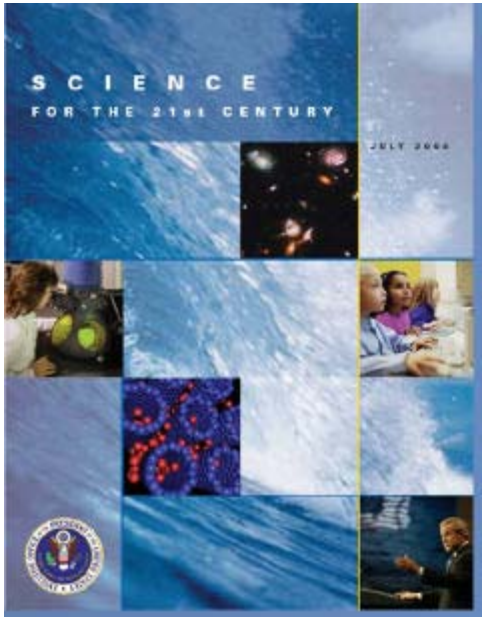


SCIENCE
FOR THE 21ST CENTURY

A PUBLICATION OF THE

NATIONAL SCIENCE AND TECHNOLOGY COUNCIL

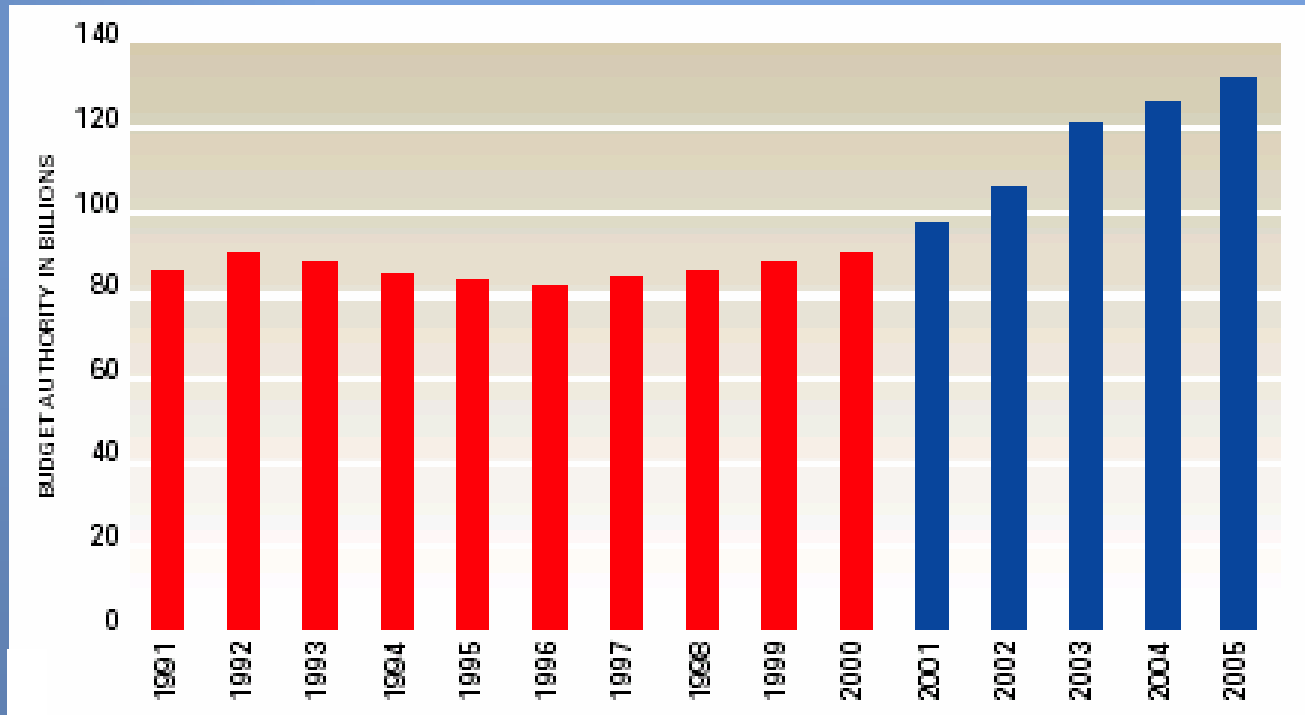
JULY 2004

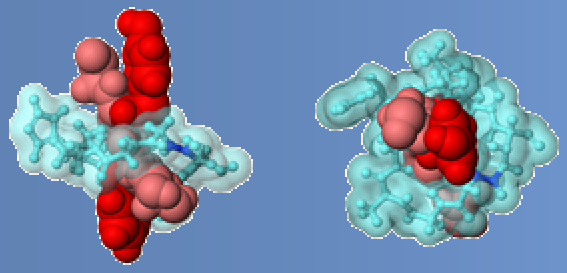
SCIENCE
FOR THE 21st CENTURY

FEDERAL RESEARCH AND DEVELOPMENT

- *Enabling the US scientific enterprise*
- *Responding to challenges and opportunities*
- *Ensuring education and workforce excellence*
- *Delivering accountability*

