and of Engineering

EDUCATION: Ph.D., Chemistry, University of California at Los Angeles

RESEARCH INTERESTS: Using rational design and combinatorial engineering methods to obtain proteins and DNA for directed assembly of nanomaterials, and their applications as selective sensors in environmental and homeland security, medical imaging using fluorescence and MRI, targeted drug delivery, nanoporous catalytic materials for organic transformation and for bioremediation.

A322 Chemical and Life Sciences Laboratory
600 South Mathews Avenue
Urbana, Illinois 61801
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Erik Luijten
Professor of Materials Science and Engineering; Associate Professor of Physics, College of Engineering

EDUCATION: Ph.D., Physics, Delft University of Technology, The Netherlands

RESEARCH INTERESTS: Thermodynamic properties and phase behavior of materials, with a strong emphasis on complex fluids, such as polymeric systems and electrolytes, and computer simulations.

202 Materials Science and Engineering Building
1304 W. Green Street
Urbana, Illinois 61801
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Joseph W. Lyding
Professor of Electrical and Computer Engineering, College of Engineering

**EDUCATION:** Ph.D., Electrical and Computer Science, Northwestern University

**RESEARCH INTERESTS:** Scanning tunneling microscopy and spectroscopy; STM-based nanolithography and nanofabrication; silicon-based molecular electronics; carbon nanotubes and carbon-based nanotechnology merged with silicon and III-V semiconductors; growth of 3D silicon nanostructures.

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Nancy Makri
Gutgsell Professor of Chemistry; Professor of Physics, Department of Chemistry, College of Liberal Arts and Sciences

**EDUCATION:** Ph.D., University of California, Berkeley

**RESEARCH INTERESTS:** Working to advance theoretical understanding of quantum mechanical processes in large molecules and the condensed phase.

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Benito Marinas
Ivan Racheff Professor of Environmental Engineering, Department of Civil and Environmental Engineering; Acting Director, Center for Advanced Materials for Purification of Water with Systems; College of Engineering

**EDUCATION:** Ph.D., Environmental Engineering, University of California, Berkeley

**RESEARCH INTERESTS:** Mechanistic aspects of chemical and ultraviolet light disinfection processes and membrane technologies for controlling waterborne pathogens. Developing hybrid adsorption/membrane processes for the control of pesticides, taste-and-odor-causing compounds and other water contaminants.

3211 Newmark Laboratory
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(217) 333-6961 • marinas@illinois.edu
Lane W. Martin
Assistant Professor, Department of Materials Science and Engineering, College of Engineering

**EDUCATION:** Ph.D., Materials Science, University of California, Berkeley

**RESEARCH INTERESTS:** Exploration of novel oxide materials—both thin film heterostructures and nanostructures, nanomaterials.

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Urbana, Illinois 61801
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Richard I. Masel
Fox Family Professor, Department of Chemical and Biomolecular Engineering, Colleges of Liberal Arts and Sciences and of Engineering

**EDUCATION:** Ph.D., University of California, Berkeley

**RESEARCH INTERESTS:** Spectroscopic tools and abinitio calculations to get a general understanding of kinetic phenomenon. Microchemical systems, micro fuel cells, catalysis in fuel cells, engineering approximations in kinetics, environmental catalysis. Small chip scale chemical reactors for fuel conversion, smart clothing and personal heat sources.

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Nadya Mason
Assistant Professor of Physics, College of Engineering

**EDUCATION:** Ph.D., Physics, Stanford University

**RESEARCH INTERESTS:** Study of electron behavior in low-dimensional, correlated materials, where enhanced interactions are expected to give novel results, nanostructures.

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**Key to Core Research Areas:**
- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment

[www.cnst.illinois.edu]
Arif Masud
Professor, and Robert H. Dodds Faculty Scholar, Department of Civil and Environmental Engineering; College of Engineering

**EDUCATION:** Ph.D., Computational Mechanics, Stanford University

**RESEARCH INTERESTS:** Stabilized and multiscale finite element methods for solids and fluids, fluid-structure interaction, computational micro and nano-mechanics, and computational biomechanics.

3110 Newmark Laboratory
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Urbana, Illinois 61801
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George H. Miley
Professor, Department of Nuclear, Plasma and Radiological Engineering, College of Engineering

**EDUCATION:** Ph.D., Nuclear/Chemical Engineering, University of Michigan

**RESEARCH INTERESTS:** Fusion systems; plasma engineering; reactor kinetics; high voltage technology; nuclear pumped lasers; direct energy conversion; hydrogen energy production; low energy nuclear reactions in solids.

100C Nuclear Engineering Laboratory
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(217) 333-3772 • ghmiley@illinois.edu

Jeffrey S. Moore
Murchison-Mallory Professor, Departments of Chemistry and Materials Science and Engineering, Colleges of Liberal Arts and Sciences and of Engineering

**EDUCATION:** Ph.D., Materials Science, University of Illinois

**RESEARCH INTERESTS:** The synthesis and study of large organic molecules and the discovery of new polymeric materials and functions. Synthetic methods to construct structure-controlled macromolecules, self-healing polymers, or photoresponsive colloids. Use of synthetic and physical organic chemistry tools to address problems at the interface of chemistry and materials science.

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600 S. Matthews Avenue
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Catherine J. Murphy
Peter C. and Gretchen Miller Markunas Professor of Chemistry, Department of Chemistry, College of Liberal Arts and Sciences

**EDUCATION:** Ph.D., Chemistry, University of Wisconsin

**RESEARCH INTERESTS:** At the interface of materials chemistry, inorganic chemistry, biophysical chemistry, and nanotechnology. Development of inorganic nanomaterials for biological and energy-related applications, and understanding the chemical interactions of nanomaterials.

A512 CLSL
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Su-A Myong
Assistant Professor, Department of Bioengineering, College of Engineering

**EDUCATION:** Ph.D., Nutrition, University of California, Berkeley

**RESEARCH INTERESTS:** Investigate and improve the antiviral immunity; study the host molecules which participate in this antiviral immune pathway using single molecule fluorescence and cell imaging techniques.

3213 Digital Computer Laboratory, MC-278
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Munir H. Nayfeh
Professor of Physics, College of Engineering

**EDUCATION:** Ph.D., Physics, Stanford University

**RESEARCH INTERESTS:** Studying the question of the existence of chaotic behavior in quantum mechanical systems whose classical analogs are known to be nonintegrable and exhibit chaotic behavior. Silicon nanoparticles, preparation and characterization. Studies include topographical, compositional, structural, optical, electrical, and chemical characterizations.

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**Key to Core Research Areas:**
- Bionanotechnology
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- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment

www.cnst.illinois.edu
Thanh H. (Helen) Nguyen
Assistant Professor, Department of Civil and Environmental Engineering, College of Engineering

EDUCATION: Ph.D., Environmental Engineering, Johns Hopkins University

RESEARCH INTERESTS: Development of conceptual models that aid in assessing the human and ecological risks associated with biological contaminants in subsurface environments and water treatment systems. Waterborne pathogen removal for water and wastewater treatment, and fate and transport of antibiotic resistant bacteria in subsurface environment.

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Ralph Nuzzo
G.L. Clark Professor, Departments of Chemistry and Materials Science and Engineering, Colleges of Liberal Arts and Sciences and of Engineering

EDUCATION: Ph.D., Organic Chemistry, Massachusetts Institute of Technology

RESEARCH INTERESTS: The chemistry of materials; the use of state of the art methods of spectroscopic analysis and physical characterization.

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Daniel W. Pack
Professor, Department of Chemical and Biomolecular Engineering, Colleges of Liberal Arts and Sciences and of Engineering

EDUCATION: Ph.D., Chemical Engineering, California Institute of Technology


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Graciela W. Padua
Research Associate Professor, Department of Food Science and Human Nutrition, College of Agricultural, Consumer, and Environmental Sciences

EDUCATION: Ph.D., Food Science, University of Illinois

RESEARCH INTERESTS: Biodegradable plastics; microwave heating of foods, bionanotechnology.

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Urbana, Illinois 61801
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Michael J. Plewa
Professor, Department of Crop Sciences, College of Agricultural, Consumer, and Environmental Sciences

EDUCATION: Ph.D., Biology, Illinois State University

RESEARCH INTERESTS: Mutation genetics, maize genetics, genetic toxicology, environmental mutagenesis, microbiology, nanoenvironment.

