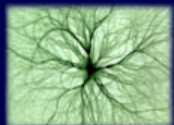


NATIONAL NANOTECHNOLOGY INITIATIVE and a GLOBAL PERSPECTIVE

Dr. M.C. Roco

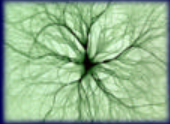
Chair, Subcommittee on Nanoscience, Engineering and Technology (NSET),
National Science and Technology Council (NSTC), <http://nano.gov>
Senior Advisor for Nanotechnology, National Science Foundation



Small Wonders

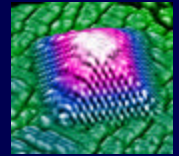
“Small Wonders”, *Exploring the Vast Potential of Nanoscience*
A National Science Foundation Symposium
Washington, DC March 19, 2002





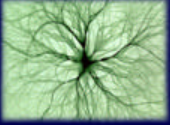
Small Wonders

National Nanotechnology Initiative Timeline



NNI

- November 1996 Nanotechnology Group (bottom-up)
- September 1998 NSTC establishes interagency IWGN, then NSET
- March 1999 OSTP/CT presentation on NNI
- May - August 1999 Congress hearings, NNI publications
- Oct. - Dec. 1999 PCAST, OMB, OSTP and WH Approval
- January 2000 WH announces NNI Initiative
- November 2000 Congress appropriates \$422M for NNI
- December 2001 Congress appropriates \$604M for FY 2002
- February 2002 WH requests \$710M for FY 2003



Small Wonders

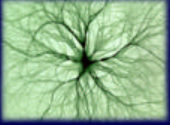
Why moving into nanoworld?

A. Intellectual drive

- Miniaturization is of interest

More important:

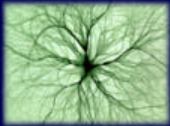
- **Novel properties/ phenomena/ processes**
- **Unity and generality**
- **Most efficient length scale for manufacturing**
- **At the confluence of steams**



Small Wonders

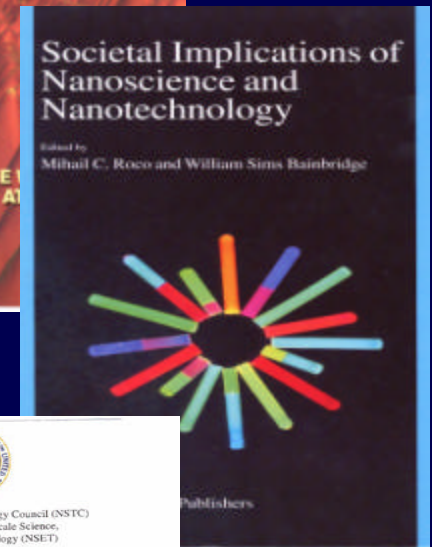
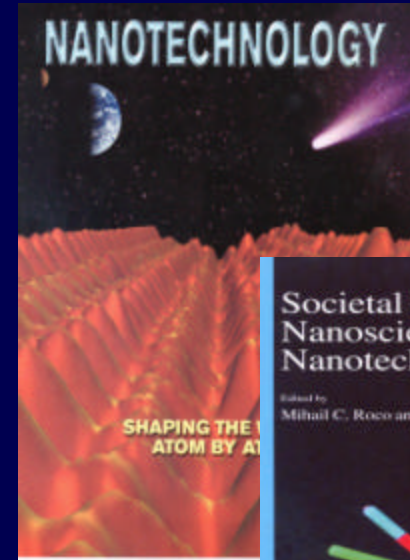
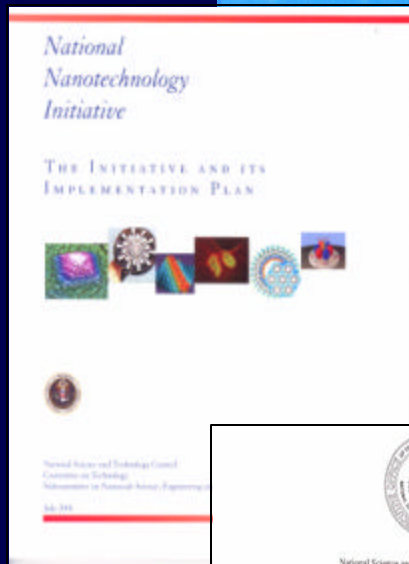
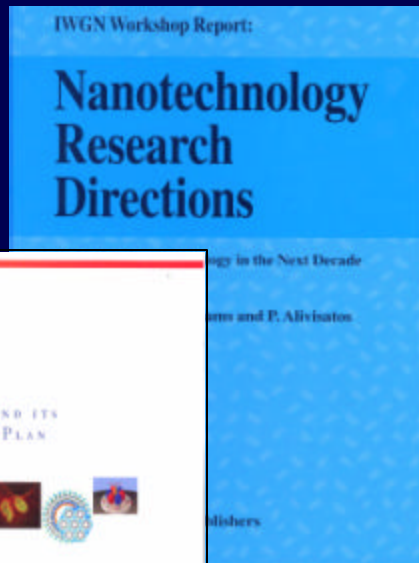
B. Promise of Nanotechnology on societal implications

