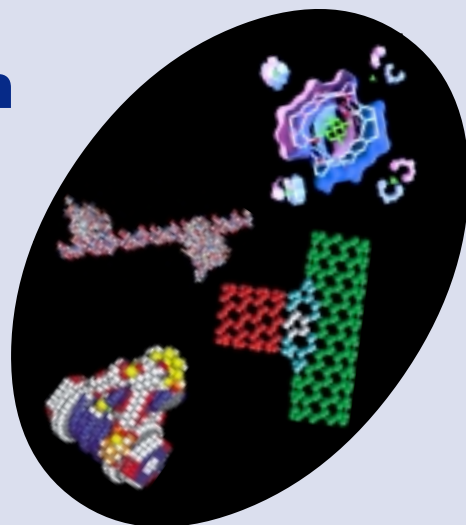


10<sup>th</sup> FORESIGHT INSTITUTE<sup>®</sup> Conference on

# Molecular Nanotechnology

October 10 - 13, 2002

Bethesda, Maryland



**Learn how the emerging nanotechnologies of today will enable the nanosystems of tomorrow**

## Topics Covered

**Nanodevices • Molecular Machines**  
**Nanostructures • Scanning Probes**  
**Nanotubes • Nanoelectronics**  
**Biomolecular Machinery • Sensors**  
**Nanomaterials • Self-Assembly**  
**Supramolecular Chemistry**  
**Computational Chemistry**

## Scientific Tutorial October 10, 2002

Tutorial Chair: **Chris Gorman**, North Carolina State University

### Topics Covered

*The Theory of Molecular Electronics:*  
Mark Ratner, Northwestern University

*Nanoparticles, Synthesis, Structures and Potential Applications:*  
Dan Feldheim, North Carolina State University

*Nano-Optical Materials and Nano-Optics:*  
Larry Dalton, University of Washington

*Experiments in Molecular Electronics and Molecular-Scale Sensing:*  
Nongjian Tao, Arizona State University

**Conference Co-chairs:** Susan B. Sinnott, University of Florida  
James Spencer, Syracuse University

## Keynote Speaker

**Mildred S. Dresselhaus**, MIT

Former President, AAAS

Winner, National Medal of Science

*The Nanoscience of Nanotubes and Nanowires*

## Invited Speakers

**Rodney Andrews**, University of Kentucky  
*Multiwall Carbon Nanotubes: Synthesis and Composite Applications*

**Donald W. Brenner**, North Carolina State University  
*Virtual Molecular Design of Nanometer-Scale Flow Control Valves, Sensors and Devices*

**Larry Dalton**, University of Washington  
*Breaking the Bandwidth Bottleneck in Telecommunications and Information Processing: New Electro-Optic Materials*

**Cees Dekker**, Delft University of Technology  
*Carbon Nanotube Transistor-Based Logic Circuits*

**Dan Feldheim**, North Carolina State University  
*Multifunctional Gold Nanoparticle for Biomolecule Detection and Intracellular Delivery*

**Craig Grimes**, Pennsylvania State University  
*Metal Oxide Nanoarchitectures for Environmental Sensing*

**Judith A. Harrison**, U.S. Naval Academy  
*Theoretical Investigation of Atomic-Scale Friction and Wear in Hydrocarbon-Containing Systems*

**Josef Michl**, Univ. of Colorado  
*Artificial Surface-Mounted Molecular Rotors*

**Nadrian C. Seeman**, New York University  
*Structural DNA Nanotechnology*

**Nongjian Tao**, Arizona State University  
*Electrochemical Gate-Controlled Discrete Conductance Switching in Polymer Wires*

**Jon A. Zubieta**, Syracuse University  
*Solid State Coordination Chemistry: Influences of Organic Components on the Structures of Inorganic Oxides*

[www.foresight.org/conference](http://www.foresight.org/conference)

## 10<sup>th</sup> Foresight Conference on Molecular Nanotechnology

Rapid advances in our ability to probe, image, and manipulate the properties of matter at the atomic scale—together with emerging insights into structure, function and self-assembly in biological systems—is bringing to fruition the tremendous promise of nanotechnology first recognized by Richard Feynman over 40 years ago. In the next decade, current research into the science and technology of nanostructures will have a major impact on fields ranging from consumer electronics to space exploration and medicine.

