# 5. PROMOTING RESEARCH

*We have to have a balanced research portfolio, because the research enterprise is increasingly interdependent. Advances in health care, for example, are often dependent on breakthroughs in other disciplines—such as the physics needed for medical imaging technology, or the computer science needed to develop more drugs more rapidly, or to continue the mapping of the human genome.*

President Clinton
December 1999

Investments in scientific discovery and technological development—both public and private—have driven economic growth and improvements in the quality of life in America for as long as our Nation has existed. In the last 50 years, developments in science and technology have generated at least half of the Nation's productivity growth, creating millions of high-skill, high-wage jobs and leading to advances in the economy, national security, the environment, transportation, and medical care. Federal Government support for science and technology has helped put Americans on the moon, boosted agricultural productivity, harnessed the atom, devised more effective treatments for cancers, tracked weather patterns and earthquake faults, and deciphered the chemistry of life.

Because technological advances are key to progress and economic growth, in 1993 President Clinton took office committed to expanding investment in civilian research and development. The President's economic strategy relied upon the critical element of investing in people and proposed targeted investments to help the Nation compete in the global economy and improve our quality of life. In his first year, the President proposed and secured passage of a research tax credit to spur additional basic and applied research as well as significant investments to fund research and development (R&D) in a range of fields. In 1999, the President established the 21st Century Research Fund for America, relying upon a coordinated and balanced investment strategy to provide resources for basic research at the National Institutes of Health (NIH), the National Science Foundation (NSF), and the Department of Energy (DOE) and a wide range of applied research activities in areas such as the environment, agriculture, energy, computers, communications, and transportation.

The Administration's support for R&D has been essential to the flow of innovative ideas, which have resulted in everything from the discovery of the first multi-planet system beyond our own, to unraveling human, plant, and microbial genomes, a critical step in understanding the function of genes and in turn, potentially treating and curing diseases now beyond the reach of medical science. Investments in science and technology can bring us breakthroughs in the areas of the environment, health, national security, and more, including, for example: fuel economies that are double those of today; radical new surgical techniques that will make procedures far less invasive; a strong defense that continually hones its technological edge; and, fundamental research that may provide answers to key basic questions—why cells age and die, how human beings learn and remember information, and whether there is life on other planets.

The interdependence of disciplines upon which today's and tomorrow's scientific breakthroughs rely means that the balanced allocation of resources is all the more important to research in the 21st Century. With this budget, the Administration builds significantly upon its ongoing strategy of balanced investments in science and technology as established in the 21st Century Research Fund. Today,

balance is often key to scientific discovery, it is increasingly true that scientific advances in a broad range of areas build upon each other, with developments in one field providing the building blocks for others, which in turn serve as the foundation for discoveries in still other areas. For example, breakthroughs in the field of health often stem from advances, or a combination of advances, in the fields of engineering, mathematics, and the physical sciences.

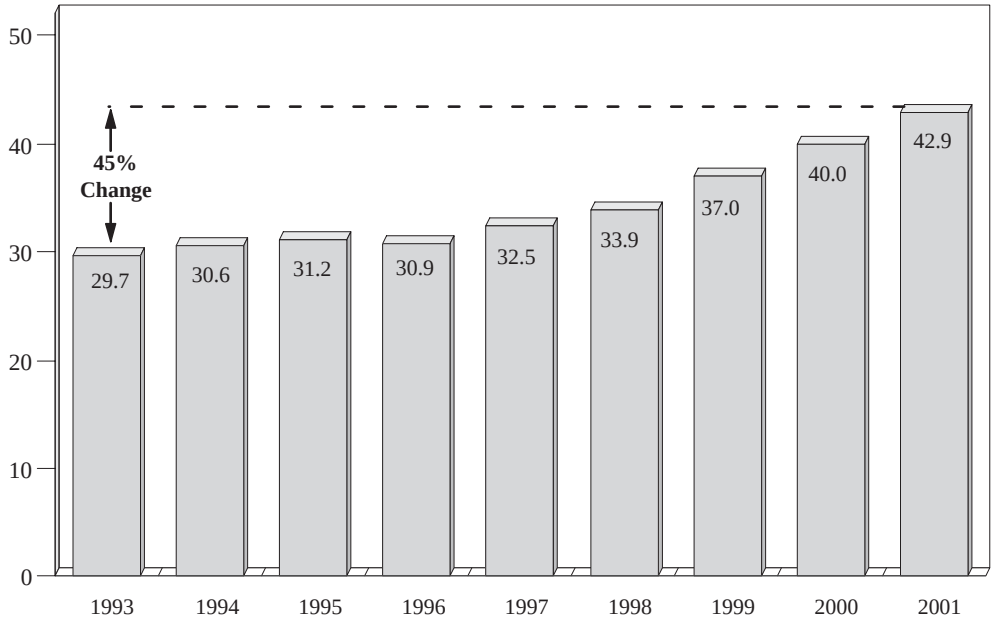
### The Science and Technology Initiative: A Bold Course of Strategic Growth

