Office of Science

High-energy physicists at Brookhaven National Laboratory

The Office of Science is the single largest supporter of basic research in the physical sciences in the United States, providing more than 40 percent of total funding for this vital area of national importance. It oversees—and is the principal federal funding agency of—the Nation's research programs in high-energy physics, nuclear physics, and fusion energy sciences.

The Office of Science sponsors fundamental research programs in basic energy sciences, biological and environmental sciences, and computational science. In addition, the Office of Science is the Federal Government's largest single funder of materials and chemical sciences, and it supports unique and vital parts of U.S. research in climate change, geophysics, genomics, life sciences, and science education.

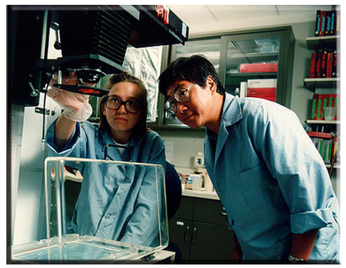
The Office of Science manages this research portfolio through five interdisciplinary program offices: Advanced Scientific Computing Research, Biological and Environmental Research, Basic Energy Sciences, Fusion Energy Sciences, and High Energy and Nuclear Physics.

The Office of Science also manages 10 world-class laboratories, which often are called the "crown jewels" of our national research infrastructure. The national laboratory system, created over a half-century ago, is the most comprehensive research system of its kind in the world.

Five are multi-program facilities: Argonne National Laboratory, Brookhaven National Laboratory, Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, and Pacific Northwest National Laboratory. The other five are single-program national laboratories: Ames Laboratory, Fermi National Accelerator Laboratory, Princeton Plasma Physics Laboratory, Stanford Linear Accelerator Center, and Thomas Jefferson National Accelerator Facility.

The Office of Science oversees the construction and operation of some of the Nation's most advanced R&D facilities, located at national laboratories and universities. These include particle and nuclear physics accelerators, synchrotron light sources, neutron scattering facilities, supercomputers, and high-speed computer networks.

Thomas Jefferson National Accelerator Facility



Microbiologists at the Pacific Northwest National Laboratory

Each year these facilities are used by more than 17,000 researchers from universities, other government agencies, and private industry.

The Office of Science is a principal supporter of graduate students and postdoctoral researchers early in their careers. About 50 percent of its research funding goes to support research at 250 colleges, universities, and institutes nationwide.

The Office of Science also reaches out to America's youth in grades K-12 and their teachers to help improve students' knowledge of science and mathematics and their understanding of global energy and environmental challenges.

To attract and encourage students to choose an education in the sciences and engineering, the Office of Science also supports the National Science Bowl, an educational competition for high school students involving all branches of science. Each year, over 12,000 students participate in the contest, and some 300 finalists representing all 50 states typically prepare for months to attend the national event in Washington, D.C.

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Office of Science
U.S. DEPARTMENT OF ENERGY

25 More Years of 'Beautiful Science' for the American People

What do all these remarkable developments of the past 25 years share in common?

- DNA sequencing and computational technologies that made possible the historic unraveling of the human genetic code, our blueprint for life.
- A microelectronic chip implanted in the eye that enables the blind to see.
- Superconducting wires that can lead to more efficient types of power generation, transmission, and electrical devices—and thereby save energy and reduce emissions.
- New holographic computerized imaging technology that identifies hidden weapons, even non-metallic ones, through the clothing of airline passengers.
- Microbes that eat waste and can be harnessed to clean up contaminated sites.

Left to right: Dr. Raymond Orbach, Secretary of Energy Spencer Abraham, and President Bush at Argonne National Laboratory

All these breakthroughs—and many, many more—have been achieved through the research and development programs sponsored by the Office of Science since the U.S. Department of Energy was established as a Cabinet-level agency in 1977.

Indeed, ever since its inception as part of the Atomic Energy Commission immediately following World War II, the Office of Science has blended cutting-edge research and innovative problem-solving to keep the United States at the forefront of scientific discovery. In fact, since the mid-1940s, the Office of Science by one count has supported the work of more than 40 Nobel Prize winners, testimony to the high quality and impact of the work it underwrites.

I am very proud to serve President Bush and Secretary of Energy Spencer Abraham as the steward of such beautiful science. I welcome the opportunity to engage the genius of American science to help meet the energy challenges identified in the President's balanced and forward-looking National Energy Plan.

Today, the Office of Science funds basic research in support of the Energy Department's missions of energy security, national security, environmental restoration, and science. Research supported by the Office of Science encompasses such diverse fields as materials sciences, chemistry, high energy and nuclear physics, plasma science, biology, advanced computation, and environmental studies.

The Office of Science also oversees outstanding laboratories with unmatched capabilities for solving complex interdisciplinary problems. In addition, the Office of Science builds and operates large-scale user facilities of importance to all areas of science. The Office of Science serves America's scientists, engineers, teachers, and students—and also the international scientific community.