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Eric Pop
Assistant Professor, Department of Electrical and Computer Engineering, College of Engineering

EDUCATION: Ph.D., Electrical Engineering, Stanford University


2258 Micro and Nanotechnology Laboratory, MC-249
208 N. Wright Street
Urbana, Illinois 61801
(217) 244-2070 • epop@illinois.edu

Key to Core Research Areas:
- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment
Gabriel Popescu
Assistant Professor, Department of Electrical and Computer Engineering, College of Engineering

EDUCATION: Ph.D., Optics, University of Central Florida

RESEARCH INTERESTS: Developing novel light imaging methods for studying cells and tissues at the nanoscale.

4055 Beckman Institute
405 N. Mathews Avenue
Urbana, Illinois 61801
(217) 333-4987 • gpopescu@illinois.edu

Nathan D. Price
Assistant Professor, Department of Chemical and Biomolecular Engineering, Colleges of Liberal Arts and Sciences and of Engineering

EDUCATION: Ph.D., University of California, San Diego

RESEARCH INTERESTS: Emerging field of systems biology—the intersection of high-throughput experimental biology with large-scale computational modeling to drive biological discovery.

119 Roger Adams Laboratory, MC-712, Box C-3
600 S. Mathews Avenue
Urbana, Illinois 61801
(217) 244-0596 • ndprice@illinois.edu

Umberto Ravaioli
Professor of Electrical and Computer Engineering, College of Engineering

EDUCATION: Ph.D., Electrical Engineering, Arizona State University

RESEARCH INTERESTS: Monte Carlo simulation of high speed electronic devices; numerical methods for semiconductor device simulation; quantum devices; supercomputation and visualization; reliability of MOS Devices; charge transport in biological systems (ionic channels); properties of carbon nanotubes, nanocomputation.

206 Engineering Hall
1308 W. Green Street
Urbana, Illinois 61801
(217) 333-2280 • ravaioli@illinois.edu

Key to Core Research Areas:
- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment
Ian M. Robertson
Donald B. Willett Professor of Engineering, Department of Materials Science and Engineering, College of Engineering

EDUCATION: D.Phil., Metallurgy, Oxford University, U.K.

RESEARCH INTERESTS: Understanding the basic processes controlling the mechanical response of materials exposed to extreme conditions. Mechanisms of strain transfer across interfaces, dynamics of deformation and fracture in aggressive and non-aggressive environments, superplasticity, deformation mechanisms under extreme conditions and deformation in nanograin materials.

203 Materials Science and Engineering Building
1304 W. Green Street
Urbana, Illinois 61801
(217) 333-1440 • ianr@illinois.edu

Angus A. Rockett
Professor, Department of Materials Science and Engineering, College of Engineering

EDUCATION: Ph.D., University of Illinois

RESEARCH INTERESTS: Sputter deposition and characterization of CuInSe2 for photovoltaics; growth of thin films; microchemical and microstructural analysis of thin films; modeling of materials, especially semiconductors, using Monte Carlo, density functional theory, and continuum methods; and micro- and nanoelectromechanical systems.

1-107 Engineering Sciences Building
1304 W. Green Street
Urbana, Illinois 61801
(217) 333-0417 • arockett@illinois.edu

John A. Rogers
Lee J. Flory Founder Chair in Engineering Innovation; Professor, Departments of Materials Science and Engineering, Chemistry, and Bioengineering; Director, Center for Nanoscale Chemical-Electrical-Mechanical Manufacturing Systems (Nano-CEMMS); Colleges of Engineering and of Liberal Arts and Sciences

EDUCATION: Ph.D., Physical Chemistry, Massachusetts Institute of Technology

RESEARCH INTERESTS: Observation and analysis of buckling mechanics in single-walled nanotubes, quasi-3D plasmonics crystals for biosensing and imaging, SWNT-based RF analog electronics, first all-nanotube transistor radios, methods for electrohydrodynamic jet printing with sub-micron resolution, routes to multilayer superstructures of aligned SWNTs.

3355 Beckman Institute
405 N. Matthews Avenue
Urbana, Illinois 61801
(217) 244-4979 • jrogers@illinois.edu
Elyse Rosenbaum
Professor, Department of Electrical and Computer Engineering, College of Engineering

EDUCATION: Ph.D., Electrical Engineering, University of California, Berkeley

RESEARCH INTERESTS: Reliability of nanoscale devices in integrated circuits; design of ESD-protected RFICs, modeling and simulation of ESD protection circuits, development of ESD test systems, design of high-speed serial I/O links, gate oxide reliability, ESD protection. For system-in-a-package and 3D ICs.

407 Coordinated Science Laboratory, MC-228
1308 W. Main Street
Urbana, Illinois 61801
(217) 333-6754 • elyse@illinois.edu

David N. Ruzic
Professor, Department of Nuclear, Plasma, and Radiological Engineering, College of Engineering

EDUCATION: Ph.D., Physics, Princeton University

RESEARCH INTERESTS: Experimental fusion research, modeling of edge-plasma atomic physics, atomic properties of potential first-wall materials, plasma processing of semiconductors, extreme ultraviolet (EUV) sources for micro and nano lithography and physical vapor deposition.

101 Nuclear Radiation Laboratory
201 S. Goodwin Avenue
Urbana, Illinois 61801
(217) 333-0332 • druzic@illinois.edu

Taher A. Saif
Gutgsell Professor, Department of Mechanical Science and Engineering; Director, Center for Cellular Mechanics, College of Engineering

EDUCATION: Ph.D., Theoretical and Applied Mechanics, Cornell University

RESEARCH INTERESTS: Mechanics of micro and nano electromechanical systems (MEMS/NEMS), fracture mechanics, submicron materials behavior and bio-MEMS. Explore the mechanics of extremely small things-from nanocrystalline metal films to living cells.

2101D Mechanical Engineering Laboratory
1206 W. Green Street
Urbana, Illinois 61801
(217) 333-8552 • saif@illinois.edu
Alexander Scheeline  
Professor, Department of Chemistry, College of Liberal Arts and Sciences  

**EDUCATION:** Ph.D., Chemistry, University of Wisconsin  

**RESEARCH INTERESTS:** Oscillatory enzyme kinetics, enzyme kinetics in microliter volumes, sensor arrays for chemical kinetics, and flame diagnostics.  

61 Roger Adams Laboratory  
600 S. Matthews Avenue, MC-712  
Urbana, Illinois 61801  
(217) 333-2999 • scheelin@illinois.edu  

Charles M. Schroeder  
Assistant Professor, Department of Chemical and Biomolecular Engineering, Colleges of Liberal Arts and Sciences and of Engineering  

**EDUCATION:** Ph.D., Stanford University  

**RESEARCH INTERESTS:** Design and implement integrated microdevices for high-throughput screening of biomolecules for medical analysis, study the action of natural and evolved enzymes at the molecular level, and investigate the non-equilibrium dynamics of soft materials.  

107 Roger Adams Laboratory, MC-712  
600 S. Matthews Avenue  
Urbana, Illinois 61801  
(217) 333-3906 • cms@illinois.edu  

Klaus J. Schulten  
Swanlund Professor of Physics, Department of Physics; Co-Director, Center for the Physics of Living Cells, College of Engineering  

**EDUCATION:** Ph.D., Chemical Physics, Harvard University  

**RESEARCH INTERESTS:** Theoretical physics and theoretical biology; structure and function of supramolecular systems in the living cell, and on the development of non-equilibrium statistical mechanical descriptions and efficient computing tools for structural biology.  

3147 Beckman Institute  
Urbana, Illinois 61801  
(217) 244-1604 • schulten@illinois.edu  

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**Key to Core Research Areas:**  
- Bionanotechnology  
- Computational and Theoretical Nanotechnology  
- Nanoelectronics and Nanophotonics  
- Nanomaterials and Nanomechanics  
- MEMS/NEMS  
- Societal & Ethical Implications of Nanotechnology & Assessment
Kenneth S. Schweizer
G. Ronald and Magaret H. Morris Professor, Department of Materials Science and Engineering, College of Engineering

**EDUCATION:** Ph.D., Physics, University of Illinois

**RESEARCH INTERESTS:** Development and application of new equilibrium and time-dependent microscopic statistical mechanical theories of condensed phase systems, employing analytical and computationally techniques. The focus is on soft materials or soft condensed matter, such as polymers, colloids, nanoparticle fluids, and crosslinked rubber networks.

