Courtesy of The Archives, California Institute of Technology.

Plenty of Room at the Bottom

Richard P. Feynman

December 1959

I imagine experimental physicists must often look with envy at men like Kamerlingh Onnes, who discovered a field like low temperature, which seems to be bottomless and in which one can go down and down. Such a man is then a leader and has some temporary monopoly in a scientific adventure. Percy Bridgman, in designing a way to obtain higher pressures, opened up another new field and was able to move into it and to lead us all along. The development of ever higher vacuum was a

web lectures
program committee
program overview
program schedule
conference home
contact meetings
meetings home
aps home

Web Lectures: View lectures given at the Opportunities in Biology for Physcists Topical Conference.

The American Physical Society (APS) plans to hold a topical conference entitled "Opportunities in Biology for Physicists" in Boston on September 27-29, 2002. The conference will be aimed predominantly at graduate students and postdocs in physics who are considering applying the methods of physics to biological topics. However, all those who are interested in entering the broad interdisciplinary area, or advising others who will do this, will be welcome.

Registration for this meeting is now closed. **No on-site registration.**

Physicists and biologists who are leaders in their fields will be asked to give broad overviews of selected areas at the interface between physics and biology. The conference schedule will allow plenty of time for discussion and opportunities to meet with the speakers informally. In addition, there will be talks on the "how to" of moving into the interface between the disciplines. Rapid strides are occurring in biology, where enormous technical and conceptual progress has been made in the last 10 years. Biology is changing from a descriptive to a quantitative and conceptually profound field. The conference is aimed at making the physics community more aware of the revolution occurring in biology. We believe that physics will make a substantial contribution to this revolution, particularly if biologists and physicists work together at this critical time.

A schedule is now available. The following five topics have been selected for emphasis:

Genomics and Evolution

Shirley Tilghman, Princeton University
Epigenetics: Building Flexibility into the Genome

Hao Li, University of California, San Francisco
Deciphering the Regulatory Code of the Genome

Richard Lenski, Michigan State University
Experiments with Digital Organisms (video will sync two minutes into talk)

Biological Networks

Andrew Murray, Harvard University
Can Physics Save Biology? (video unavailable)

Stanislas Leibler, Rockefeller Institute

b lectures
ogram overview
nference
hedule (pdf)
ering committee
nference home
ntact meetings
etings home
s home

Opportunities in Biology for Physicists II

Rapid strides are occurring in biology, where enormous technical and conceptual progress has been made in the last 10 years. Biology is changing from a descriptive to a quantitative and conceptually profound field. The conference is aimed at making the physics community, particularly students and postdocs, more aware of the revolution occurring in biology. We believe that physics will make a substantial contribution to this revolution, particularly if biologists and physicists work together at this critical time.

Opening Remarks
30 January 2004
Judy Franz and Bob Austin (American Physical Society)
Duration: 15:00, 0 slides

Bioinformatics of Protein Function and Interactions
30 January 2004
Edward Marcotte (University of Texas, Austin)
Duration: 45:00, 32 slides

Using DNA Microarrays to Infer Genetic Networks
30 January 2004
Michael Laub (Harvard University)
Duration: 30:00, 43 slides

Morphogen Gradients and Size Regulation in Drosophila Embryos
30 January 2004
Eric Wieschaus (Princeton University)
Duration: 45:00, 52 slides

A Physicist's View of Dictyostelium Aggregation
30 January 2004
Herbert Levine (UCSD)

National Nanotechnology Initiative - Mozilla

NATIONAL NANOTECHNOLOGY INITIATIVE

The National Nanotechnology Initiative (NNI) provides a multi-agency framework to ensure U.S. leadership in nanotechnology that will be essential to improved human health, economic well being and national security. The NNI invests in fundamental research to further understanding of nanoscale phenomena and facilitates technology transfer.