The President's new Science and Technology Initiative builds upon the Administration's 21st Century Research Fund, a balanced set of investments in basic and applied research in areas throughout the Federal Government (see Chart 5–1). In addition to allocating resources in a balanced manner, the Research Fund serves as an effective tool to ensure that complementary disciplines are funded consistent with a balanced portfolio of research activity.

The Science and Technology Initiative provides a $2.9 billion, or seven-percent, increase over the 2000 Research Fund total. The goal of the initiative is to accelerate our scientific progress toward meeting long-term economic, medical, and national security needs. It supports major new investments in existing and new research areas. The initiative will sustain U.S. economic and scientific leadership through key investments across many fields of science and technology; increase investments in fundamental, long-term research; help maintain the balance between health care research and other scientific disciplines; emphasize university-based research; and increase support for strategic research priorities.

The Science and Technology Initiative puts special emphasis on high-priority, long-term basic research, including funding to support

**Chart 5-1. Funding for Programs in the 21st Century Research Fund**




Note: The President first proposed the 21st Century Research Fund in 1999.

## Table 5–1. 21st Century Research Fund

(Budget authority, dollar amounts in millions)

| | 1993 Actual | 1999 Actual | 2000 Estimate | 2001 Proposed | Percent Change: 1993 to 2001 | Percent Change: 2000 to 2001 |
|---|---|---|---|---|---|---|
| **Health and Human Services:** | | | | | | |
| National Institutes of Health | 10,335 | 15,612 | 17,813 | 18,813 | +82% | +6% |
| **National Science Foundation** | 2,750 | 3,672 | 3,897 | 4,572 | +66% | +17% |
| **National Aeronautics and Space Administration (NASA):** | | | | | | |
| Space Science | 1,770 | 2,119 | 2,193 | 2,399 | ..... | ..... |
| Earth Science | 996 | 1,414 | 1,443 | 1,406 | ..... | ..... |
| Aerospace Technology | 884 | 1,199 | 984 | 1,058 | ..... | ..... |
| Life and Microgravity Sciences | 408 | 264 | 275 | 302 | ..... | ..... |
| NASA Total | 4,058 | 4,996 | 4,895 | 5,165 | +27% | +6% |
| **Department of Energy (DOE):** | | | | | | |
| Science Programs | 3,066 | 2,721 | 2,788 | 3,151 | ..... | ..... |
| Solar and Renewable R&D | 249 | 336 | 315 | 410 | ..... | ..... |
| Energy Conservation R&D | 346 | 526 | 577 | 660 | ..... | ..... |
| DOE Total | 3,661 | 3,583 | 3,680 | 4,221 | +15% | +15% |
| **Department of Defense (DOD):** | | | | | | |
| Basic Research | 1,314 | 1,068 | 1,167 | 1,217 | ..... | ..... |
| Applied Research | 3,549 | 3,052 | 3,415 | 3,144 | ..... | ..... |
| DOD Total | 4,863 | 4,120 | 4,582 | 4,361 | –10% | –5% |
| **Department of Agriculture (USDA):** | | | | | | |
| CSREES Research and Education | 433 | 486 | 487 | 469 | ..... | ..... |
| Economic Research Service | 59 | 54 | 53 | 55 | ..... | ..... |
| Agricultural Research Service | 661 | 794 | 830 | 894 | ..... | ..... |
| Forest Service Research | 183 | 197 | 203 | 231 | ..... | ..... |
| USDA Total | 1,336 | 1,531 | 1,573 | 1,649 | +23% | +5% |
| **Department of Commerce (DOC):** | | | | | | |
| Oceanic and Atmospheric Research | 202 | 287 | 301 | 303 | ..... | ..... |
| National Institutes of Standards and Technology [1] | 364 | 540 | 534 | 559 | ..... | ..... |
| DOC Total | 566 | 827 | 835 | 862 | +52% | +3% |
| **Department of Transportation (DOT):** | | | | | | |
| Highway Research | 221 | 468 | 490 | 715 | ..... | ..... |
| Aviation Research | 230 | 150 | 156 | 184 | ..... | ..... |
| DOT Total | 451 | 618 | 646 | 899 | +99% | +39% |
| **Department of the Interior: U.S. Geological Survey** | 750 | 797 | 813 | 895 | +19% | +10% |
| **Environmental Protection Agency (EPA):** | | | | | | |
| Office of Research and Development | 517 | 562 | 561 | 531 | ..... | ..... |
| Climate Change Technology programs | ..... | 109 | 103 | 227 | ..... | ..... |
| EPA Total | 517 | 671 | 664 | 758 | +47% | +14% |
| **Department of Education: Research programs** | 162 | 289 | 319 | 379 | +134% | +19% |
| **Department of Veterans Affairs: Medical Research** | 232 | 316 | 321 | 321 | +38% | ..... |
| **21st Century Research Fund** | **29,681** | **37,032** | **40,038** | **42,895** | **+45%** | **+7%** |
| **Science and Technology Initiative** | ..... | ..... | ..... | **2,857** | ..... | ..... |