Federal R&D spending 1991-2005





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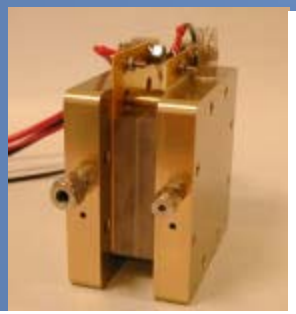
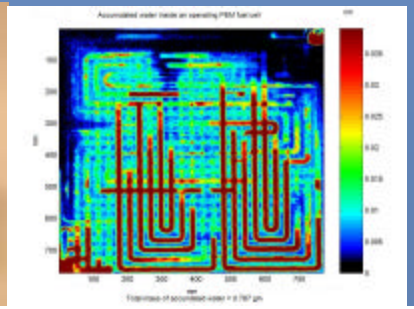
FOUR RESPONSIBILITIES OF THE FEDERAL SCIENCE ENTERPRISE

1. ***Promote discovery and sustain the excellence of the Nation's scientific research enterprise***
2. ***Respond to the Nation's challenges with timely, innovative approaches***
3. ***Invest in and accelerate the transformation of science into National benefits***
4. ***Achieve excellence in science and technology education and in workforce development***





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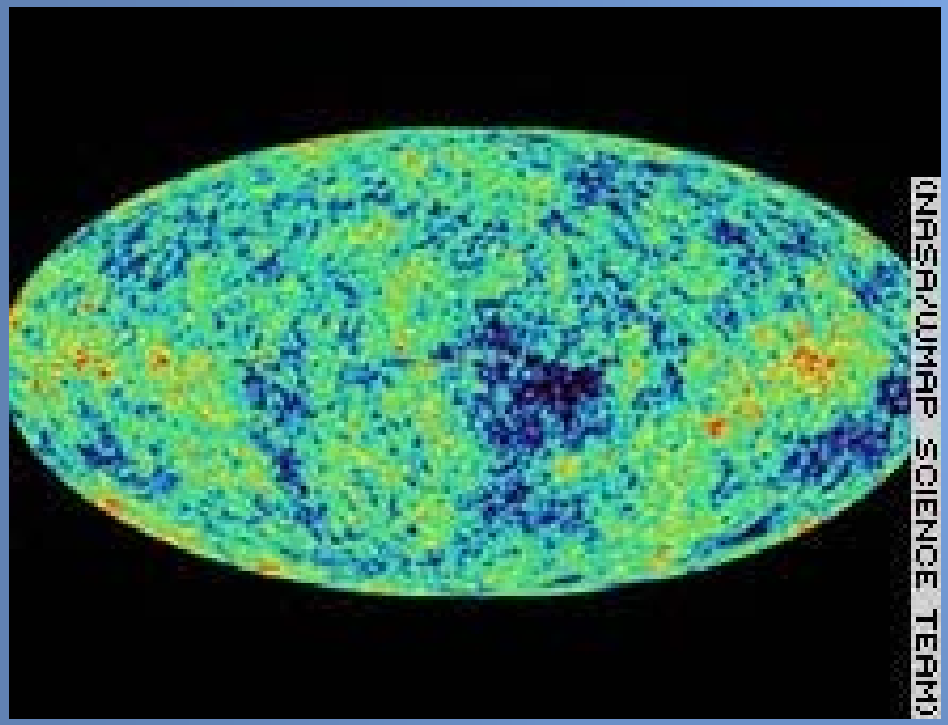

With this 2003 "baby photo" of the universe "dark energy" was shown to be the dominant force in the universe and the age of the universe was precisely pegged at 13.7 billion years.

1 ***Promote discovery and sustain the excellence of the Nation's scientific research enterprise***