- **Knowledge base**
- **A new world of industrial products:**
 - ~ \$1 trillion / yr in 10-15 years
 - ~ 2 million nanotech workers
- **Improved healthcare**
 - extend life-span, human capabilities
- **Sustainability:**
 - agriculture, water, energy, materials, environment

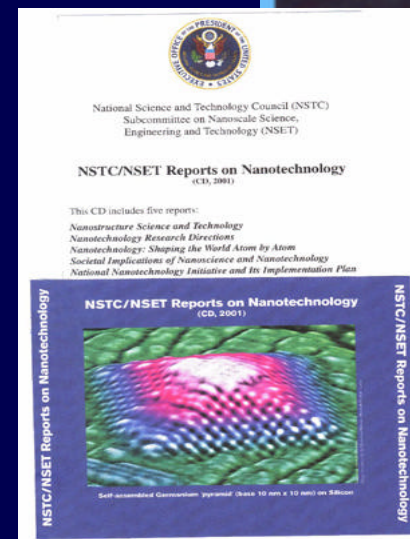
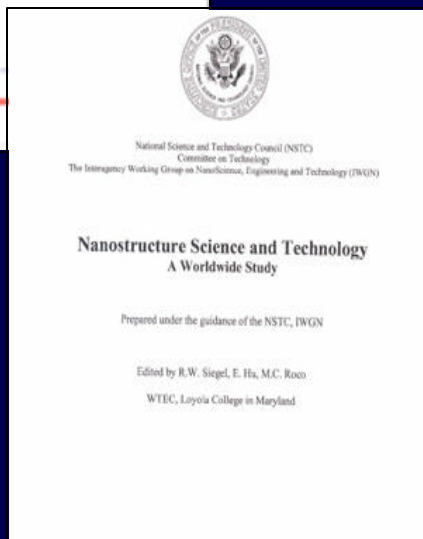


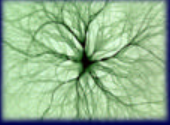
Small Wonders

National Nanotechnology Initiative



Reports





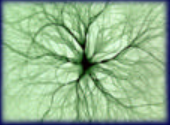
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NNI: Key Investment Strategies

- *Focus on fundamental research*
- *Policy of inclusion and partnerships*
- *Long-term vision*
- *Prepare the nanotechnology workforce*
- *Address broad humanity goals*
- *Transforming strategy; bio-inspired approach*

NNI as part of U.S. Federal R&D ~ 0.6%

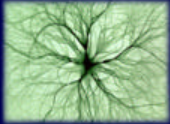
U.S. as part of world nanotech investment ~ 30%



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Elements of NNI Initiative in FY 2001

- **Fundamental Research**
- **Grand Challenges**
- **Centers and Networks of Excellence**
- **Research Infrastructure**
- **Societal Implications and Workforce Education and Training**