Leading to a Revolution in Technology and Industry

About the NNI

Nanotech Facts

Government Dept/Agencies

Research

Society & Safety

Funding Oportunities

Nanotechnology Centers

Newsroom

Education Center

Resources

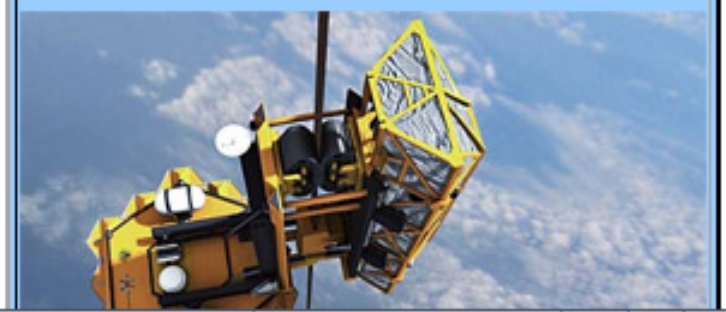
Nanoparticles Deliver Anticancer Drugs to Animal Tumors

University of Michigan scientists have created the nanotechnology equivalent of a Trojan horse to smuggle a powerful chemotherapeutic drug inside tumor cells – increasing the drug's cancer-killing activity and reducing its toxic side effects.

Previous studies in cell cultures have suggested that attaching anticancer drugs to nanoparticles for targeted delivery to tumor cells could increase the therapeutic response. Now, U-M scientists have shown that this

NEW: Nano Currents

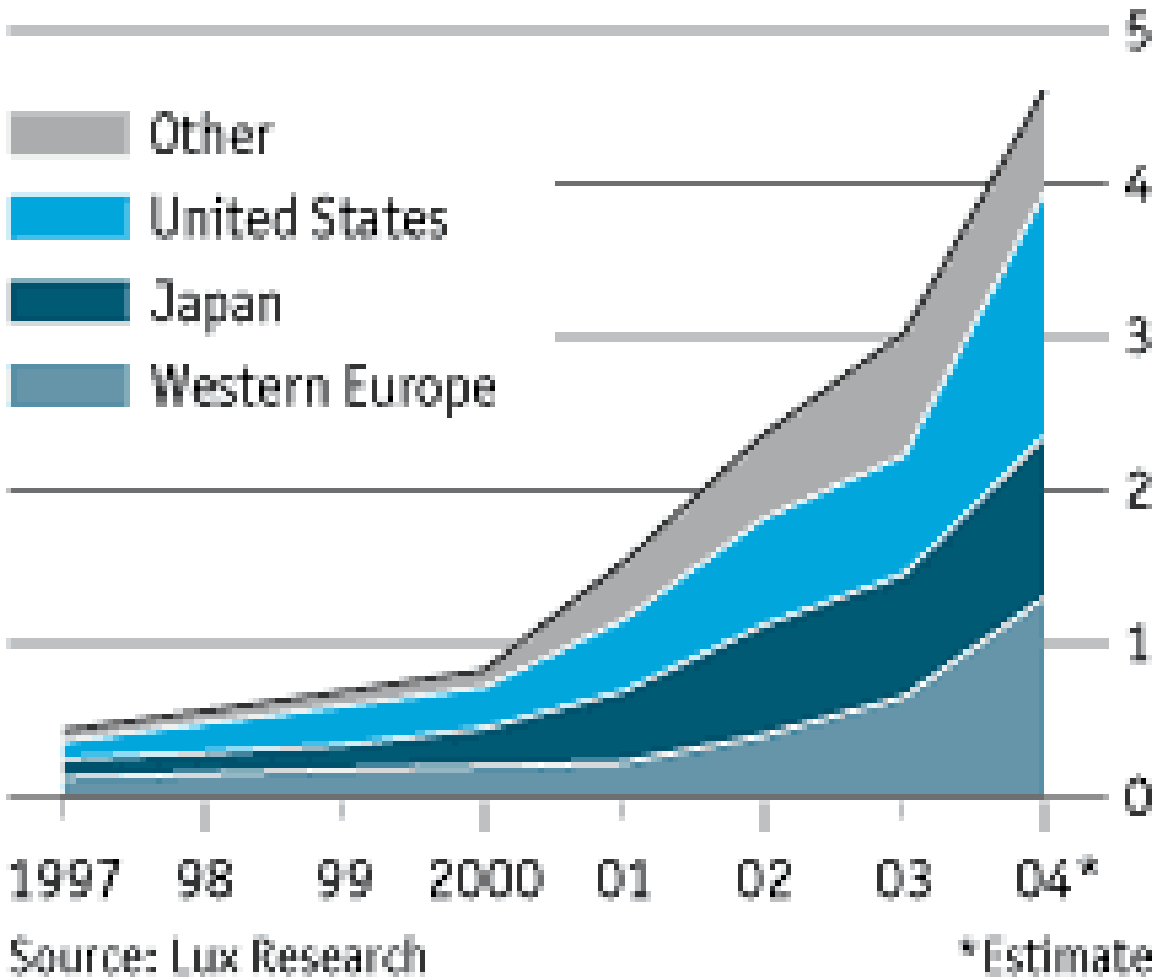
- NCI Alliance for Nanotechnology in Cancer
- NASA Awards 'Quantum Wire' Contract to Rice University Lab to Produce Prototype Power Cable for Next-gen Spacecraft
- NASA Announces First Centennial Challenges' Prizes