[1] Does not include the Manufacturing Extension Partnership.

the development of nanotechnology, which is based upon the manipulation of matter at the atomic level that could result in new technologies as significant to our economy as was the development of the transistor and the Internet. For example, nanotechnology offers the promise that medical science may one day be able to perform surgery with minimally invasive techniques or detect cancerous tumors when they are only a few cells in size.

The initiative also funds the development of biobased products and bioenergy to develop new technologies for products to compete with transportation fuels and other products made from fossil energy resources. In addition, it provides significant funding increases for the ongoing Information Technology R&D program to supplement fundamental research and advanced supercomputing applications. The initiative also boosts many new initiatives and on-going programs, including biocomplexity and work force education at NSF, basic energy sciences at DOE, solar system exploration and space launch technology at the National Aeronautics and Space Administration (NASA), critical infrastructure protection at the Department of Defense (DOD), and the advanced technology program at the Department of Commerce (DOC).

In keeping with the Administration's emphasis on civilian R&D activities, the budget provides an increased share for civilian R&D investments, now 51 percent of the total and a substantial increase from 42 percent in 1993. (For total Federal R&D funding, see Table 5–2; for Science and Technology Initiatives highlights, see Table 5–3.) Many of the key features of the Science and Technology Initiative are described below.

***Strengthening Basic Research and Balancing the Federal Research Portfolio:*** Over the last several years, private industry has expanded its support for research and development, but most of these efforts focus on bringing new products to market rather than funding the basic research that can lead to breakthrough applications in a wide range of fields. By supporting basic research that can provide the foundation for tomorrow's technologies, the Federal Government can act as a catalyst for these breakthroughs. Federal investment in basic research increased by nearly 45 percent from 1993 to 2000, with emphasis on health research. The budget proposes $20.3 billion to advance a balanced portfolio in basic research, an increase of $1.3 million, or seven percent, over 2000.

This initiative builds upon recent gains for the NIH and furthers the President's commitment to sustained increases in NIH funding. It provides double the largest annual dollar increase ever for NSF, to increase support for Administration research priorities and university-based research. With this initiative, NIH will have grown 82 percent since 1993 and NSF by 66 percent. This initiative also provides an increase of $363 million for DOE's science portfolio, providing a much needed increase for the physical sciences and the user facilities that serve the entire science community. NASA's space science program would increase $206 million—nine percent for important basic research programs that probe the universe and explore nearby planets.