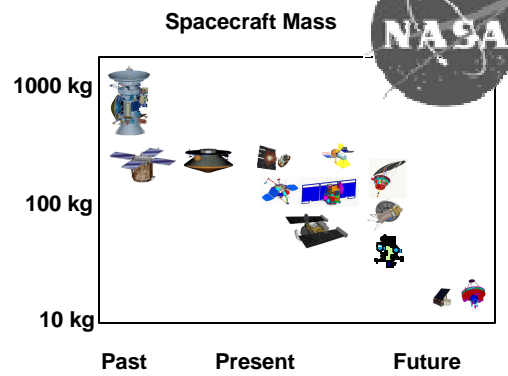
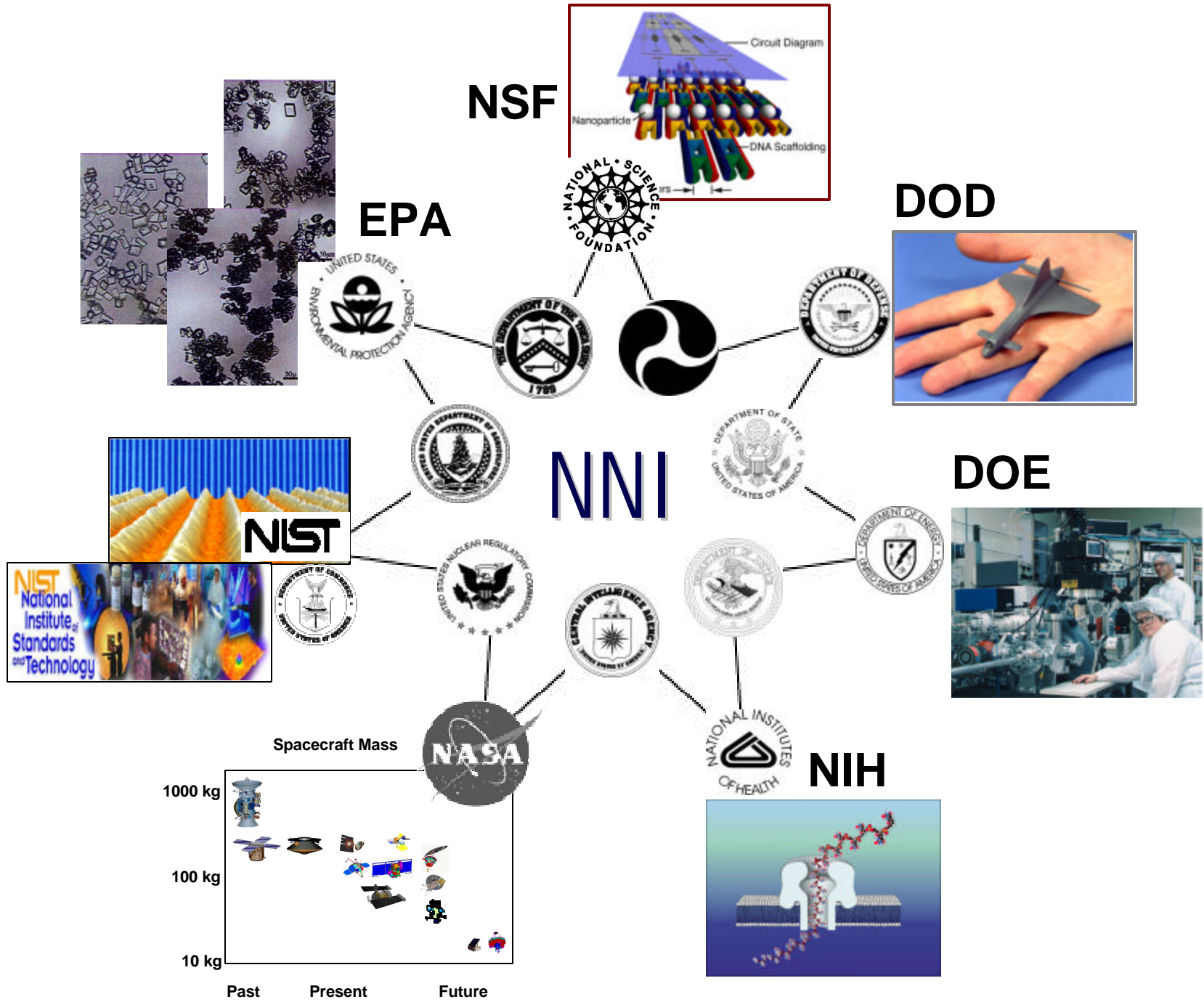