Growing up

2

Government nanotechnology spending, $bn



Source: Lux Research

*Estimate

Society & Safety

Funding Opportunities

Nanotechnology Centers

Newsroom

Education Center

Resources

figures are reflected in the table below.

The 2006 budget request that President Bush has sent to Congress calls for a total NNI budget of $1,052 million. **Read more** about the FY 2006 budget request.

As much as two-thirds of the funding requested under the NNI will support university-based research. The table below presents the requested budget breakdowns by agency.

NNI Budget Overview by Agency

(dollars in millions)

Agency	2003 Actual	2004 Actual	2005 Estimate*	2006 Request
NSF	221	256	338	344
DOD	403	394	407	230
DOE	134	202	210	207
HHS (NIH)	78	108	143	145
DOC(NIST)	64	77	75	75
NASA	36	47	45	32
USDA	5	2	3	8
EPA	5	5	5	5
HHS (NIOSH)			3	3
DOJ	1	2	2	2
DHS (TSA)		1	1	1
TOTAL	943	1,094	1,230	1,052

NCI Alliance for Nanotechnology in Cancer - Mozilla

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NCI Alliance for Nanotechnology in Cancer

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Transforming the diagnosis, prevention, treatment and clinical outcomes for cancer patients

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Nanotech Highlights

Request for Applications RFA-CA-06-010
Fellowships in Cancer Nanotechnology Research
Receipt Date: November 16, 2005

Nanotechnology in Cancer Spotlighted at NSTI Nanotech 2005
Speaker: Gregory Downing, D.O., Ph.D., National Cancer Institute

NCI NCL Solicitation NOT-CA-05-011
Nanotech Strategies for Cancer Research
Next Submission Due Date: Sept. 1,

This Week's Nanotech News [view all]

Nanofluidic Transistor Directs Chemical Flow With No Moving Parts July 11

Understanding How Targeted Nanoparticles Enhance Drug Activity July 11

Magnetic Nanoprobe Detects Molecular Interactions in Live Cells July 11

New Technology Creates Well-Defined Nanoparticles July 11

Quick Links

Nanotechnology Characterization Lab

Nanotechnology Teaming Site

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Upcoming Events

Monthly Feature

Transferring data from nano.cancer.gov...