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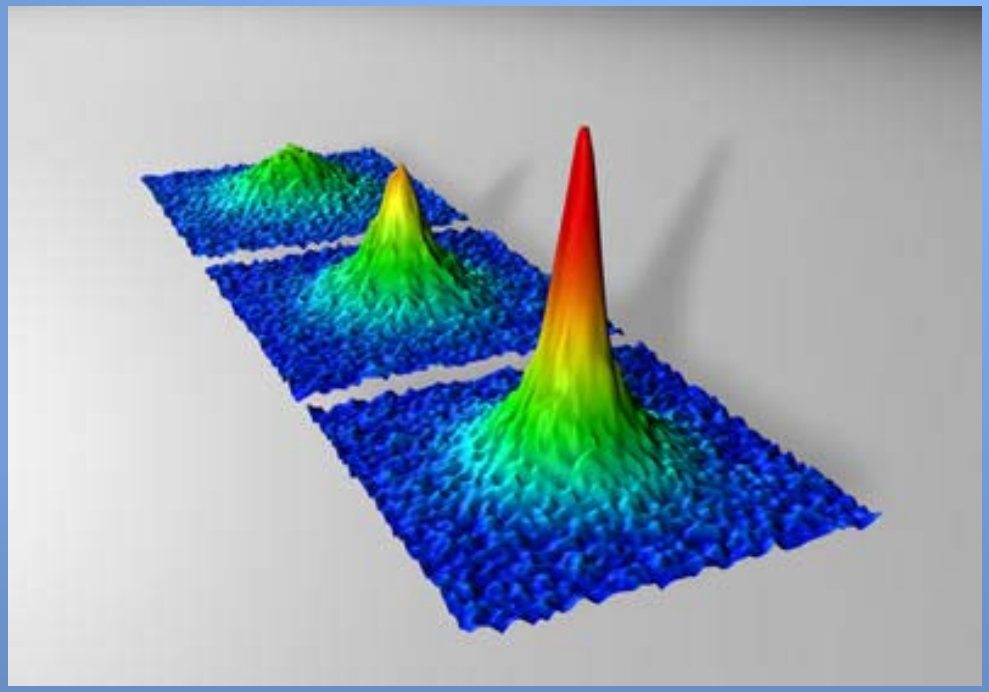
In December 2003 NIST physicist Deborah Jin discovered a new form of matter, the* fermion condensate.** ***Together with the 1995 discovery of Bose-Einstein condensates (also at NIST), this represents the only two states of matter discovered in modern times (the other know states are solid, liquid, gas, and plasma).



False color images of a condensate formed from pairs of fermion potassium ions

1 ***Promote discovery and sustain the excellence of the Nation's scientific research enterprise***

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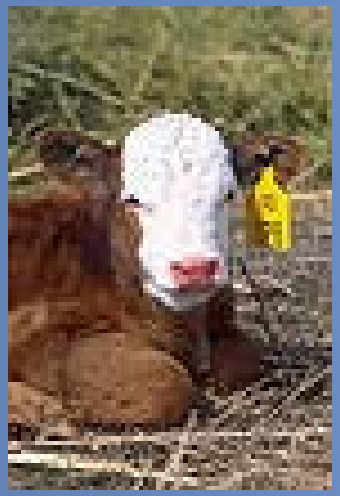

The International Bovine Genome Sequencing Project brings together Federal agencies with industry and international partners to advance common research priorities. Sequencing livestock genomes may result in many benefits including increased food safety, lower costs, and nutritional and health benefits.

1 ***Promote discovery and sustain the excellence of the Nation's scientific research enterprise***

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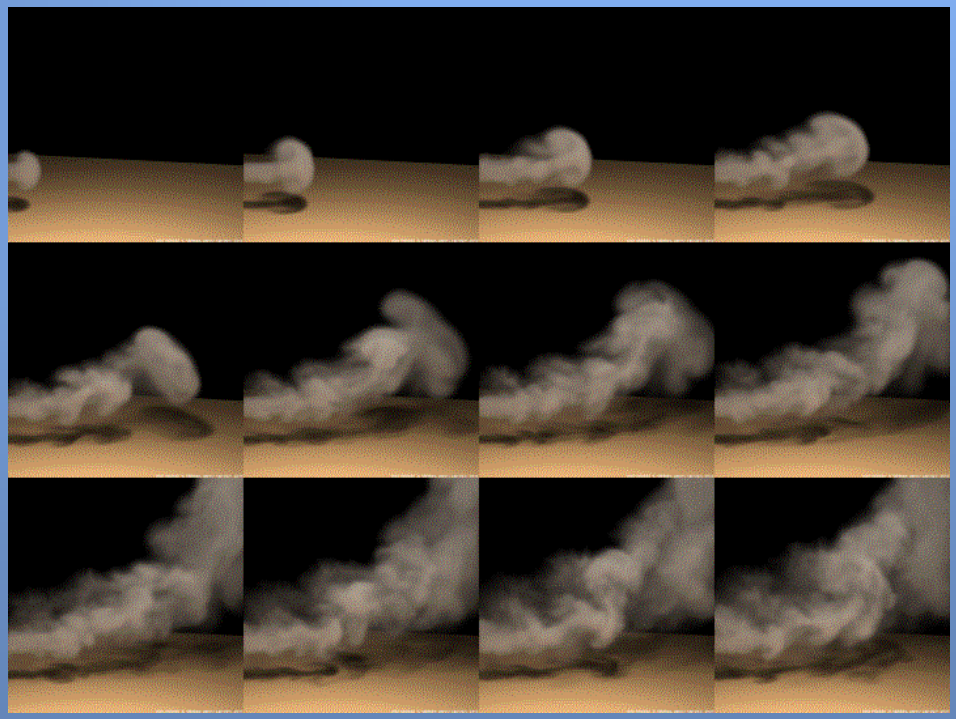
The importance of advances in fundamental mathematics to scientific discovery continues to grow with the increased complexity of much interdisciplinary research and the need to work with very large data sets.