206 Materials Science and Engineering Building
1304 W. Green Street
Urbana, Illinois 61801
(217) 333-6440 • kschweiz@illinois.edu

Edmund G. Seebauer
James W. Westwater Professor and Head, Department of Chemical and Biomolecular Engineering, Colleges of Liberal Arts and Science and of Engineering

**EDUCATION:** Ph.D., University of Minnesota

**RESEARCH INTERESTS:** Focuses on the control of defect behavior in semiconducting materials to make nanoscale devices of interest in energy, environmental, and microelectronics applications.

207 Roger Adams Laboratory, MC-712
600 S. Matthews Avenue
Urbana, Illinois 61801
(217) 244-9214 • eseebaue@illinois.edu

Paul R. Selvin
Professor, Department of Physics, College of Engineering

**EDUCATION:** Ph.D., Biophysics, University of California, Berkeley

**RESEARCH INTERESTS:** Single-molecule methods, single-molecule fluorescence microscopy and spectroscopy, nucleic acid and protein translocases, DNA protein interactions, molecular biology, structure and dynamics of biological macromolecules.

365 Loomis Laboratory
Urbana, Illinois 61801
(217) 244-3371 • selvin@illinois.edu
Mark A. Shannon
J. W. Bayne Professor, Department of Mechanical Science and Engineering, College of Engineering

EDUCATION: Ph.D., Mechanical Engineering, University of California, Berkeley

RESEARCH INTERESTS: Nanoscale, microscale, and mesoscale science and technologies that address real-world problems, bionanotechnology.

2132 Mechanical Engineering Laboratory
1206 W. Green Street
Urbana, Illinois 61801
(217) 244-1545 • mshannon@illinois.edu

Moonsub Shim
Associate Professor, and Willett Faculty Scholar, Department of Materials Science and Engineering, College of Engineering

EDUCATION: Ph.D., Chemistry, University of Chicago

RESEARCH INTERESTS: Low dimensional semiconductor materials from their synthesis to developing high performance components for electronics.

4105 Materials Science and Engineering Building
1304 W. Green Street
Urbana, Illinois 61801
(217) 333-7361 • mshim@illinois.edu

Sanjiv Sinha
Assistant Professor, Department of Mechanical Science and Engineering, College of Engineering

EDUCATION: Ph.D., Mechanical Engineering, Stanford University

RESEARCH INTERESTS: Electro-thermal transport in nanostructures, semiconduct physics, and close-packed nanocrystal assemblies; physics of heat flow at atomistic levels to improve reliability of nanoelectronics and to engineer materials with novel thermophysical properties.

228 Mechanical Engineering Building
1206 W. Green Street
Urbana, Illinois 61801
(217) 244-1891 • sanjiv@illinois.edu

Key to Core Research Areas:
- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment

www.cnst.illinois.edu
Stephen G. Sligar
I.C. Gunsalus Professor of Biochemistry, Department of Chemistry; Director, School of Molecular and Cellular Biology; Colleges of Liberal Arts and Sciences and of Medicine

**EDUCATION:** Ph.D., Physics, University of Illinois

**RESEARCH INTERESTS:** The development and utilization of novel technologies to understand the central mechanisms of biological function at the molecular and cellular level; and physical and chemical means by which enzymes catalyze biological oxidations. Research focus is on the cytochrome P450 dependent mixed function oxidases playing central and crucial roles in mammalian, plant, insect, viral, and microbial metabolism.

116 Morrill Hall
505 S. Goodwin Avenue
Urbana, Illinois 61801
(217) 244-7395 • s-sligar@illinois.edu

Nahil A. Sobh
Site Lead, Network for Computational Nanotechnology; Research Staff, Computational Multiscale Nanosystems, NanoHub, College of Engineering

**EDUCATION:** Ph.D, Applied Mathematics; Ph.D, Solid Mechanics/Civil Engineering, University of Colorado, Boulder

**RESEARCH INTERESTS:** High performance scientific computing, computational nanotechnology, large scale applications in online nano-biotechnology and imaging, large scale reservoir simulation, fluid-structure interaction (FSI), space-time finite element techniques, Discontinuous Galerkin methods.

1258 Micro and Nanotechnology Laboratory, MC-249
208 N. Wright Street
Urbana, Illinois 61801
(217) 244-9481 • sobh@illinois.edu

Petros Sofronis
Professor, Department of Mechanical Science and Engineering; Director, International Institute on Carbon-Neutral Energy Research (I2CNER), College of Engineering

**EDUCATION:** Ph.D., Theoretical and Applied Mechanics, University of Illinois

**RESEARCH INTERESTS:** Solid mechanics, micro and nano mechanics, and fracture mechanics. Developing mechanistic understanding of hydrogen embrittlement in pipeline steels for safe transportation of hydrogen fuel at enormous pressures through existing pipelines.

149 Mechanical Engineering Building
1206 W. Green Street
Urbana, Illinois 61801
(217) 333-2636 • sofronis@illinois.edu
Nancy R. Sottos
Donald B. Willett Professor of Engineering, Department of Materials Science and Engineering, College of Engineering

EDUCATION: Ph.D., Mechanical Engineering, University of Delaware

RESEARCH INTERESTS: Fabrication of heterogeneous materials systems with highly complex micro and nanostructures using advanced material processing techniques, surface and interface effects, characterization of mechanical properties, performance and reliability, characterization of deformation and failure mechanisms.

210 Materials Science and Engineering Building
1304 W. Green Street
Urbana, Illinois 61801
(217) 333-1041 • n-sottos@illinois.edu

Kenneth S. Suslick
Marvin T. Schmidt Professor of Chemistry, Departments of Chemistry, and Materials Science and Engineering, Colleges of Liberal Arts and Sciences and of Engineering

EDUCATION: Ph.D., Chemistry, Stanford University

RESEARCH INTERESTS: Organometallic, bio-organic, materials surface, analytical and physical chemistry. Chemical effects of ultrasound, bioinorganic and materials chemistry of metalloporphyrins and now especially, their applications as chemical sensors.

A420 Chemical and Life Sciences Laboratory
600 S. Matthews Avenue
Urbana, Illinois 61801
(217) 333-2794 • ksuslick@illinois.edu

Jonathan V. Sweedler
James R. Eiszner Family Chair in Chemistry; Professor, Departments of Chemistry and Bioengineering; Director, R.J. Carver Biotechnology Center; Colleges of Liberal Arts and Sciences and of Agricultural, Consumer, and Environmental Sciences

EDUCATION: Ph.D., Chemistry, University of Arizona

RESEARCH INTERESTS: Development of analytical methods for assaying complex microenvironments, capillary electrophoresis separation methods, laser-based detection methods, MALDI sampling techniques, nanoliter volume NMR and micro/nanofluidic sampling; study of the distribution and dynamic release of neuropeptides and classical transmitters.

2317 Beckman Institute
405 N. Mathews Avenue
Urbana, Illinois 61801
(217) 244-4398 • jsweedle@illinois.edu
Emad Tajkhorshid
Assistant Professor of Biochemistry and Pharmacology, Colleges of Medicine and of Liberal Arts and Sciences

EDUCATION: Ph.D., Biophysics, University of Heidelberg, Germany

RESEARCH INTERESTS: Structure function relationship of membrane proteins, in particular membrane channels and transporters, and understanding the mechanism of their function using simulation and computational methodologies.

3009 Beckman Institute
405 N. Mathews Avenue
Urbana, Illinois 61801
(217) 244-6914 • emad@life.illinois.edu

Kimani C. Toussaint
Assistant Professor, Department of Mechanical Science and Engineering, College of Engineering

EDUCATION: Ph.D., Electrical Engineering, Boston University

RESEARCH INTERESTS: Optics, particularly as it relates to nano- and biophotonics. Optical physics techniques to explore the properties of light and light/matter interactions and development ultrasensitive optics.

2119 Mechanical Engineering Laboratory, MC-244
1206 W. Green Street
Urbana, Illinois 61801
(217) 244-4088 • ktoussai@illinois.edu

Dallas R. Trinkle
Assistant Professor Department of Materials Science and Engineering, College of Engineering

EDUCATION: Ph.D., Physics, Ohio State University

RESEARCH INTERESTS: Atomistic computation of defects, defect interactions, and the mechanical behavior of materials. Mathematical modeling to predict behavior of real material.