NANOTECHNOLOGY RESEARCH SUPPORT AT NIH

Reviewed in Dedicated Panel

BECON

Nanoscience and Nanotechnology in Biology and Medicine

- i) create & use structures, devices & systems that have novel properties and functions because of their small size, to achieve a fundamental understanding of biological processes or for disease detection, therapy, or prevention; ii) conceive, fabricate and test devices to detect and analyze nanoscale entities of relevance to biomedicine; iii) study biological systems at the nanoscale to develop nanotechnologies and nanostructured materials for use in biomedicine.
- Encourages team approach to nanotechnology research
- R01 (research project) & R21 (exploratory/developmental) if little preliminary data and potential for groundbreaking impact. R21s are for up to 3 years, up to $125,000 per year direct cost
- Review panels dedicated to this program announcement
- Application Receipt: February 18, August 18, through 2006
- http://grants.nih.gov/grants/guide/pa-files/PAR-03-045

NANOTECHNOLOGY RESEARCH AT NIH

BECON

CONCLUSIONS:

NIH supports nanoscience and nanotechnology research in the context of many programs, with a goal of increasing the knowledge needed to improve human health.

Nanotechnology offers technical and conceptual paths to solving important biomedical problems.

Biology offers tools and concepts applicable to nanotechnologies that will be used in non-medical fields.

Nanotechnology concepts offer entirely new ways to extract information from, and ultimately to intervene in, biology, to correct damage.

Successful dovetailing of nanotechnology and biomedicine requires interdisciplinary teams and novel research capabilities.

Featured Clinical Trial

Therapy for Treatment-Resistant or Recurrent Gliomas

Notes

Science Writers' Seminar Focuses on Childhood Cancers

NCI Sponsors New International Research Fellowships

Grodzinski Joins OTIR

Brochure on Reducing Radiation Risks Available

Community Update

Patient Navigator Program Guides Underserved Cancer Patients

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the Health Research Board of the Ireland Department of Health and Children. Up to five JRPFs are available. The application deadline is July 22, 2005. Details are available at http://www.hrb.ie/r&d.

The Japan JRPF is part of the U.S.-Japan Cooperative Cancer Research Program. Fellowships can be proposed in basic, clinical, or behavioral/population science. The application deadline is fall 2005; up to three JRPFs can be supported each year. Details will be posted on the OIA Web site at http://www.cancer.gov/oia.

Grodzinski Joins OTIR

On April 4, Dr. Piotr Grodzinski joined the staff of NCI as program director for cancer nanotechnology in the Office of Technology and Industrial Relations. He will manage the activities of the newly formed Alliance for Nanotechnology in Cancer, as well as related cancer nanotechnology research. Dr. Grodzinski received his Ph.D. in materials science from the University of Southern California in 1992. Subsequently, he held positions in research and research management at Motorola, and most recently with the Los Alamos National Laboratory where he was group leader and interim chief scientist of the Center for Integrated Nanotechnologies.

Brochure on Reducing Radiation Risks Available

A new publication, *Interventional Fluoroscopy: Reducing Radiation Risks for Patients and Staff*, has been produced by NCI's Division of Cancer Epidemiology and Genetics and the Society of Interventional Radiology. Intended primarily for health care professionals, the brochure discusses the increasing use, complexity, and value of interventional fluoroscopy; the associated radiation risks; and the importance of optimizing patient radiation dose. It also outlines the potential clinical effects of radiation exposures to the skin and eye lens, suggests strategies to minimize radiation dose for patients and staff, provides guidelines for dosimetry records and follow-up, and encourages education and training in radiation sciences for health care professionals. The brochure is being distributed at national professional meetings and through mailings to radiologists and other professionals who perform these procedures. It is available on NCI's Web site at http://cancer.gov/cancertopics/interventionalfluoroscopy. For a limited number of copies, please contact Ursula Leitzmann at Leitzmau@mail.nih.gov.

Nanobiology Program

CCR Grand Rounds

Bulletin Archive

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The Cancer Information Service reported an increase in calls related to the two topics, with many callers citing the show as the source of their curiosity. HH&S is conducting research to determine how many viewers feel they know more about the health issues mentioned after watching episodes with the cancer-related story lines.