Smoke animated using an algorithm based on the technique of "vorticity confinement."



1 Promote discovery and sustain the excellence of the Nation's scientific research enterprise

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The President has challenged NASA with a new vision for space exploration

Mars rovers Spirit and Opportunity are exploring Mars' terrain, helping researchers see into Mars' past, and discovering indications that the rocks were once exposed to flowing water.

1 Promote discovery and sustain the excellence of the Nation's scientific research enterprise

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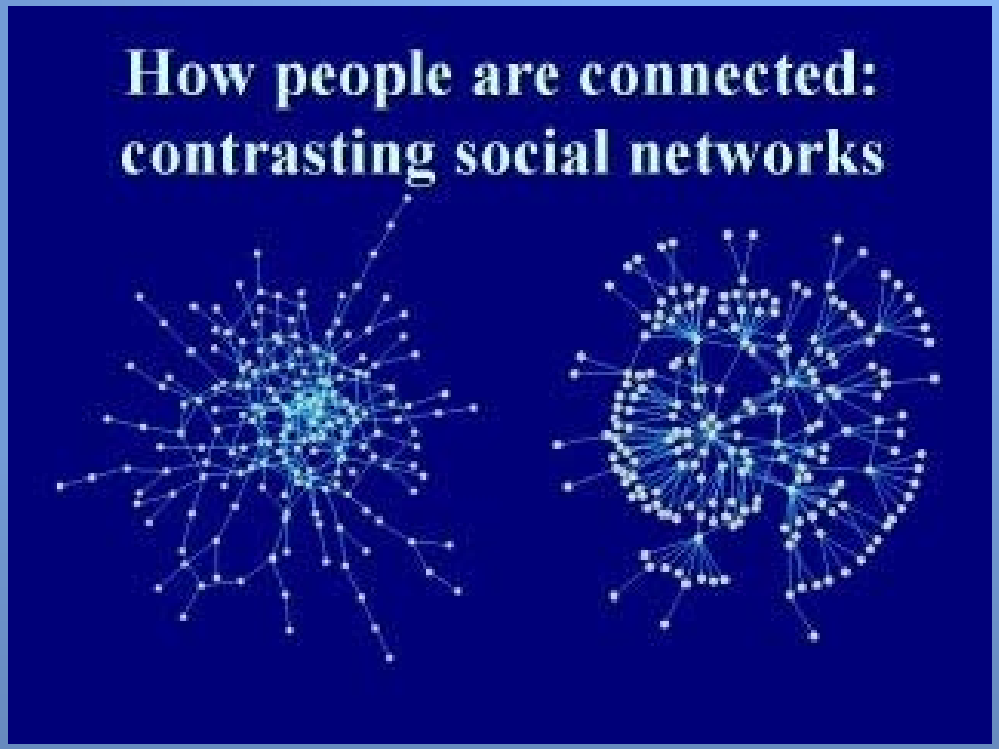
Understanding human group processes and social information flow can contribute to homeland security with analysis tools that model terrorist networks or help to optimize security and response measures



2 ***Respond to the Nation's challenges with timely, innovative approaches***

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Researcher working in a BSL-4 (highest need for containment) laboratory.

In response to public health concerns relating to either naturally occurring or deliberately introduced pathogens, multiple Federal agencies have joined together, and with international partners, to develop new response tools.