308 Materials Science and Engineering Building
1304 W. Green Street Urbana, Illinois 61801
(217) 244-6519 • dtrinkle@illinois.edu

Key to Core Research Areas:
- Bionanotechnology
- Computational and Theoretical Nanotechnology
- Nanoelectronics and Nanophotonics
- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment

nano@illinois
Dale J. Van Harlingen
Professor and Head, Department of Physics, College of Engineering

EDUCATION: Ph.D., Physics, Ohio State University

RESEARCH INTERESTS: Non-equilibrium superconductivity; superconductor device physics; superconductor materials, including classic, high T_c, and heavy fermion superconductors; microfabrication and nanofabrication techniques; mesoscopic physics; scanning tunneling microscopy and scanning SQUID microscopy.

211 Loomis Laboratory
1110 W. Green Street
Urbana, Illinois 61801
(217) 333-3760 • dvh@illinois.edu

Lila O. Vodkin
Professor, Department of Crop Sciences, College of Agricultural, Consumer, and Environmental Sciences

EDUCATION: Ph.D., Genetics, North Carolina State University

RESEARCH INTERESTS: Plant biotechnology and molecular biology, plant breeding, genetics and cytogenetics- soybean molecular genetics, bionanotechnology, plant molecular biology and physiology- soybean gene expression, seed metabolism, and genetic engineering.

384A Edward R. Madigan Laboratory
Urbana, Illinois 61801
(217) 244-6147 • l-vodkin@illinois.edu

Amy J. Wagoner-Johnson
Assistant Professor, Department of Mechanical Science and Engineering, College of Engineering

EDUCATION: Ph.D., Materials Science Engineering, Brown University

RESEARCH INTERESTS: Repair of bone lost through trauma or disease. Design of synthetic bone substitute materials and systems using biomaterials. Effect of residual stresses on the mechanical behavior of micro-wires.

128 Mechanical Engineering Building
1206 West Green Street
Urbana, Illinois 61801
(217) 265-5581 • ajwj@illinois.edu

Yingxiao (Peter) Wang
Assistant Professor, Department of Bioengineering, College of Engineering

EDUCATION: Ph.D., Bioengineering, University of California, San Diego

RESEARCH INTERESTS: Live cell imaging, fluorescence, bionanotechnology, biophotonics, mechanobiology.

4261 Beckman Institute
405 N. Matthews Avenue
Urbana, Illinois 61801
(217) 333-6727 • yingxiao@illinois.edu
Ning Wang  
Professor, Department of Mechanical Science and Engineering, 
College of Engineering  

EDUCATION: Sc.D., Physiology, Harvard University  

RESEARCH INTERESTS: Cell mechanics, including cytoskeletal biomechanics and control of cell form and function; bio-imaging of cytoskeletal structures and stress distribution in living cells; mechanotransduction, nuclear deformation and gene expression, bionanotechnology.  

2326 Mechanical Engineering Laboratory, MC-244  
1206 W. Green Street  
Urbana, Illinois 61801  
(217) 265-0913 • nwangrw@illinois.edu  

Kenneth L. Watkin  
Professor, Department of Speech and Hearing Science, College of Applied Health Sciences  

EDUCATION: Ph.D., Speech Physiology, University of Washington  

RESEARCH INTERESTS: Development of nanoparticles for drug delivery, development of imaging contrast agents for image guided therapy, development of cyberphysial systems for health monitoring and therapy, and high resolution 3-D multimodal brain imaging, nanomedicine.  

709 W. University Avenue  
Urbana, Illinois 61801  
(217)-326-2512 • watkin@illinois.edu  

John H. Weaver  
Professor, Department of Materials Science and Engineering, College of Engineering  

EDUCATION: Ph.D., Solid State Physics, Iowa State University  

RESEARCH INTERESTS: Properties of surfaces, interfaces and nanostructured materials. Visualization and understanding of surfaces and nanostructures in real space, evolving dynamically at elevated temperature, or immobilized at very low temperature.  

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104 S. Goodwin Avenue  
Urbana, Illinois 61801  
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Key to Core Research Areas:  
- Bionanotechnology  
- Computational and Theoretical Nanotechnology  
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- Nanomaterials and Nanomechanics  
- MEMS/NEMS  
- Societal & Ethical Implications of Nanotechnology & Assessment
Charles J. Werth
Professor, Department of Civil and Environmental Engineering, College of Engineering

EDUCATION: Ph.D., Environmental Engineering and Science, Stanford University

RESEARCH INTERESTS: Transport and fate organic chemicals in the environment, and on the development of sustainable technologies for pollution abatement. Study of reactive transport mechanisms of pollutants in porous media, nanoenvironment.

3215 Newmark Laboratory
205 N. Matthews Avenue
Urbana, Illinois 61801
(217) 333-3822 • werth@illinois.edu

Matthew B. Wheeler
Professor, Department of Animal Sciences, College of Agricultural, Consumer, and Environmental Sciences

EDUCATION: Ph.D., Physiology and Biophysics, Colorado State University

RESEARCH INTERESTS: Microfluidics; nanometer-scale integrated systems, biology of single mammalian embryos and embryonic stem cells, bionanotechnology, remote sensing of embryo metabolism and embryonic health, microcalorimetry and MEMS actuators.

368 Animal Sciences Laboratory
1207 W. Gregory
Urbana, Illinois 61801
(217) 333-2239 • mbwheele@illinois.edu

Scott R. White
Professor, Department of Aerospace Engineering, College of Engineering

EDUCATION: Ph.D., Engineering Mechanics, Pennsylvania State University

RESEARCH INTERESTS: Self-generating materials that incorporate the ability to create, transform, or replicate themselves by a synthetic route; self-regulating materials, with the ability to autonomically assess their state and respond through multiscale and multifunctional mechanisms such as magnetostrictive actuation or shape memory behavior.

205C Talbot Lab
104 S. Wright Street
Urbana, Illinois 61801
(217) 333-1077 • swhite@illinois.edu
Andrzej Wieckowski
Professor, Department of Chemistry, College of Liberal Arts and Sciences

EDUCATION: D.Sc., Chemistry, University of Warsaw, Poland

RESEARCH INTERESTS: Electrode surface structure in relation to electrocatalysis combined with molecular-level studies of surface oxidation and reduction processes, surface motional behavior in electrocatalysis; new catalyst syntheses, the use of electro-analytical and spectroscopic methods for single crystal and nanoparticle studies.

58 Roger Adams Laboratory
600 South Mathews Avenue
Urbana, Illinois 61801
(217) 333-7943 • andrzej@scs.illinois.edu

Brenda A. Wilson
Associate Professor, Department of Microbiology, College of Liberal Arts and Sciences

EDUCATION: Ph.D., Chemistry, Johns Hopkins University

RESEARCH INTERESTS: Molecular interactions and biochemical mechanisms by which protein toxins produced by pathogenic bacteria cause their toxic effects on animal cells, bionanotechnology.

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601 S. Goodwin Avenue
Urbana, Illinois 61801
(217) 244-9631 • bawilson@life.illinois.edu

Min-Feng Yu
Associate Professor, Department of Mechanical Science and Engineering, College of Engineering

EDUCATION: Ph.D., Physics, Washington University

RESEARCH INTERESTS: Behavior of materials at very small scales. Mechanics and electro-mechanical behavior of materials at the nanoscale comparing to those at larger scales. Nanomechanics, electromechanics; actuation; sensing and robotics for nanoscale systems.

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Urbana, Illinois 61801
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Key to Core Research Areas:
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- Nanomaterials and Nanomechanics
- MEMS/NEMS
- Societal & Ethical Implications of Nanotechnology & Assessment
Yuanhui Zhang
Innovator Professor in Engineering; Professor, Department of Agricultural and Biological Engineering; Colleges of Agricultural, Consumer, and Environmental Sciences and of Engineering

EDUCATION: Ph.D., Agricultural Engineering, University of Saskatchewan, Canada

RESEARCH INTERESTS: Bioenvironmental engineering, nanoenvironment, focusing on the immediate environment of living things, people, animal and plants. Indoor air quality engineering and pollutant emission control from building sources, indoor airflow measurement and modeling, thermochemical conversion of biowaste materials into bioenergy.