Foresight Institute's 1<sup>st</sup> Conference on Nanotechnology, which predated the National Nanotechnology Initiative by a decade, was the first comprehensive conference on the subject. Foresight-sponsored events continue to be the premiere venue for discussing new and innovative multidisciplinary research in nanotechnology. Last year's conference attracted over 400 researchers from academic, government and industrial laboratories world-wide, and included papers from the electronics, biological, medical, and computing communities. Foresight's 10<sup>th</sup> Conference will again provide a forum in which leaders from all disciplines delving into nanoscale science and technology present and discuss their latest ideas and results.

### About the Keynote Speaker

Mildred S. Dresselhaus, an Institute Professor at the Massachusetts Institute of Technology, has made numerous contributions to the study, understanding, and characterization of nanostructures, including fullerenes, carbon nanotubes, bismuth nanotubes, and low dimensional thermoelectric materials. Professor Dresselhaus has served as the President and Chairman of the Board of the American Association for the Advancement of Science, and, most recently, Director of the Office of Science in the US Department of Energy. She was awarded the National Medal of Science in 1990.

### Poster Session

The conference poster session will be held on Friday, October 11, at 5:30 PM and representatives for each poster will be available for discussion during that time. There will be additional time on Saturday morning, October 12, for poster viewing and discussion.

### 2nd Annual Panel on Venture Capital for Nanotechnology—Oct. 11

Due to the rapid increase in interest from the venture funding community, there will be a panel discussion on nanotechnology funding featuring venture capital representatives active in nanotechnology.

### Abstracts

Abstracts for both oral presentations and posters are due **June 1, 2002** and should be submitted on the web at: ([www.foresight.org/Conferences/MNT10/SpeakerInfo.html#ConfAbst](http://www.foresight.org/Conferences/MNT10/SpeakerInfo.html#ConfAbst)). If you have questions, contact the conference co-chairs, Susan Sinnott, <[ssinn@mse.ufl.edu](mailto:ssinn@mse.ufl.edu)>, or James Spencer, <[jtsponce@syr.edu](mailto:jtsponce@syr.edu)>.

### Special Issue of *Journal of Nanoscience and Nanotechnology*

Papers based on presentations and posters accepted for the 10th Foresight Conference and representing original and unpublished work will be published in a special issue of the *Journal of Nanoscience and Nanotechnology* ([www.aspbs.com/jnn](http://www.aspbs.com/jnn)). Published bimonthly by American Scientific Publishers, *JNN* is a cross-disciplinary peer-reviewed international journal on nanoscience and nanotechnology encompassing fundamental and applied research in all disciplines of science, engineering, and medicine.

For the latest information on the conference:  
[www.foresight.org/conference](http://www.foresight.org/conference)

## Topics Covered

The Foresight Conference covers the key topics required for an integrated understanding of molecular nanotechnology:

### *Products and goals*

**Nanostructures** underlie all nanotechnologies. Their diverse physical, chemical and electronic properties determine what nanotechnologies can do.

**Nanomaterials** gain special mechanical, optical, and electronic properties from their nanoscale structure.

**Nanodevices** — including sensors, transistors, actuators, and others — will be components first of early products, and later of advanced nanosystems.

**Nanoelectronics** is a natural extension of the microelectronic technologies of today, expected to be a crucial application of emerging nanotechnologies.

### *Enabling technologies, tools, and parts*

**Sensors** at the nanoscale can be used to recognize molecules and to probe the properties of surfaces and objects at the atomic scale.

**Nanotubes** provide strong, stiff building blocks with diverse electronic properties, suiting them for use in a wide range of nanoelectromechanical systems (NEMS).

**Biomolecular machinery** evolved by nature — such as the bacterial flagellar motor and the actin-myosin system of muscle — has shown the feasibility of molecular machine systems and may provide prefabricated working components.

**Scanning probe** instruments have led the way in imaging and manipulating molecular structures on surfaces.

**Computational chemistry** enables designers of molecular systems to understand which designs will produce which results, helping synthetic chemists to produce devices that will function properly in systems.

**Molecular machines** produce controlled motion on a molecular scale. By bringing other molecules together in a controlled way, they will one day be used to control the sequences of chemical reactions that will enable molecular manufacturing of complex nanosystems.

### *Enabling sciences and principles*

**Supramolecular chemistry** — by moving beyond the traditional concern with individual molecules to a focus on building larger structures from assemblages of molecules — is a key enabling technology for a wide range of nanosystems.