2 ***Respond to the Nation's challenges with timely, innovative approaches***

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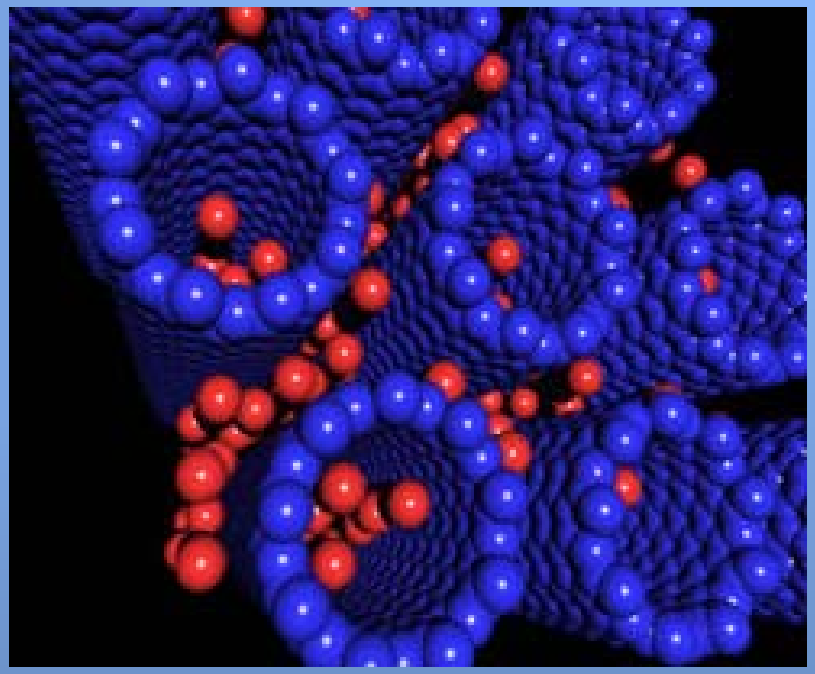
The President's Hydrogen Fuel Initiative significantly increases the Nation's investment in hydrogen energy R&D, with high-risk/high-payoff investments in innovative materials and processes for the production, storage, and use of hydrogen in fuel cells.



Structure of absorbed hydrogen in an array of nanotubes

2 ***Respond to the Nation's challenges with timely, innovative approaches***

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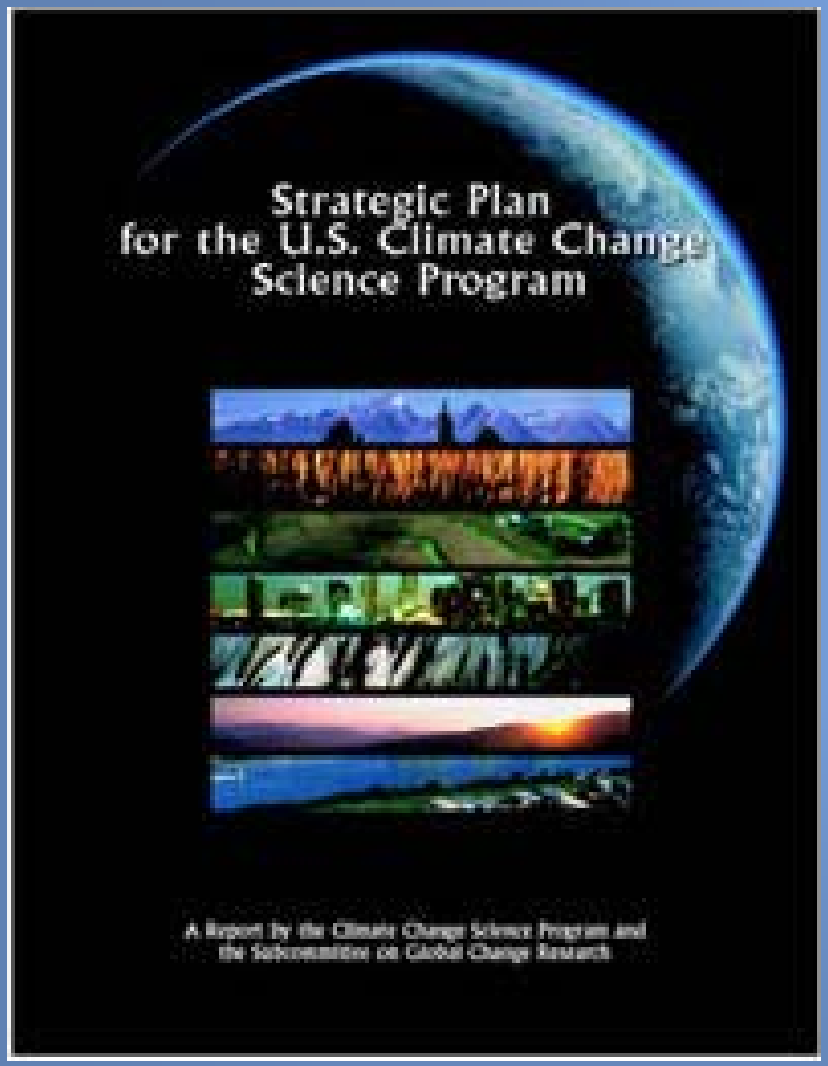
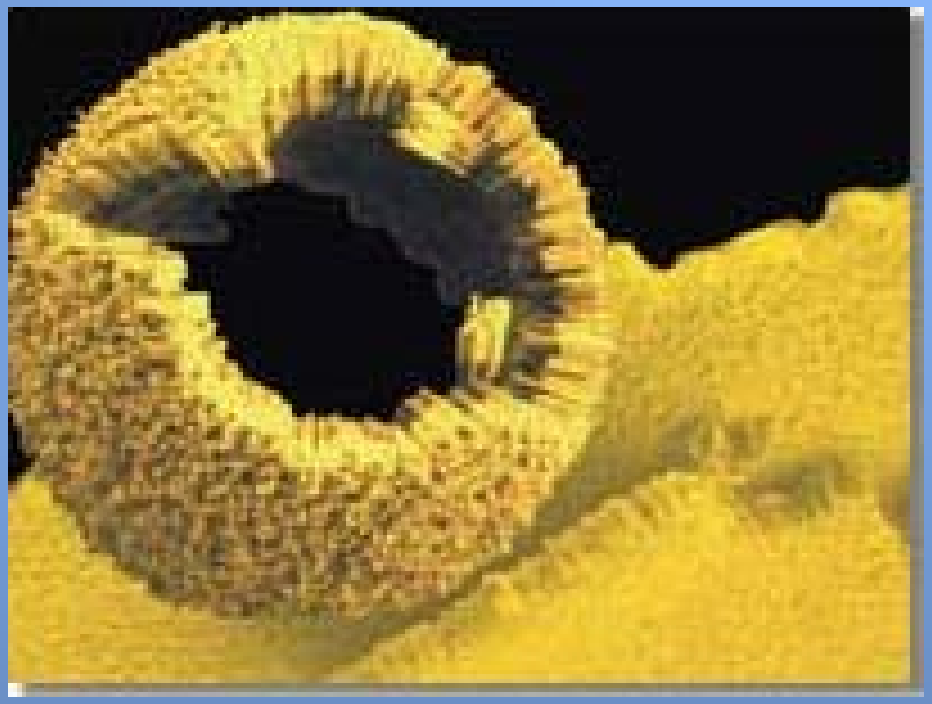