332-B Agricultural Engineering Sciences Building, MC-644
1304 W Pennsylvania Avenue
Urbana, Illinois 61801
(217) 333-2693 • yzhang1@uiuc.edu

Huimin Zhao
Centennial Endowed Chair and Professor, Department of Chemical and Biomolecular Engineering, Colleges of Liberal Arts and Science and of Engineering

EDUCATION: Ph.D., Chemistry, California Institute of Technology

RESEARCH INTERESTS: Directed evolution in combination with rational design to create proteins, receptors, biosynthetic pathways, and whole cells with improved or novel functions, detailed biochemical and biophysical characterizations, bionanotechnology.

215 Rogers Adams Laboratory, Box C-3, MC-712
600 S. Mathews Avenue
Urbana, Illinois 61801
(217) 333-2631 • zhao5@illinois.edu

Steven Zimmerman
Roger Adams Professor and Head, Department of Chemistry, College of Liberal Arts and Sciences

EDUCATION: Ph.D., Columbia University


354B Roger Adams Laboratory, MC-712
600 S. Mathews Avenue
Urbana, Illinois 61801
(217) 333-6655 • sczimmer@illinois.edu
Charles F. Zukoski
William H. and Janet G. Lycan Professor, Department of Chemical and Biomolecular Engineering, Colleges of Liberal Arts and Sciences and of Engineering

EDUCATION: Ph.D., Princeton University

RESEARCH INTERESTS: Understanding the relationships between surface physical chemistry and the material properties of colloidal suspensions. Particular attention is paid to methods of manipulating interparticle forces to alter particle and suspension properties.

109 Roger Adams Laboratory, MC-712
600 S. Matthews Avenue
Urbana, Illinois 61801
(217) 244-8358 • czukoski@illinois.edu

Jian-Min (Jim) Zuo
Professor Department of Materials Science and Engineering, College of Engineering

EDUCATION: Ph.D., Physics, Arizona State University


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L. Brian Stauffer, UI News Bureau: Ha, Selvin, Nayfeh
## Index of Faculty Core Research Thrusts*

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### Nanoelectronics and Nanophotonics

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### Nanomaterials and Nanomechanics

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### Societal Implications of Nanotechnology and Assessment

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*some faculty members may appear in up to two thrusts*
# Overview of Research and Technology Transfer

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### Core Research
- NanoAgriculture
- Nanoenergy
- Nanomanufacturing
- Nanomedicine
- Nanosecurity

### Translational Research
- Nanotechnology
- Nanoeconomy
- Nanomaterials
- Nanoscale
- Nanonanotechnology

### Technology Transfer
- Training
- Entrepreneurship
- Outreach
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**Agencies**

AFOSR Air Force Office of Scientific Research
DARPA Defense Advanced Research Projects Agency
DOE Department of Energy
NCI National Cancer Institute
NIH National Institutes of Health
NSF National Science Foundation
USAID United States Agency for International Development
USDA United States Department of Agriculture
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<td>Mary-Grace Danao</td>
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<td>Jennifer Eardley</td>
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<td>Rebecca L. Krisher</td>
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*The additional collaborators listing involves those who are actively engaged with nanotechnology researchers in joint projects, proposals, or conducting or managing hands-on training in molecular and cell biology, and micro/nanofabrication/nanotechnology, and/or are engaged in conducting outreach activities.
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<thead>
<tr>
<th>Core Research</th>
<th>Translational Research</th>
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<td>Bionanotechnology</td>
<td>Nanotechnology and Energy</td>
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<td>Nanotechnology and Nanomanufacturing</td>
<td>Entrepreneurship</td>
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<td>Nanomaterials and Nanomechanics</td>
<td>Outreach</td>
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<td>Phoebe E. Lenear</td>
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<td>Zaida Luthey-Schulten</td>
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<td>Sophi I. Martin</td>
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<td>Jennifer M. Quirk</td>
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<td>Gene E. Robinson</td>
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<td>Massoud Rostam-Abbadi</td>
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www.cnst.illinois.edu  69
# Multidisciplinary Laboratories and Centers: Relevant List

## A–H

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<tr>
<th>Code</th>
<th>Name</th>
<th>URL/Details</th>
</tr>
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<tr>
<td>ADM-IPPL</td>
<td>ADM Institute for the Prevention of Postharvest Loss</td>
<td><a href="http://www.postharvestinstitute.illinois.edu">www.postharvestinstitute.illinois.edu</a></td>
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<tr>
<td>ASL</td>
<td>Animal Sciences Laboratory • <a href="http://www.fs.uiuc.edu/ada/0165.html">www.fs.uiuc.edu/ada/0165.html</a></td>
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<tr>
<td>ACC</td>
<td>Assured Cloud Computing Center (AFOSR/AFRL) • <a href="http://assured-cloud-computing.illinois.edu">assured-cloud-computing.illinois.edu</a></td>
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<tr>
<td>BRP</td>
<td>Cancer Nanomedicine (NIH- co-location)</td>
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<tr>
<td>Beckman</td>
<td>Beckman Institute of Advanced Science and Technology</td>
<td><a href="http://www.beckman.illinois.edu">www.beckman.illinois.edu</a></td>
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<tr>
<td>CABPN</td>
<td>Center for Agricultural, Biomedical, and Pharmaceutical Nanotechnology (NSF I/UCRC) • <a href="http://www.cnst.illinois.edu/cabpn">www.cnst.illinois.edu/cabpn</a></td>
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<tr>
<td>CBCB</td>
<td>Center for Biophysics and Computational Biology</td>
<td><a href="http://www.life.illinois.edu/biophysics">www.life.illinois.edu/biophysics</a></td>
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<tr>
<td>CCM</td>
<td>Center for Cellular Mechanics • <a href="http://www.ccm.illinois.edu">www.ccm.illinois.edu</a></td>
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<tr>
<td>CHAD</td>
<td>Center for Health, Aging, and Disability • <a href="http://www.chad.illinois.edu">www.chad.illinois.edu</a></td>
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<tr>
<td>CNST</td>
<td>Center for Nanoscale Science and Technology Collaboratory</td>
<td><a href="http://www.cnst.illinois.edu">www.cnst.illinois.edu</a></td>
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<td>CPLC</td>
<td>Center for the Physics of Living Cells (NSF Physics Frontier Center) • <a href="http://www.cplc.illinois.edu">www.cplc.illinois.edu</a></td>
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<tr>
<td>CSL</td>
<td>Coordinated Science Laboratory • <a href="http://www.csl.illinois.edu">www.csl.illinois.edu</a></td>
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<td>DRI</td>
<td>Disability Research Institute • <a href="http://www.dri.uiuc.edu">www.dri.uiuc.edu</a></td>
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<td>EBI</td>
<td>Energy Biosciences Institute • <a href="http://ebi-forecast.igb.uiuc.edu/bety">ebi-forecast.igb.uiuc.edu/bety</a></td>
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<td>EBICS</td>
<td>Emergent Behaviors of Integrated Cellular Systems Center (NSF STC co-location) • <a href="http://www.ebics.net">www.ebics.net</a></td>
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<tr>
<td>EMRL</td>
<td>Edward Madigan Research Laboratory • <a href="http://www.fs.uiuc.edu/ada/0336.html">www.fs.uiuc.edu/ada/0336.html</a></td>
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<tr>
<td>FSEC</td>
<td>Food Safety Engineering Center (USDA co-location)</td>
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<td>FSMRL</td>
<td>Frederick Seitz Materials Research Laboratory • <a href="http://mrl.illinois.edu">mrl.illinois.edu</a></td>
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<td>GEM⁴</td>
<td>Global Enterprise for Micro-Mechanics and Molecular Medicine (co-location) • <a href="http://www.gem4.org">www.gem4.org</a></td>
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<td>HUNT*</td>
<td>Center of Hyper-Uniform Nanophotonic Technologies (DARPA) • <a href="http://news.illinois.edu/news/04/0621hunt.html">news.illinois.edu/news/04/0621hunt.html</a></td>
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<td>IGB</td>
<td>Institute for Genomic Biology • <a href="http://www.igb.illinois.edu">www.igb.illinois.edu</a></td>
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<td>IGERT-CMMB</td>
<td>Integrative Graduate Education and Research Traineeship-Cellular and Molecular Mechanics and BioNanotechnology (NSF) • <a href="http://www.cmmb-igert.illinois.edu">www.cmmb-igert.illinois.edu</a></td>
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<td>IGERT-Neuro Engineering</td>
<td>A Unified Educational Program for Systems Engineering and Neuroscience (NSF) • <a href="http://igert.beckman.illinois.edu">igert.beckman.illinois.edu</a></td>
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<td>i2CNER</td>
<td>International Institute for Carbon-Neutral Energy Research (co-location)</td>
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<td>ITI</td>
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<td>LSCM</td>
<td>Laboratory for Sialobiology and Comparative Metabolomics</td>
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<td>MNTL</td>
<td>Micro and Nanotechnology Laboratory • <a href="http://www.mntl.illinois.edu">www.mntl.illinois.edu</a></td>
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<td>MURI</td>
<td>Fundamental Study of Defects and their Reduction in Type-II Superlattice Materials (MURI-ARO) • muri-t2sl.ece.illinois.edu</td>
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<td>NCDBN*</td>
<td>National Center for the Design of Biomimetic Nanoconductors (NIH Nanomedicine Center) • <a href="http://www.nanoconductor.org">www.nanoconductor.org</a></td>
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<td>NCLT</td>
<td>National Center for Learning and Teaching in Nanoscale Science and Engineering (NSEC-NSF, co-location) • <a href="http://www.community.nsee.us">www.community.nsee.us</a></td>
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<td>Network for Computational Nanotechnology, and nanoHub (NSF-NNI, co-location) • <a href="http://www.nanohub.org">www.nanohub.org</a></td>
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<td>National Center for Supercomputing Applications (NSF Teragrid Center) • <a href="http://www.ncsa.illinois.edu">www.ncsa.illinois.edu</a></td>
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<td>Nanomedicine for Cancer Research (USAID-HEC-Pakistan) • <a href="http://www.cnst.illinois.edu/cancernano">www.cnst.illinois.edu/cancernano</a></td>
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<td>nPEAP</td>
<td>Nano Photonics and Electronics Industry Affiliates Program (planning phase) • <a href="http://www.cnst.illinois.edu/nPEAP">www.cnst.illinois.edu/nPEAP</a></td>
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<td>NSRL</td>
<td>National Soybean Research Laboratory • <a href="http://www.stratsoy.uiuc.edu">www.stratsoy.uiuc.edu</a></td>
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<td>Nano-CEMMS</td>
<td>Center for Nanoscale-Chemical, Electrical, Mechanical, Manufacturing Systems (NSF NSEC) • <a href="http://www.nano-cemms.illinois.edu">www.nano-cemms.illinois.edu</a></td>
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<tr>
<td>PRI</td>
<td>Prairie Research Institute • <a href="http://www.prairie.illinois.edu">www.prairie.illinois.edu</a></td>
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<tr>
<td>RJCBC</td>
<td>Roy J. Carver Biotechnology Center • <a href="http://www.biotech.uiuc.edu">www.biotech.uiuc.edu</a></td>
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<td>SCCNE*</td>
<td>Siteman Center of Cancer Nanotechnology Excellence (NCI CCNE, co-location) • <a href="http://www.cnst.illinois.edu/sccne-uiuc.htm">www.cnst.illinois.edu/sccne-uiuc.htm</a></td>
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<td>SDBC</td>
<td>Soybean Disease Biotechnology Center (USDA) • <a href="http://www.nsrl.uiuc.edu/SDBC/index.html">www.nsrl.uiuc.edu/SDBC/index.html</a></td>
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<tr>
<td>VDL</td>
<td>Veterinary Diagnostic Laboratory and Teaching Hospital • vetmed.illinois.edu/vdl</td>
</tr>
<tr>
<td>Water CAMPWS</td>
<td>Center of Advanced Materials for Purification of Water with Systems (NSF STC) • watercampws.uiuc.edu</td>
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*Recently completed centers