For more than half a century, every President and each Congress have recognized the vital role of science in sustaining this Nation's world-power status. Estimates are that fully half of the growth in the U.S. economy in the last 50 years was due to Federal funding of scientific and technological innovation. American taxpayers have received great value for their investment in the basic research sponsored by the Office of Science.

I am pleased to highlight some of the Office of Science's historic accomplishments in the following pages—and to invite you to learn more about our work by visiting our web site or contacting us directly. I also hope you will share my excitement that, as long as this Nation maintains its commitment to investment in scientific research, the Office of Science is poised for 25 more years of beautiful science—to benefit the United States of America and the world.

Dr. Raymond L. Orbach
Director, Office of Science
U.S. Department of Energy

Basic Research with Historic Results

The Office of Science maintains our Nation's scientific infrastructure and ensures U.S. world leadership across a broad range of scientific disciplines. It supports research and development programs enabling the Department of Energy to accomplish its missions in energy security, national security, environmental restoration, and science.

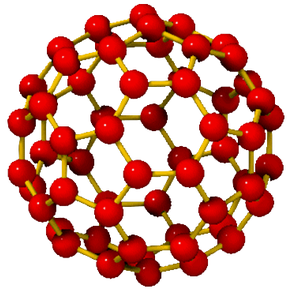
Office of Science research investments have yielded a wealth of dividends, including significant technological innovations, medical and health advances, new intellectual capital, enhanced economic competitiveness, and improved quality of life for the American people.

Research sponsored by the Office of Science has produced many key scientific breakthroughs and contributed to this Nation's well-being:

- Initiated the Human Genome Project in 1986, the historic undertaking to discover the genetic blueprint of human beings that will enable scientists to identify more genes responsible for countless diseases and develop new diagnostic and treatment approaches
- One of the great intellectual achievements of the 20th century: the discovery of all but one (the electron) of the most fundamental constituents of matter, namely quarks and leptons, which confirmed the Standard Model—physicists' current theory of matter and the forces of nature—and led to 13 Nobel Prizes

Neutron detector for land mines

- Lithium batteries that offer high-energy storage capacity and an environmentally benign alternative to the harmful lead used in conventional batteries
- The discovery of a new form of carbon, which is spurring a revolution in carbon chemistry and may lead to a profusion of new materials, polymers, catalysts, and drug delivery systems



New form of carbon known as "Bucky Ball"

- Installation of the first supercomputer available to the civilian research community that broke the peak performance barrier of 1 teraflop—or a trillion operations per second—and development of the first civilian scientific application to achieve actual performance over 1 teraflop
- New and improved metals, plastics, and other composite materials that are used in military hardware and motor vehicles
- Neutron detectors that can identify concealed nuclear weapons and land mines and are used for arms control and nonproliferation verification
- Advanced sensors that can detect explosives, narcotics, and chemical and biological agents—and many other innovations that will contribute to homeland security
- Key advances in positron emission tomography (PET) and magnetic resonance imaging (MRI), which permit non-invasive and improved detection and diagnosis
- Software and computer systems to model and simulate environmental conditions and project climate change under varying emissions scenarios.

Positron Emission Tomography (PET)

Office of Science

A Challenging—and Promising—Future

Throughout its distinguished history, the Office of Science has taken a very deliberate approach to its work: identifying seminal challenges and establishing coordinated programs that transcend what individuals alone can do. Its multidisciplinary capability is one of the Office's great strengths, leading to its highly respected record of advancing scientific frontiers to address broad societal needs.

Obviously nobody can say for sure what the great scientific and technological breakthroughs of the 21st century will be. Yet, ever committed to remaining at the forefront of major new scientific discoveries, the Office of Science already is embarked on important and promising pursuits in several directions:

National lab scientist mentors students

Supercomputer at an Office of Science user facility

- Restoring U.S. leadership in scientific computation, recently lost to Japan's newly superior supercomputing capability
- Training a 21st century workforce by bolstering education in math and science for both teachers and students
- Pioneering the new field of nanoscience, the study of matter at the atomic scale, which may hold the key to a second industrial revolution
- Solving the mystery of "dark energy," responsible for the remarkable recent finding that the expansion of the universe is accelerating, rather than slowing due to gravity as expected
- Promoting the availability of fusion power, which has remarkable promise as an inexhaustible, safe, and environmentally attractive energy source
- Harnessing the biotechnology revolution to develop clean energy and repair damage to our environment through the Genomes to Life Initiative

GENOMES to LIFE
BIOLOGICAL SOLUTIONS FOR ENERGY CHALLENGES
U.S. DEPARTMENT OF ENERGY
INNOVATIVE APPROACHES ALONG UNCONVENTIONAL PATHS

- Developing further scientific foundations for detecting, preventing, protecting against, and responding to terrorism
- Expanding access to the national laboratories by improving and modernizing America's scientific infrastructure.

The Office of Science, with its outstanding scientists, remarkable facilities, and unrivalled record of accomplishments and contributions, promises to deliver many more discoveries in these and other areas to benefit the United States of America and the world.

Holographic scanner for airport security

Office of Science