Based at the University of Southern California's Annenberg School for Communication, HH&S is billed a a "one-stop shop to provide entertainment industry professionals with accurate and timely information f health story lines."

Blumenthal to Head New CCR Nanobiology Program

Dr. Robert Blumenthal has been appointed as director of the new Center for Cancer Research Nanobiology Program (CCRNP), which combines physics, computational sciences, and biology to develop nanoscale material-based strategies for the prevention, diagnosis, and treatment of cancer. Th program, previously the Laboratory of Experimental and Computational Biology, will interface with NCI's main Nanotechnology Program, other CCR basic research labs and clinical branches, and the extramural community.

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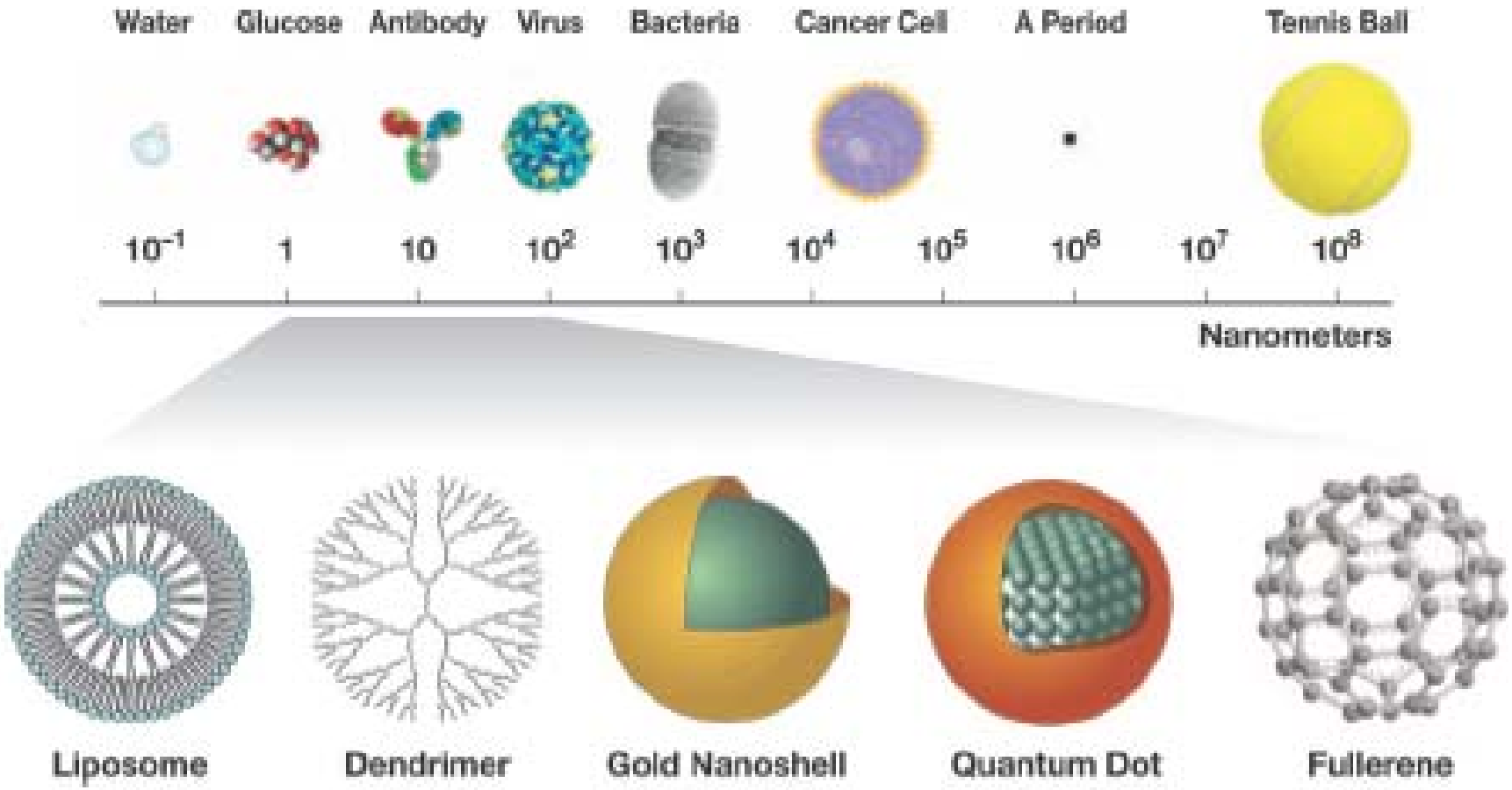