**Innovation-based Entrepreneurship**

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<th>Acronym</th>
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<td>Academy for Entrepreneurial Leadership • <a href="http://www.business.illinois.edu/ael">www.business.illinois.edu/ael</a></td>
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<td>EWBI</td>
<td>Enterprise Works Business Incubator, Research Park • researchpark.illinois.edu/facilities/enterpriseworks</td>
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<td>EAI</td>
<td>Entrepreneurship at Illinois • <a href="http://www.illinois.edu/academics/entrepreneur">www.illinois.edu/academics/entrepreneur</a></td>
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<tr>
<td>HTMP</td>
<td>Hoeft Technology and Management Program • <a href="http://www.techmgmt.illinois.edu">www.techmgmt.illinois.edu</a></td>
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<td>IDEA</td>
<td>Illinois Initiative for the Development of Entrepreneurs in Agriculture • web.extension.illinois.edu/idea</td>
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<tr>
<td>IV</td>
<td>Illinois Ventures • <a href="http://www.illinoisventures.com">www.illinoisventures.com</a></td>
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<td>OTM</td>
<td>Office of Technology Management • <a href="http://www.otm.illinois.edu">www.otm.illinois.edu</a></td>
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<td>TEC</td>
<td>Technology Entrepreneur Center • <a href="http://www.tec.illinois.edu">www.tec.illinois.edu</a></td>
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</table>
Multidisciplinary Laboratories and Centers: Select Full Description

Center for Nanoscale Science and Technology

www.cnst.illinois.edu

Established in 2001-02, the University of Illinois Center for Nanoscale Science and Technology (CNST) is the premier center for nanotechnology research, education and training, and entrepreneurial and outreach activities. CNST draws its strength from working as a collaboratory involving the Beckman Institute for Advanced Science and Technology, Roy J. Carver Biotechnology Center, Coordinated Science Laboratory, Frederick Seitz Materials Research Laboratory, Institute for Genomic Biology, Micro and Nanotechnology Laboratory, Center for Nanoscale Chemical, Electrical, Mechanical, Manufacturing Systems, National Center for Supercomputing Applications, the Schools of Chemical Sciences and of Molecular and Cellular Biology, and other multidisciplinary centers. It brings together nanoscale research from across the campus, drawing faculty from engineering, chemistry, physics, biology, neuroscience, agriculture, medicine, and other areas. The center envisions seamless integration of research from materials to devices to systems and applications.

CNST is uniquely located to harness the entrepreneurial and technical spirit in downstate Illinois, with ongoing linkages with the University Research Park, the Illinois Department of Commerce and Economic Opportunity, and the State legislature. Industrial and international linkages have also been initiated through multidisciplinary centers. In addition, CNST has embarked on developing a curriculum for nanotechnology education, which will transcend a number of campus departments and units. Exceptional students with interest in nanotechnology projects have been awarded fellowships, as the center prepares the next generation workforce. CNST-led efforts have led to leveraging of existing nanotechnology labs into also hands-on training sites for molecular and cellular biology, mechanobiology, micro and nanofabrication, and enabling technologies, and tissue engineering.

The CNST thrives on its cutting-edge core research in bionanotechnology, computational nanotechnology, nanocharacterization, nanoelectromechanical systems, nanoelectronics, nanofabrication, nanomaterials, and nanophotonics. Translational areas include: nanoagriculture and food, nanoenvironment, nanomanufacturing, nanomedicine, nanosecurity, and societal implications of nanotechnology.

Societal Implications of Nanotechnology
Economic, Ethical, Environmental, Healthcare, Legal, and Social

Innovation-based Entrepreneurship

Agriculture & Food
Communications & Electronics
Medical & Pharma
Computational
Atmospheric, Environmental, & Energy

nano@illinois Nanotechnology Thrusts
The Micro and Nanotechnology Laboratory

www.mntl.illinois.edu

The Micro and Nanotechnology Laboratory (MNTL) is one of the nation’s largest and most sophisticated university-based facilities for semiconductor, nanotechnology, and biotechnology research. It contains over 8,000 square feet of class 100 and class 1,000 clean room laboratories and instrumentation for state-of-the-art ultra-high-speed optical and electrical device and circuit measurements.

The Laboratory has in the past housed various centers including the NSF-funded Engineering Research Center for Compound Semiconductor Microelectronics and the DARPA-funded Center for Optoelectronic Science and Technology. MNTL is currently home to an ARO MURI, an NSF IGERT, an NIH training grant, and an NSF I/UCRC, including several multidisciplinary projects some of which are funded by DOE, the US Army TATRC, USAID, and the USDA.