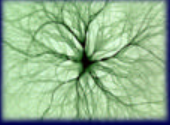
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Nanotechnology R&D Funding by Agency

Fiscal year	2001 Appropriated	2002 Appropriated	2003 Request
National Science Foundation	150	199	221
Department of Defense	110	180	201
Department of Energy	93	91.1	139.3
National Institutes of Health	39	40.8	43.2
NASA	20	46	51
NIST	10	37.6	43.8
Environmental Protection Agency		5	5
Dept. of Transportation/FAA		2	2
Department of Agriculture		1.5	2.5
Department of Justice		1.4	1.4
Total (All in millions \$)	422.0	604.4	~ 710.2

Other participating agencies: DOC, DOS, DOTreas, NOAA, NRC, USG





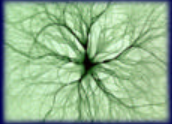
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Regional alliances

- Nanotechnology Alliance in Southern California
- 5 states - Nanotechnology Franklin Institute (PA)
- Texas Nanotechnology Initiative

- **NSET/NNCO** sponsors regional meetings for networking
researcher providers / industry / business

- **Other partnerships:**
 - State activities (Ex: Texas)
 - NanoBusiness Alliance hubs (Ex: Denver area)



Small Wonders

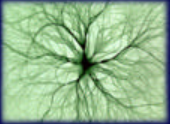
Nanotechnology in the world

Comparison for industrialized countries

Estimated government sponsored R&D in \$ millions/year

Fiscal Year	1997	2000	2001
W. Europe	126	200	~ 225
Japan	120	245	~ 465
USA	116	270	422
Others *(~)	70	110	~ 380
Total	432	825	1,502

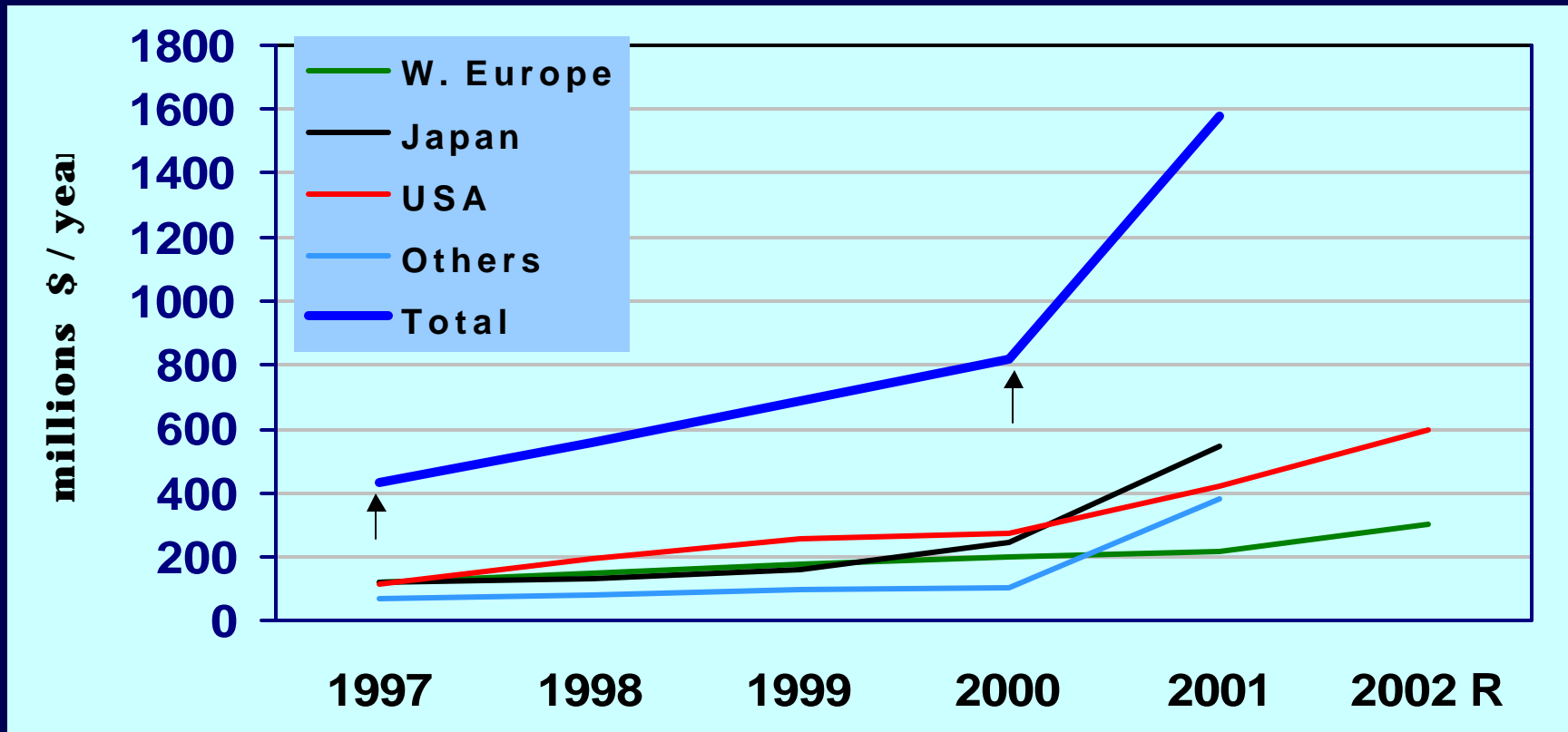
* Australia, Canada, China, E. Europe, FSU, Israel, Korea, Singapore, Taiwan