Nanotechnology for the biologist

Scott E. McNeil[1]

Published on May 27, 2005 as DOI:10.1189/jlb.0205074

TABLE 1. Examples of Nanoparticles Used in Biological Research

Nanoparticle	Application	Refere
Dendrimers	Targeting of cancer cells, drug delivery, imaging, boron neutron capture therapy	[1, 8, 85
Ceramic nanoparticle	Passive targeting of cancer cells	[69]
Lipid-encapsulated perfluorocarbon nanoemulsions	Passive targeting of cancer cells	[70]
Magnetic nanoparticles	Specific targeting of cancer cells, tissue imaging	[71, 8
LH-RH-targeted silica-coated lipid micelles	Specific targeting of cancer cells	[71]
Thiamine-targeted nanoparticles	Directed transfer across Caco-2 cells	[29]
Liposomes	Specific targeting of cancer cells, gene therapy, drug delivery	[73, 89,
Nanoparticle-aptamer bioconjugate	Targeting of prostate cancer cells	[74]
Anti-Flk antibody-coated ^{90}Y nanoparticles	Antiangiogenesis therapy	[15]
Gold nanoshells	Tissue imaging, thermal ablative cancer therapy	[91–9
Anti-HER2 antibody-targeted gold/silicon nanoparticles	Breast cancer therapy	[93]
CLIO paramagnetic nanoparticles	Imaging of migrating cells	[94]
Quantum dots	Tissue imaging	[5, 95,
Silicon-based nanowires	Real-time detection and titration of antibodies, virus detection, chip-based biosensors	[97–9
Carbon nanotubes	Electronic biosensors	[100
Transfersomes	Noninvasive vaccine delivery, drug delivery	[101, 1

HER2: Human epidermal growth factor receptor-2; CLIO: cross-linked iron oxide

Nanotechnology for the biologist

Scott E. McNeil[1]

Published on May 27, 2005 as DOI:10.1189/jlb.0205074

University of Washington

Materials Science & Engineering

< >

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Office: 302L Roberts Hall

Positions Available

Research Group

Research Interests

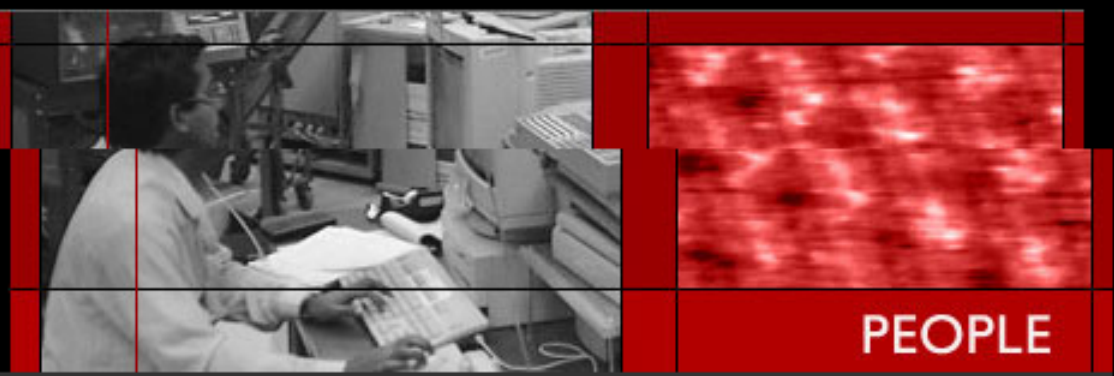
Gregory M. Lanza, M.D., Ph.D.
Assistant Professor of Medicine and Biomedical Engineering, Washington University