Recently, an $18 million Illinois State-funded expansion of the MNTL was completed, which included addition of a 3000 square foot bionanotechnology laboratory plus additional space for researchers and trainees. MNTL is a user facility, with approximately 280 researchers being educated and trained each year.
The Frederick Seitz Materials Research Laboratory

www.mrl.illinois.edu

The Frederick Seitz Materials Research Laboratory (FSMRL) is an interdisciplinary research laboratory focused on fundamental issues in materials science. It is a department of the Engineering College but also has attributes of a Department of Energy National Laboratory, including the operation of a DOE National Electron Beam User’s Center (CMM, the Center for Microanalysis of Materials).

The primary goals of the programs at the FSMRL are to develop fundamental research programs of the highest quality in the areas of materials science, condensed matter physics, and materials chemistry, to educate scientists and engineers at the PhD and Post-doctoral levels with skills in those areas, and to transfer science and technology developed at the FSMRL to other DOE National Laboratories and to US industry via research collaborations, mutually supportive interactions, and continuing education. Technology transfer also occurs when industry employs our outstanding graduate students and Post-Doctoral Research Associates. These young scientists and engineers are highly sought after since they are trained to pursue large-scale problems in a multidisciplinary environment. In addition, through the Center for Microanalysis of Materials (CMM), the FSMRL is the largest supplier of scientists and engineers educated in the use of advanced instruments for the materials sciences. Approximately 400 new users are educated each year. FSMRL is a user facility.
The Beckman Institute for Advanced Science and Technology

www.beckman.illinois.edu

The Beckman Institute for Advanced Science and Technology is an interdisciplinary research institute devoted to leading-edge research in the physical sciences, computation, engineering, biology, behavior, cognition, and neuroscience. The Institute's primary mission is to foster interdisciplinary work of the highest quality, transcending many of the limitations inherent in traditional university organizations and structures. The Institute was founded on the premise that reducing the barriers between traditional scientific and technological disciplines can yield research advances that more conventional approaches cannot. The Beckman Institute's research programs are focused around four main themes: Biological Intelligence, Human-computer Intelligent Interaction, Integrative Imaging, and Molecular and Electronic Nanostructures. More than 600 researchers from 40 University of Illinois departments as far-ranging as psychology, computer science, and biochemistry, comprising 13 Beckman Institute groups, work within and across these overlapping areas. The building is magnificent and offers more than 200 offices; specialized, state-of-the-art laboratories and other facilities; and meeting areas. The 313,000 square foot building was made possible by a generous gift from U of I alumnus and founder of Beckman Instruments, Inc., Arnold O. Beckman, and his wife Mabel M. Beckman, with a supplement from the State of Illinois. Additionally, the Arnold and Mabel Beckman Foundation provides ongoing financial assistance for various Institute and campus programs. Daily operating expenses of the Institute are funded by the state and its research programs are mainly supported by external funding from the federal government, corporations, and foundations.
The Coordinated Science Laboratory

**www.csl.illinois.edu**

The University of Illinois’ Coordinated Science Laboratory is a world-class multidisciplinary research laboratory that focuses on information technology at the crossroads of computing, control and communications. With a rich history of 60 years of innovation, CSL has developed and deployed innovations that have achieved international scientific recognition and transformed the way people interact with technology.

Led by a faculty of world-renowned experts and researchers, CSL uses these innovations to explore critical issues in defense, economics, energy systems, environmental sciences, life-enhancement for the disabled, medicine, and robotics. The Laboratory works toward breakthroughs at every level, from designing nanoscale circuits to architecture for massively parallel supercomputers. In addition, CSL has been the incubator of nationally and internationally renowned initiatives such as the Advanced Digital Sciences Center in Singapore, the Information Trust Institute and the newly launched Parallel Computing Institute.

The Institute for Genomic Biology

**www.igb.illinois.edu**

The Institute for Genomic Biology (IGB) at the University of Illinois at Urbana-Champaign was established in 2003 to advance life science research and stimulate bio-economic development in the state of Illinois. Construction of the $75 million, 186,000 square foot state-of-the-art IGB facility began in April 2004 and was completed in 2006. The facility now houses over 180 faculty and affiliates in three broad Program Areas:

- Systems Biology
- Cellular and Metabolic Engineering
- Genome Technology

IGB research is focused on applications of genomic biology in addressing significant problems in agriculture, medicine and the environment. These include understanding how global climatic change affects plant ecosystems, creating new biofuels and renewable energy resources, identifying genes that influence animal behavior, discovery of new antibiotics, and the diagnosis and treatment of chronic human diseases.
The Roy J. Carver Biotechnology Center (RJCBC) located at the Edward R. Madigan Research Laboratory, provides through its core laboratories in genomics and proteomics a state of the art research infrastructure to investigators both on and off campus. Research facilities consist of the Proteomics Center and the W. M. Keck Center for Comparative and Functional Genomics.

The Proteomics Center is composed of four units involved in protein and cell characterization: Flow Cytometry Facility, Immunological Resource Center, Carver Metabolomics Center, and Protein Sciences Facility. The W.M. Keck Center is subdivided into three units by their research focus: High-Throughput Sequencing and Genotyping, Functional Genomics, and Bioinformatics.

The Biotechnology Center provides genomic and proteomic research services to more than 221 principal investigators on campus representing six colleges and 38 departments, as well as numerous off-campus projects. In addition, the Center’s Placement Office assists graduate students and postdoctoral fellows in career placement.

The National Center for Supercomputing Applications, and Institute for Advanced Computing Applications and Technologies

The National Center for Supercomputing Applications (NCSA) provides powerful computers and expert support that help thousands of scientists and engineers across the country improve our world.

With the advanced computing, networking, data storage and visualization resources available at NCSA, researchers simulate how galaxies collide and merge, how proteins fold and how molecules move through the wall of a cell, nanoscale molecular dynamics, how tornadoes and hurricanes form, and other complex natural and engineered phenomena. NCSA will soon deploy the Blue Waters supercomputer, a system capable of sustained performance of 1 petaflop (1 quadrillion calculations per second) on a range of science and engineering applications.

NCSA—established in 1986 as one of the original sites of the National Science Foundation’s Supercomputer Centers Program—is supported by the state of Illinois, the University of Illinois, the National Science Foundation, and grants from other federal agencies.
Center for Nanoscale Chemical Electrical Mechanical Manufacturing Systems

www.nano-cemms.illinois.edu

MISSION: Nano-CEMMS is developing the science, processes, systems and diverse human resources to manufacture at the nanoscale. Its work will provide the basis for a scalable, robust, economic and environmentally friendly approach to nanoscale manufacturing.

PROGRAM DESCRIPTION: Nano-CEMMS is an NSF-funded Nanoscale Science and Engineering Center (NSEC). Its focus is on nanoscale manufacturing processes and systems. Led by the University of Illinois at Urbana-Champaign, it involves participants from North Carolina A&T University, Stanford University, University of Notre Dame, Northwestern University, and University of California at Irvine. This multidisciplinary effort involves several disciplines, including Chemistry, Chemical Engineering, Electrical Engineering, Materials Sciences, Mechanical Engineering, Physics and others in an attempt to realize an assembly line for manufacturing at the nanoscale.

GRAND CHALLENGES: To accomplish its mission, the Center’s research addresses problems associated with the nanoscale transcription of matter and the transduction of its state. Concentrating primarily on a fluidics-based approach, the research program involves (a) micro and nanofluidic devices and VLSI systems, (b) nanoscale sensing, (c) nanoscale positioning systems, and (d) integration of these capabilities and technologies into prototype manufacturing systems.

EDUCATION: The Center’s Education and Diversity Program is engaged in the development of education programs that address the needs of graduate and undergraduate students with an interest in nanomanufacturing. It also reaches out to K-12 students and teachers through camps and workshops to create a general awareness of the opportunities and challenges that reside at the nanoscale. Through its Industrial Advisory Board and Affiliates Program, the Center engages industry across the value-chain of nanotechnology.
Center for Advanced Materials for Purification of Water with Systems

**www.watercampws.illinois.edu**

**MISSION:** The Center’s twin missions are to develop revolutionary new materials and systems to purify water safely and economically, and to develop the human resources to advance the science and technology of water purification. The WaterCAMPWS is a research and education center for increasing water supplies for human use through enhanced treatment technologies.