Small Wonders

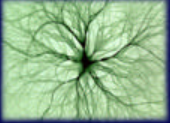
Context – Nanotechnology in the World

Government investments 1977-2001



Note:

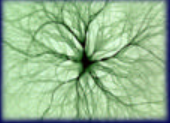
- U.S. begins FY in October, six month before EU & Japan in March/April
- U.S. does not have a commanding lead as it was for other S&T megatrends (such as BIO, IT, space exploration, nuclear)



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From NNI to INI?

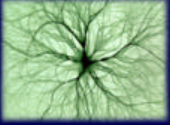
- **Nanotechnology activities at the national level**
 - U.S. (NNI), Canada (NIN), Mexico
 - EU, Switzerland, Eastern Europe
 - Japan, China, India, Singapore, Korea, Taiwan, Thailand
 - Russia and FSU
 - Australia, Israel, Turkey, Egypt, others
- **Nanotechnology in international activities**
 - NSF-EC, -Japan, -India, -Germany, -Italy, others
 - NY-Quebec; Group Twinning; PASI in Costa Rica, APEC
 - Focus: Win-win precompetitive, Leverage investments
Educating young investigators



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NSF – EC Cooperation

- **The US-EU Science and Technology Agreement**
- **The EC-NSF Coordinated Call for Proposals**
 - Three calls to date; New: US-Europe in 2002
- **Four Workshops 2002:**
 - Manufacturing and Processing for Nanotechnology
January 2002 in Puerto Rico, US
 - Societal / Educational Aspects of Nanotechnology
February 2002 in Italy, EU
 - Tools and Instrumentation for Nanoscale S&T
June 2002 in France, EU
 - Materials for Nano-technology
December 2002 in Boston, US

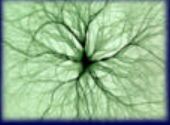


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International Grand Challenges (suggestions)

- Focus on Single Molecule and Single Cell
- Tools and standards
- Sustainable Environment
- Societal Implications and Education

For added value and mutual interest



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NNI Issues in the Future (2002-)

Need for coherent 5-10 year programs:

draft Bill in preparation in Congress

Horizontal versus vertical S&T development:

0.5% (on basics) versus 5% (plus precompetitive generic technologies) of national R&D budget

Increasing focus on:

Manufacturing, Infrastructure and Education

Human performance and societal issues

International collaboration and competition