Dr. Lanza is a founder of Kereos and has served as a board member since inception. He is an Assistant Professor of Medicine and Biomedical Engineering at Washington University, and is on the Barnes-Jewish Hospital staff. Previously, he served as Research Manager at Monsanto Company, St. Louis where he directed pre-clinical development of bovine somatotropin (Posilac). Among various other honors, he has received multiple National Cancer Institute's Unconventional Innovation Program Awards. His research has focused on site-targeted therapeutics and contrast agents for both cancer and cardiovascular diease, and he is the author of over 80 publications. Dr. Lanza holds an M.D. degree from Northwestern University, a Ph.D. and M.S. from the University of Georgia, and a B.A. in Biology from Colby College.

top of page

Thomas C. Melzer

C(N)SI



Carlo Montemagno, Ph.D.

Curriculum Vitae

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Website: www.mae.ucla.edu/academics/faculty/montemagno.htm

Research Interests:

Cancer Nanotechnology Platform Partnerships

RFA Number: RFA-CA-05-026

Participating Organizations
National Institutes of Health (NIH), (http://www.nih.gov/)

Components of Participating Organizations
National Cancer Institute (NCI), (http://www.nci.nih.gov/)

Release Date: November 30, 2004
Letter of Intent Receipt Date: February 25, 2005
Application Receipt Date: March 25, 2005

Executive Summary

(RPGs) to support development of nanotechnology platforms for basic, applied, and translational multi-disciplinary research that uses nanotechnology (e.g., nanoscale devices or nanomaterials less than 1000 nm in size, although the assembly, synthesis, and/or fabrication of components at dimensions less than 300 nm should be demonstrated) in cancer research. Proposed projects will be eligible for consideration if they address one or more of the following thematic/programmatic areas of focus: molecular imaging and early detection, *in vivo* imaging, reporters of therapeutic efficacy, multifunctional therapeutics, prevention and control of cancer, and research enablers. The NCI intends to commit approximately 7 million dollars in FY 2005 to fund approximately 10 new grants in response to this RFA. An applicant may request a project period of up to 5 years and a budget for total costs up to 1 million dollars per year.

Ruth L. Kirschstein NRSA Fellowships in Cancer Nanotechnology Research

General Information

Funding Opportunity Number:	RFA-CA-06-010
Posted Date:	Jul 13, 2005
Original Due Date for Applications:	Sep 16, 2005
Expected Number of Awards:	36
Estimated Total Program Funding:	$15,500,000.00

Description

- This RFA supports the training of individuals from the basic, biomedical, clinical, and information sciences and engineering who are pursuing research that applies nanotechnology development and application for the prevention, detection, diagnosis, or treatment of cancer.

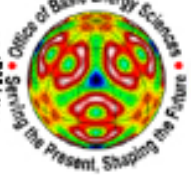
- The NCI intends to commit approximately $15.5M dollars over 3 years to fund a total of 36 new fellowships in response to this RFA (approximately 18 for each mechanism). The total amount of funds committed for F32 fellowships for FY 2006 is approximately $0.75 M. The total for F33 fellowships and supplements for FY 2006 is approximately $4.42M. An applicant may request a project period of up to 3 years for F32 and 2 years for F33 fellowships.

- The anticipated start date for fellowship awards is April 2006, and funding will terminate no later than September 2009.

- Any individual with the skills, knowledge, and resources necessary to carry out the proposed research is invited to work with his or her institution and mentor to develop an application for support.