The WaterCAMPWS is a National Science Foundation Science and Technology Center, with participants from the lead institution, the University of Illinois at Urbana-Champaign from Chemistry, Civil and Environmental Engineering, Geology, Material Science and Engineering, and Mechanical Engineering. Faculty from Berkeley, Clark Atlanta, MIT, Rose Hulman, and Stanford universities also participate.

**GRAND CHALLENGES:** Profound threats to providing sufficient safe and clean water face the peoples of the world, affecting their health and economic well-being. The problems with economically providing clean water are growing so quickly that incremental improvements in current methods of purification of water will leave much of the U.S. and the world without clean water in mere decades. The challenges to overcome in science, technology, and society require a long-term vision of what needs to be solved. Grand Challenges that need to be addressed over the next twenty years to meet the impending threats to clean water are outlined below. They serve as arrows for WaterCAMPWS, pointing the way for our efforts in advancing revolutionary new materials and systems for water purification.

Interdisciplinary CAMPWS Teams (ICT’s) address three major objectives identified for water purification by the WaterCAMPWS, the National Academy of Sciences, Sandia National Laboratories, and the Environmental Protection Agency. The three ICTs are:

- Increasing sources of potable water through Desalination and Reclamation,
- Removal of toxic substances to Decontaminate Potable Water Source, and
- Disinfecting water supplies to provide new methods to robustly remove pathogens without toxic byproducts. Each ICT has 4 components: science, materials synthesis, systems integration, and human resource development that are directed towards achieving the stated goals.

**EDUCATION:** The WaterCAMPWS offers a number of opportunities to graduate students to grow professionally and academically. It offers grants and fellowships to give graduate students greater depth in their research experience. We also provide many ways for them to grow professionally through mentoring programs and participation in the Student Leadership Council.

*A National Science Foundation Science and Technology Center*
**MISSION:** To conduct industrially-relevant fundamental research, enhance graduate education and research, and facilitate technology transfer to industry.

**APPLICATION-ORIENTED CHALLENGES:**

- The Center for Agricultural, Biomedical, and Pharmaceutical Nanotechnology (CABPN) leverages the deep expertise in the areas of gene-based and protein-based disease diagnostics at the University of Illinois.
- We are approaching an era of “personalized medicine” in which predictions about which individuals will be likely to benefit or suffer harmful side effects from a pharmaceutical compound will be made based upon their gene expression.
- Pharmaceutical companies will seek FDA approval for drugs based on safety/efficacy as they do today, but rather than for the entire population of humans, a drug will be approved for patients that satisfy a specific set of genetic preconditions, such as “genetic biomarkers” or “protein biomarkers” used to conclusively diagnose a disease.
- Nanosensors can be used to rapidly detect gene and/or protein expression at exceedingly low concentrations, providing the tools that will be used to drive this industry.
- Gene and protein-based diagnostics are not only applicable to human diseases, but also for understanding and diagnosing crop diseases, and food pathogens.
- To aid the process of crop-based genetic engineering that can confer pest resistance, increase yield, or incorporation of genes from other organisms, and develop new knowledge, technologies and systems for detection & prevention of chemical and microbial contamination of foods.

A National Science Foundation Industry/University Cooperative Research Center (NSF-I/UCRC). I/UCRCs Enable Discovery and Innovation through Collaboration
IGERT: CMMB Mission: The CMMB IGERT's mission is to train the next generation of leaders who will define the new frontiers of cellular and molecular mechanics and bionanotechnology.

Integrating biology and medicine with micro and nanotechnology can be categorized into two broad areas, namely how micro/nano-fabrication can help solve problems in life sciences (such as diagnostics, therapeutics, and tissue engineering) and how we can learn more from life science to solve important problems in micro/nano-science and engineering (such as bio-inspired self-assembly).

The Grand Challenge: Critical experiments during the last decade show a fundamental link between the micro and macro mechanical environment (i.e., intracellular forces, local shear, gravitational force) and a variety of cell functionalities, their lineage, and phenotype. These findings pose the grand challenge: what is the underlying molecular mechanism that the cells employ to transduce mechanical signals to biochemical pathways?

In response to this challenge the CMMB IGERT has launched an inter-disciplinary research effort with national and international collaborators. Conducted at molecular to inter-cellular scales, this research involves biological experiments, imaging, large scale computations, and development of new engineering methodologies to address the challenge in a quantitative way previously not available to the research community.

Education: The educational goals of the CMMB IGERT is to train the next generation of researchers and educators in the interdisciplinary area of cellular and molecular mechanics and bio-nanotechnology, and to build a community of faculty, PhD students, REU students, international researchers, and colleagues from industry and national labs to collaborate on education and research. We expect that this new generation of educators and researchers will be knowledgeable in biology and engineering, and in science and technology, and will have developed a network of resources (people, facilities, international connections) that will benefit them in their future career.
M-CNTC Mission: The M-CNTC is training the next generation of leaders who will define the new frontiers and applications of nanotechnology in cancer research.

Integrating biology and medicine with micro and nanotechnology can be categorized into two broad areas, namely how micro/nano-fabrication can help solve problems in life sciences (such as diagnostics, therapeutics, and tissue engineering) and how we can learn more from life science to solve important problems in micro/nano-science and engineering (such as bio-inspired self-assembly).

The Grand Challenge: It is known that more than 1.5 million Americans were diagnosed with cancer during 2009, and half a million have died (Cancer Statistics 2009, ACS). In spite of considerable effort, there has been limited success in reducing per capita deaths from cancer since 1950. This calls for a paradigm shift in the understanding, detection, and intervention of the evolution of cancer from a single cell to tumor scale.

In response to this challenge the M-CNTC has assembled a preeminent interdisciplinary team of researchers and educators across the University of Illinois and clinical collaborators in the Midwest to train the next generation of engineers, physical scientists, and biologists to address the challenge of understanding, managing, diagnosing, and treating cancer using the most recent advancements in nanotechnology.

Education: The educational goals of the M-CNTC are to train the next generation of researchers and educators in the interdisciplinary area of cancer nanotechnology and to aid the NCI Alliance in building a community of faculty, PhD students, postdocs, and colleagues from clinical institutions to collaborate on education and research. We expect that this new generation of educators and researchers will be knowledgeable in cancer biology, nanotechnology, and nanoengineering, and will have developed a network of resources (people, facilities, international connections) that will benefit them in their future careers.
EBICS MISSION: To create a new scientific discipline for building living, multi-cellular machines that solve real world problems in health, security, and the environment.

This mission will be achieved through integrated research and education efforts, human resource development, diversity and outreach programs, and knowledge transfer activities. The EBICS Strategic Plan details EBICS’ approach for addressing the ambitious and transformative goals of the Center.

THE GRAND CHALLENGE: This NSF STC (EBICS) comprising of Massachusetts Institute of Technology, University of Illinois, and Georgia Institute of Technology, and University of California, Merced, City College of New York, and Morehouse College will address the grand challenge of engineering multi-cellular biological machines that have desired functionalities and can perform prescribed tasks. These machines consist of sensing, information processing, actuation, protein expression, and transport elements that can be effectively combined to create functional units. The scientific goals of EBICS are to establish a fundamental understanding of cell-cell and cell-environment interactions, and their control by biochemical and mechanical cues; assemble and characterize the properties and performance of multi-cellular machines, thereby creating the nascent discipline for building living, multi-cellular machines for a wide range of applications.

EDUCATION: Develop innovative education, outreach, and training programs across EBICS that will prepare students to become future researchers and education leaders in the new discipline. To produce the next generation of researchers and a supporting community to nucleate and develop the nascent discipline for building living, multi-cellular machines. This requires a diverse group of leaders who are equally proficient in biology and engineering, prepared for future challenges in their careers in a global environment.
Overview of Research Interests and Resources
For listing and additional details of laboratories see pgs 70–77
To download updated version of the nano@illinois Research Faculty Handbook visit: www.cnst.illinois.edu/pubs/NanoRFH_Illinois_CNST.pdf

Limited hard copies are available on request; additional copies are available on cost

For feedback, send email to nanotechnology@illinois.edu