The President's Climate Change Research Initiative is a new approach to coordinating Federal research that will improve our understanding of climate change, reduce key uncertainties, and provide information to support decision making.

2 ***Respond to the Nation's challenges with timely, innovative approaches***

***Nanoscience** may lead to important applications, but the cost of nanoscience instrumentation, equipment, and facilities can be very high. NIST, DOE and NSF are supporting the development of nanoscale R&D user centers nationwide, to provide access to the necessary infrastructure for researchers at small businesses and academic institutions.*



Self-assembly of gold-polymer nanorods

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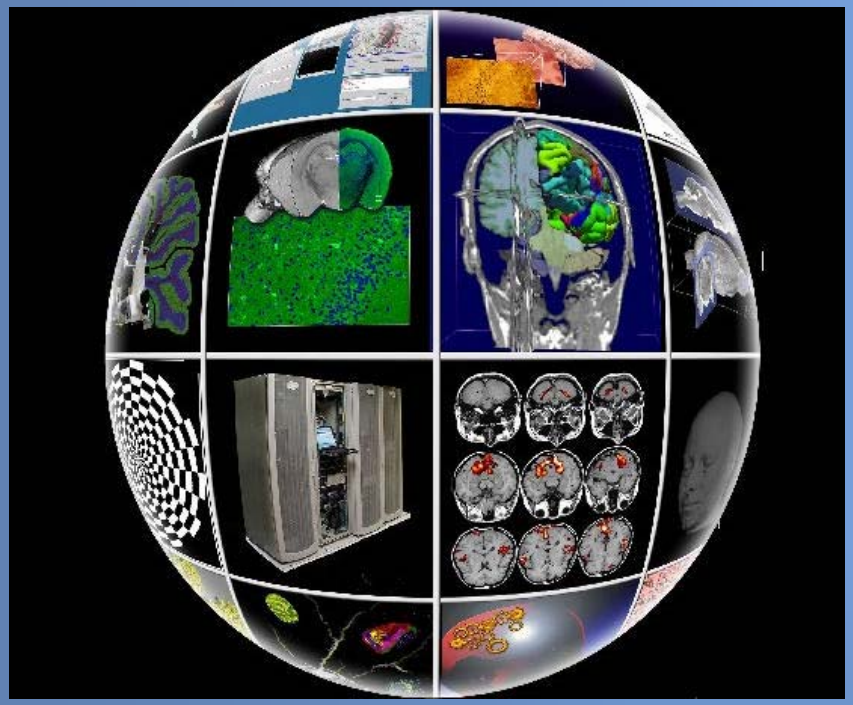
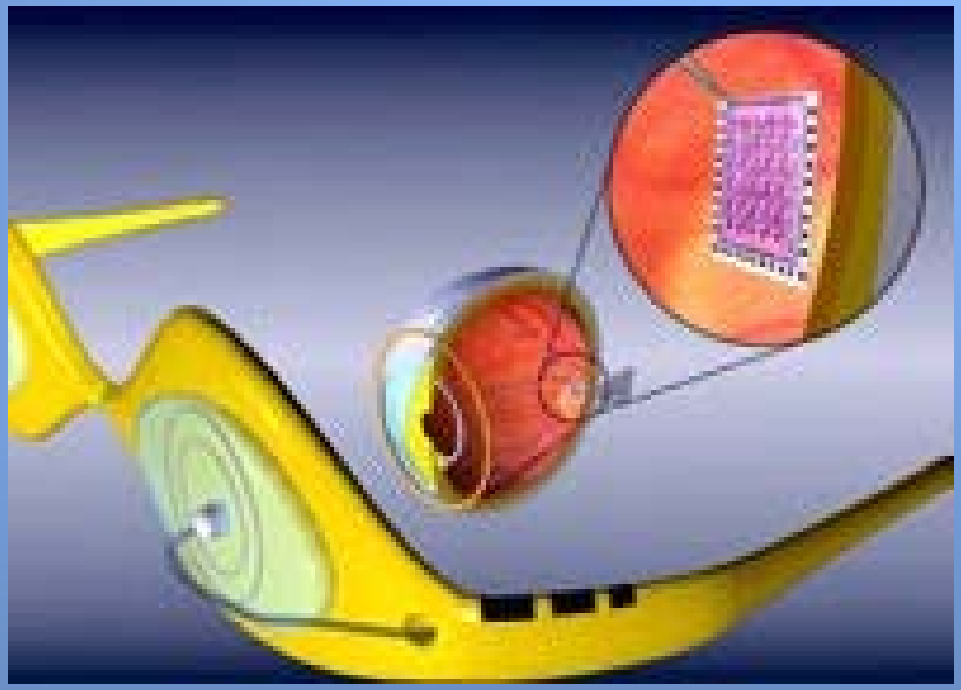