National Institute of Biomedical Imaging and Bioengineering

U.S. Department of Energy

NIBIB-DOE Workshop on Biomedical Applications of Nanotechnology
March 17-18, 2005
Hyatt Regency Bethesda
Bethesda, Maryland

The National Institute of Biomedical Imaging and Bioengineering (NIBIB) and the Department of Energy (DOE) conducted a joint "Workshop on Biomedical Applications of Nanotechnology" on March 17-18 at the Bethesda Hyatt Hotel in Bethesda, Maryland. The workshop was sponsored by the NIBIB, the DOE Office of Basic Energy Sciences (BES), and the DOE Office of Biological and Environmental Research (BER). A total of about 200 researchers, program managers, and administrative staff from the NIH, DOE national laboratories, and National Institute of Standards and Technology (NIST) attended the meeting. .

Objectives of the workshop were to (1) make DOE national laboratory scientists and NIST researchers aware of NIH needs and potential new biomedical applications on nanotechnology, (2) make NIH researchers and program staff aware

PRESIDENT'S COUNCIL OF ADVISORS ON SCIENCE AND TECHNOLOGY • MAY 2005

The National Nanotechnology Initiative at Five Years:

Ascent of Nanoscience in China

Chunli Bai

The three most widely used high-tech words in China now are "computer," "gene," and "nanometer," according to the China Association for Science and Technology. The ability to utter these words, of course, does not guarantee that the speaker understands their meanings and implications. I witnessed an episode that illustrates the point. A news reporter asked a woman he was interviewing for a story about nanotechnology if she had ever heard the term "nanometer." "Yes," the lady answered. But when the reporter asked her what she thought the word meant, the woman replied that it might denote a special kind of rice. She was in fact drawing upon her knowledge of the language. In Chinese, the word for "meter" has two meanings: One refers to the unit of length, and the other means rice. The woman's misunderstanding of the term "nanometer," in this case, is more amusing than concerning. But as nanoscience and nanotechnology become ever more consequential in our lives, we in the scientific community need to better inform and educate the public about the transformations this new nano era is likely to bring.

This yearlong essay series celebrates 125 years of *Science* by inviting researchers from around the world to provide a regional view of the scientific enterprise.
Series editor, Ivan Amato

enjoyed particularly rapid development in China in the past decade are nanoscience and nanotechnology. These terms refer to the growing knowledge base and technical framework for understanding and manipulating matter on nanometer scales ranging from the atomic to the cellular. Like many other countries, we in China expect that the development of nanoscience and nanotechnology will greatly affect many areas of scientific research and industrial development, and many aspects of everyday life. In time, we hope no one in China will think of rice when they hear the word "nanometer."

Nanoscience Takes Root

When the concept of nanoscience and nanotechnology was first introduced in the 1980s, it was received favorably in China. The initial interest was in part stimulated by the development of new tools and techniques for observing materials on the nanoscale, especially scanning probe microscopes (SPMs). Early explorations by Chinese scientists using scanning tunneling microscopes (STMs) and other types of SPMs helped build excitement about nanoscience and nanotechnology. Technology Commission (SSTC) began funding nanoscience-related work and activities. Among the specific areas that received this early support were the development of scanning tunneling microscopy, then a groundbreaking technique for viewing the atomic and molecular landscapes of materials' surfaces, and nanomaterials research, in which investigators aim to engineer the optical, electronic, and other properties of materials by precisely controlling the structures' anatomy on the nanometer scale.

China also has helped those who work in nanoscience and nanotechnology to develop their sense of being part of a new research and development (R&D) community. Since 1990, for example, dozens of international and domestic conferences in the field have been held in China, including important early gatherings like the 7th International Conference on Scanning Tunneling Microscopy (1993) and the 4th International Conference on Nanometer-Scale Science and Technology (1996). These meetings, both held in Beijing, addressed a wide range of top-