**Self-assembly** — the principle behind supramolecular chemistry and the assembly of the molecular machinery of living systems — is central both to many present-generation nanotechnologies and to anticipated pathways toward complex nanosystems.

## Feynman Prizes & Awards—Oct. 12

### The 2002 Foresight Feynman Prizes in Nanotechnology

(Experimental and Theoretical) will be awarded to the person or group whose recent research has made the most significant contribution to the advancement of nanotechnology. An award of \$5,000 will be given in each category to the top submission selected by a prize committee of past winners. Nominations or submissions must be received by **July 31, 2002**. ([www.foresight.org/FI/2002Feynman.html](http://www.foresight.org/FI/2002Feynman.html))

The Saturday evening awards banquet will include presentation of prizes and acceptance speeches by the 2002 Feynman Prize winners, and presentation of the Foresight 2002 Communication Prize ([www.foresight.org/FI/communicationprize2.html](http://www.foresight.org/FI/communicationprize2.html)) and 2002 Foresight Distinguished Student Award ([www.foresight.org/FI/StudentAward5.html](http://www.foresight.org/FI/StudentAward5.html))

### 2002 Institute for Molecular Manufacturing Prizes in Computational Nanotechnology

A new series of prizes will begin at this conference, with the awarding of the first IMM Prizes in Computational Nanotechnology, designed to encourage advances in molecular machine design. ([www.imm.org/prizes](http://www.imm.org/prizes))

## Pre-conference Tutorials

Most conference attendees have the prerequisites for the scientific tutorial.

**Scientific Tutorial** Thursday October 10 (9 am to 5 pm)

**Tutorial Chair:** Chris Gorman, North Carolina State University

### Goal

If you have substantial science background relevant to nanotechnology, but want to get up to speed on areas you're unfamiliar with, choose the scientific tutorial. The focus is on getting you oriented on recent research on key topics.

### Who Should Attend

Researchers and technologists with science or engineering backgrounds.

### Topics and Instructors

#### The Theory of Molecular Electronics

**Mark Ratner** teaches chemistry at Northwestern University, where he is also associate director of the Nanotechnology Institute. His work lies in the area of molecular electronics, and in the molecular organization of matter including proteins, DNA and polymers. He received the 2001 Feynman Prize, and has been very active in the general area of modeling of electronic behavior. One of the major challenges in developing an appropriate theoretical approach to molecular nanostructures has been developing appropriate structure/function relations based on careful comparison of theory and experiment - this is a major focus of Ratner's current research.

#### Nanoparticles, Synthesis, Structures and Potential Applications

**Dan Feldheim** is an Associate Professor of Chemistry at North Carolina State University. Some members of his research group seek to understand electron transport in nanometer-sized metal particles and organic molecules. This knowledge is being applied toward the fabrication of low power, sensitive chem/ biological sensors. Understanding how biomolecule-metal particle complexes can interact with cell membranes and cellular transcription machinery is the goal of other members of the group with the ultimate goal of developing small particles which can deliver therapeutic agents into cells with high efficiency and cell specificity.

#### Nano-Optical Materials and Nano-Optics

**Larry Dalton** is a Professor of Chemistry and Engineering (Electrical and Materials Science & Engineering) at University of Washington and University of Southern California. He is the inaugural holder of the Harold and Lillian Moulton Chair of Organic Chemistry and Scientific Co-Director of the Loker Institute. He is Director of the DoD MURI Center on Smart Polymeric Materials and the NSF STC Center on Information Technology Research. Current research focuses on the realization of large, ultrafast index of refraction changes (exploiting the concepts of nanoengineering of materials) and application of such effects to development of a wide range of new devices.

#### Experiments in Molecular Electronics & Molecular-Scale Sensing

**Nongjian Tao** is a Professor of Electrical Engineering and affiliated Professor of Chemistry and Biochemistry at Arizona State University. His research focuses on development of electronic device and chemical sensor applications using molecules as basic elements. His recent work includes electrochemical fabrication of nanoelectrodes and nanowires, interactions between organic molecules and metallic nanowires, electron transport in single conducting polymer chains and electron transfer in redox molecules on solid electrodes.