The Biomedical Informatics Research Network allows sharing, analysis, visualization, and data comparisons across laboratories

State-of-the-art computing, communications, and information technologies are radically empowering the Nation's research and education communities. An explosion of collaborative research has resulted from employing the new capabilities.

3 ***Invest in and accelerate the transformation of science into National benefits***

Combining advanced electronics with biomedicine is creating advances in treating the most intractable diseases. The retinal prosthetic device uses signals from a video camera that are sent to an electrode array attached to the retina via a receiver that is implanted behind the patient's ear.



The retina prosthetic system

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The 2003 team arrives at the North Pole Environmental Observatory

The Arctic, which has an important role in regulating global climate, is experiencing rapid thinning of sea ice and shifts in ocean circulation. Research will help Arctic communities respond to the changing environment and will enhance our understanding of the Earth's climate processes.

3 ***Invest in and accelerate the transformation of science into National benefits***

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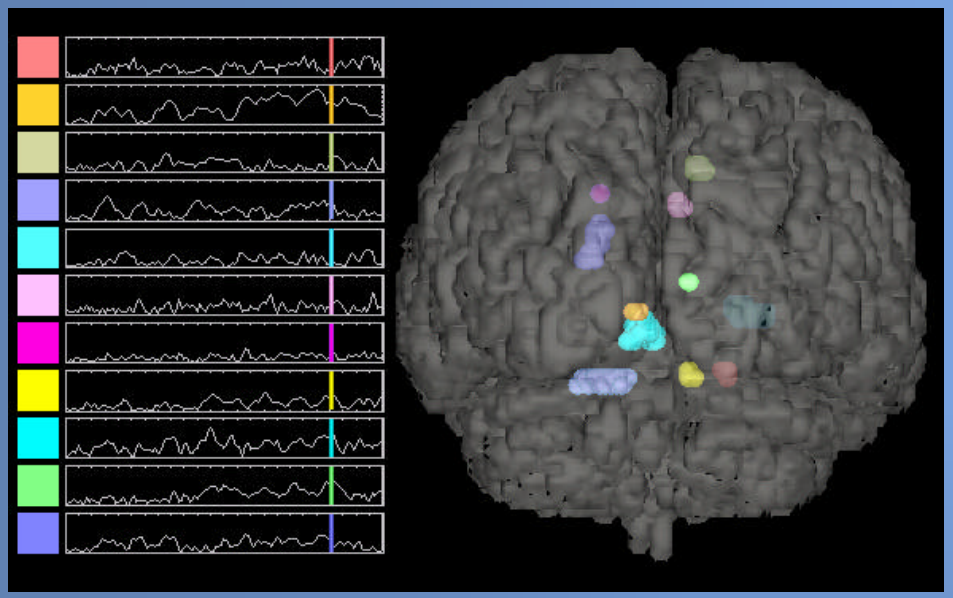
The Institute of Education Sciences was created as part of the Education Reform Act of 2002 to address the need for rigorous research on learning that will lead to research-based education tools for improving education programs and practices.

Students use computer-based assessment systems that help teachers plan appropriate lessons

Achieve excellence in science and technology education and in workforce development



Neural electromagnetic measurements characterize neural function

Brain imaging studies funded by DOE and NIH, augment theory-driven cognitive studies funded by NSF to further our understanding of how people acquire and organize new knowledge or skills.

The Math-Science Partnership (MSP) program strengthens K-12 science and mathematics education by uniting local school districts with college and university faculty in mathematics, science, and engineering, enhancing education programs and improving teacher preparation.

Teacher preparation using a redesigned "Math for Teachers" course developed through an MSP grant

An explorer school student works with a NASA education specialist

NASA Explorer Schools provide the opportunity for teachers and administrators serving grades 4-9 to gain professional development experiences using NASA's unique content, experts, and resources. School teams receive grants to support enhanced student engagement in science and mathematics.

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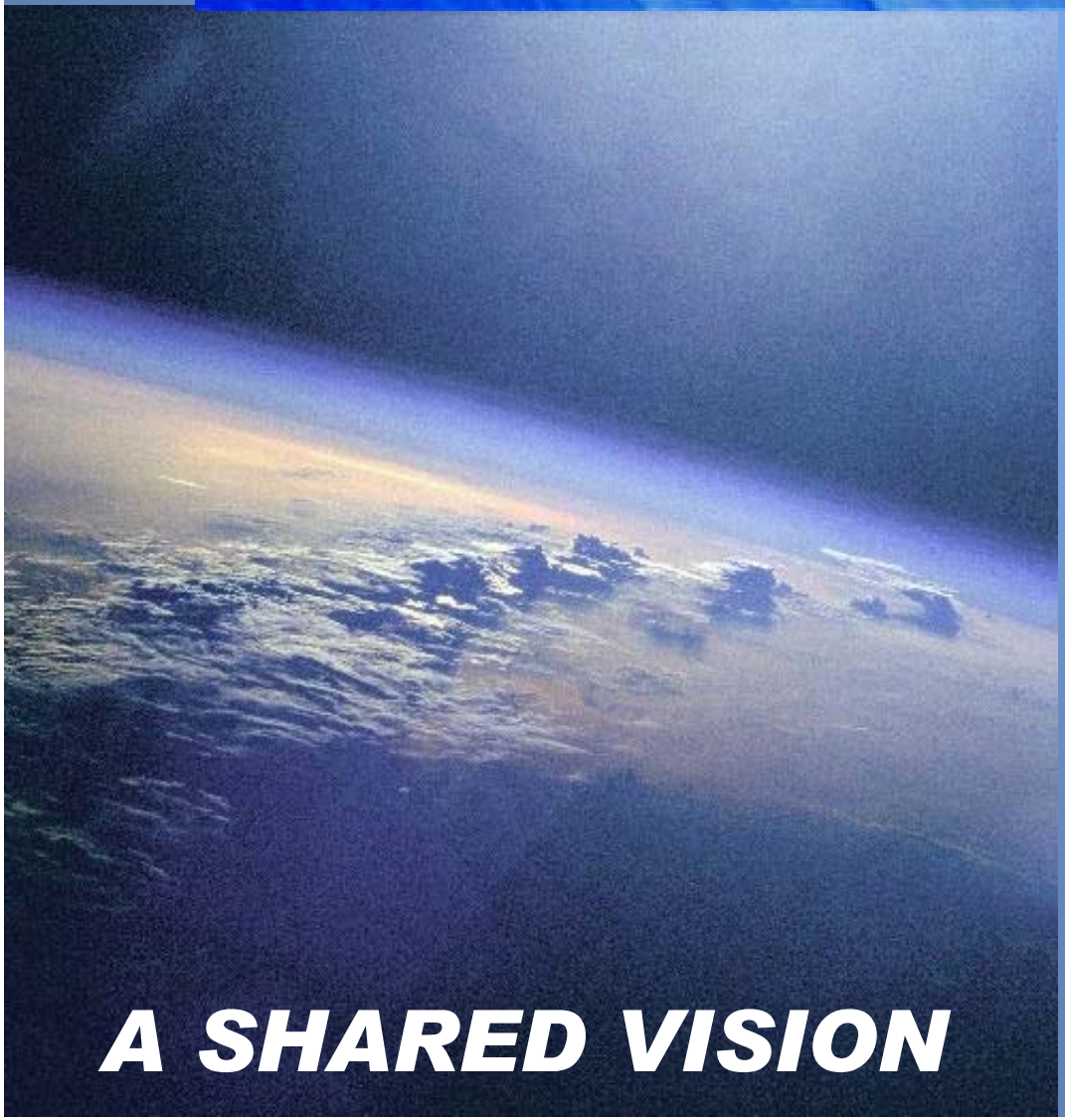

A SHARED VISION

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A CHALLENGE FOR THE FUTURE