**Basic Tutorial** Thursday October 10 (9 am to 5 pm)

**Tutorial Chair:** Ralph Merkle, Zyvex Corp.

### Goal

If you don't have a degree in science or engineering but would like to get oriented on nanotechnology as quickly and painlessly as possible, this is the event for you. The focus is on providing you with the basics in an understandable way.

### Who Should Attend

Non-researchers who are new to the field: investors, analysts, attorneys.

### Topics Covered

- What are the different types of nanotechnology?
- Which are long-term, which short-term?
- What are nanotubes, moletronics, bionanotechnology, scanning probes, quantum dots?
- What is the role of software?
- When should you be most skeptical?

See ([www.foresight.org/conference/MNT10](http://www.foresight.org/conference/MNT10)) for details.

## Registration Fees

**Registration fees include** the Thursday evening welcoming reception; general session which begins on Friday morning and ends Sunday afternoon; morning bagels and coffee; coffee breaks; poster session reception; and Friday, Saturday, and Sunday lunch. (There is a "no lunch" option that does not include lunch on Friday, Saturday or Sunday [see back page]).

**Optional items** available at this year's conference include the Feynman Prize Banquet Dinner, Senior Associate Reception, and JNN Special Issue. The Banquet Dinner is being held on Saturday, October 12, from 6:00 to 8:00 PM and includes presentation of prizes and acceptance speeches by the 2002 Feynman Prize Winners. The Senior Associate Reception will be held on Friday, October 11, from 8:00 to 10:00 PM and is open to all conference attendees. See the Registration page for pricing information.

**The registration for the tutorial is separate from the conference registration.** The tutorial registration fee includes Thursday lunch. You may register for the conference only, the tutorial only, or both the conference and tutorial.

Tutorial space is limited, therefore early registration is recommended. For additional information, see the web site or contact the Conference Office at 1(650) 917-1122, <[foresight@foresight.org](mailto:foresight@foresight.org)> or Christopher Gorman, North Carolina State University, <[Chris\\_Gorman@ncsu.edu](mailto:Chris_Gorman@ncsu.edu)> or Ralph Merkle, Zyvex Corp., <[merkle@foresight.org](mailto:merkle@foresight.org)>

Amounts over \$175 are tax-deductible in the U.S. as a charitable contribution, excluding optional items.

## Site and Accommodations

**Hyatt Hotel** • One Bethesda Metro • Wisconsin Ave. at Old Georgetown Road • Bethesda, Maryland 20814

**Reservations:** 1 (800) 233-1234 or +1 (301) 657-1234 or ([www.hyatt.com](http://www.hyatt.com)). Attendees are responsible for making their own reservations. Mention the **Foresight Nanotechnology Conference**.

**Group Rate:** Through Monday, **Sept. 15, 2002** there will be a limited number of rooms available at the Group Rate of \$139 plus tax—single or double occupancy. Please reserve early.

**Location:** The Hyatt is located at Metro Center, Maryland's high tech corridor, 6 miles to downtown Washington, D.C., within walking distance to restaurants, theaters and world-class shopping; 5 miles to National Zoo, 18 miles to Washington/National Airport, 32 miles to BWI airport and 18 miles to Dulles International Airport. For complete directions: ([www.hyatt.com/usa/bethesda/hotels/map\\_bethe.html](http://www.hyatt.com/usa/bethesda/hotels/map_bethe.html)).

**Airport Transportation:** Royal Airport Shuttle (800) 653-0888 or +1 (301) 657-0888 is available from Washington National, Dulles or BWI airports between 5:00 am and 11:00 pm. Reservations are required. The Metro is available from Washington National Airport only.

## Refund Policy

Refunds of registration fees can only be made upon receipt of a written request, postmarked no later than Monday **Sept. 15, 2002**, and are subject to a \$75 administrative fee.

## Special Needs

Participants with special needs should notify the organizers at least one month in advance. Please contact Foresight Institute [foresight@foresight.org](mailto:foresight@foresight.org), +1 (650) 917-1122, fax +1 (650) 917-1123.

*Foresight Institute and Institute for Molecular Manufacturing are non-profit organizations focused on nanotechnology education and research and are funded primarily through Senior Associate donations. Senior Associates receive discounts for all Foresight and IMM sponsored events. For more information about the Senior Associate Program including our annual Gatherings see [www.foresight.org/SrAssoc](http://www.foresight.org/SrAssoc)*

This conference is sponsored by:



**Institute for  
Molecular  
Manufacturing**

## Conference & Tutorial Registration

Please **print clearly** and fax or mail this form to:  
Foresight Institute • Box 61058 • Palo Alto CA 94306 USA  
Tel: (650) 917-1122 • Fax: (650) 917-1123

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City, State: \_\_\_\_\_

Zip/Postal Code, Country: \_\_\_\_\_

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

Email: \_\_\_\_\_

Position (Professor, Director, Programmer, etc.): \_\_\_\_\_

Organizational affiliation (for your badge): \_\_\_\_\_

- Yes, include my contact information: name, badge affiliation, and email on an attendee list.**
- No, do not include my contact information on an attendee list.**

*Senior Associates of Foresight Institute or IMM may register at the academic rate, regardless of their employment status. For more information about becoming a Senior Associate, see [www.foresight.org/SrAssoc](http://www.foresight.org/SrAssoc).*

**COVER:** Art Credits from top clockwise:

*A Synthetic Self-Assembling Spherical Complex, by J. Rebek and M. Pique, The Scripps Research Inst. Nanotube Junctions for Nanoelectronic Devices, by D. Srivastava, NASA Ames, MRJ & M. Menon, University of Kentucky • Molecular Manipulator Design: A Fine Motion Controller, by K. E. Drexler, Inst. for Molecular Manufacturing • Supramolecular Chemistry of Addressable Biostructures, by J. Wendel and S. Smith, City of Hope Medical Center*



Box 61058  
Palo Alto, CA 94306 USA

### Conference Fee with **LUNCHES** included: (Oct. 11-13)

Conference fees include: Welcome reception, bagels, coffee, poster reception.

	by Aug. 1	after Aug. 1
Academic, Nonprofit, Govt., Sr. Assoc.	<input type="checkbox"/> \$475	<input type="checkbox"/> \$595
Corporate, Individual	<input type="checkbox"/> \$595	<input type="checkbox"/> \$725
Full-time Student**	<input type="checkbox"/> \$225	<input type="checkbox"/> \$325
One day <input type="checkbox"/> Fri <input type="checkbox"/> Sat <input type="checkbox"/> Sun	<input type="checkbox"/> \$175	<input type="checkbox"/> \$225

### Conference Fee with **NO LUNCHES** (Oct. 11-13)

Conference fees include: Welcome reception, bagels, coffee, poster reception.

	by Aug. 1	after Aug. 1
Academic, Nonprofit, Govt., Sr. Assoc.	<input type="checkbox"/> \$345	<input type="checkbox"/> \$465
Corporate, Individual	<input type="checkbox"/> \$465	<input type="checkbox"/> \$590
Full-time Student**	<input type="checkbox"/> \$ 95	<input type="checkbox"/> \$195

**No lunches option omits lunch on Friday, Saturday, Sunday.**

\*\* Full-time students must **fax** a copy of **current** university student ID with the registration form or Academic Fee will be charged.

### Tutorial Fees include lunch (Oct.10)

Scientific Tutorial— 9am - 5 pm	<input type="checkbox"/> \$475	<input type="checkbox"/> \$595
Basic Tutorial— 9am - 5 pm	<input type="checkbox"/> \$475	<input type="checkbox"/> \$595

### Optional Items:

Feynman Prize Banquet (Oct.12)	<input type="checkbox"/> \$ 60	<input type="checkbox"/> \$ 75
Senior Associate Reception (Oct.11)	<input type="checkbox"/> \$ 45	<input type="checkbox"/> \$ 65
JNN Special Issue	<input type="checkbox"/> \$ 35	<input type="checkbox"/> \$ 35

(Senior Associate membership not required to attend the reception)

Conference	\$ _____
Tutorial	\$ _____
Feynman Prize Banquet	\$ _____
Senior Associate Reception	\$ _____
Journal of Nanoscience & Nanotechnology	\$ _____
<b>TOTAL</b>	\$ _____

Please make checks payable to Foresight Institute. Checks and bank drafts must be in U.S. dollars drawn on a U.S. bank.

VISA or MasterCard Number: \_\_\_\_\_ Exp. Date: \_\_\_\_\_

Signature \_\_\_\_\_

Printed Name \_\_\_\_\_

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## October 10-13, 2002

**10<sup>th</sup>**  **FORESIGHT**  
INSTITUTE®

**Conference on  
Molecular  
Nanotechnology**