***Strengthening University-Based Research:*** University-based basic research plays a special role in the development of scientific advances. The competitive grants process upon which university research relies fosters innovation and expands scientific frontiers. At the same time, these research grants provide a training ground for the next generation of scientists and engineers.

Funding support for universities, provided primarily through NSF, NIH, and DOD, has grown to roughly $16.5 billion, a 42-percent increase, since 1993 (see Chart 5–2). The budget proposes $17.8 billion for university-based research, an increase of $1.3 billion over 2000. NSF represents nearly four percent of Federal R&D funding, but supports over 50 percent of the Federal non-health basic research conducted at colleges and universities. By significantly increasing the number and size of new awards available for non-health university researchers in 2001, the NSF budget also creates incentives to encourage promising students to pursue careers in science and technology.

## Table 5–2. Research and Development Investments

(Budget authority, dollar amounts in millions)

| | 1993 Actual | 1999 Actual | 2000 Estimate | 2001 Proposed | Percent Change: 1993 to 2001 | Percent Change: 2000 to 2001 |
|---|---|---|---|---|---|---|
| **Funding by Agency:** | | | | | | |
| Defense | 38,898 | 38,850 | 38,719 | 38,640 | –1% | ..... |
| Health and Human Services | 10,472 | 15,797 | 18,063 | 18,998 | +81% | +5% |
| National Aeronautics and Space Admin | 8,873 | 9,715 | 9,753 | 10,035 | +13% | +3% |
| Energy | 6,896 | 6,992 | 7,091 | 7,655 | +11% | +8% |
| National Science Foundation | 2,012 | 2,702 | 2,903 | 3,464 | +72% | +19% |
| Agriculture | 1,467 | 1,645 | 1,773 | 1,825 | +25% | +3% |
| Commerce | 793 | 1,084 | 1,073 | 1,152 | +45% | +7% |
| Transportation | 613 | 786 | 585 | 731 | +19% | +25% |
| Environmental Protection Agency | 511 | 670 | 648 | 679 | +33% | +5% |
| Veterans Affairs | 253 | 644 | 655 | 655 | +159% | ..... |
| Interior | 649 | 500 | 584 | 590 | –9% | +1% |
| Education | 200 | 205 | 233 | 271 | +36% | +16% |
| Other | 1,055 | 752 | 664 | 638 | –40% | –4% |
| Total | 72,692 | 80,342 | 82,744 | 85,333 | +17% | +3% |
| **Funding by R&D Type:** | | | | | | |
| Basic Research | 13,362 | 17,468 | 19,027 | 20,328 | +52% | +7% |
| Applied Research | 13,608 | 15,915 | 17,193 | 18,026 | +32% | +5% |
| Development | 42,795 | 44,302 | 44,071 | 44,321 | +4% | +1% |
| Equipment | [1] | 1,045 | 1,026 | 1,137 | NA | +11% |
| Facilities | 2,727 | 1,612 | 1,427 | 1,521 | –3% | +7% |
| Total | 72,492 | 80,342 | 82,744 | 85,333 | +18% | +3% |
| **Funding by Civilian Theme:** | | | | | | |
| Basic Research | 11,951 | 16,340 | 17,808 | 19,054 | +59% | +7% |
| Applied Research | 9,130 | 11,551 | 12,405 | 13,274 | +45% | +7% |
| Development | 7,269 | 8,522 | 8,818 | 8,981 | +24% | +2% |
| Equipment | [1] | 745 | 743 | 852 | NA | +15% |
| Facilities | 1,979 | 1,135 | 976 | 1,112 | –1% | +14% |
| Subtotal | 30,329 | 38,293 | 40,750 | 43,273 | +43% | +6% |
| **Funding by Defense Theme:** | | | | | | |
| Basic Research | 1,411 | 1,128 | 1,219 | 1,274 | –10% | +5% |
| Applied Research | 4,478 | 4,364 | 4,788 | 4,752 | +6% | –1% |
| Development | 35,526 | 35,780 | 35,253 | 35,340 | –1% | ..... |
| Equipment | [1] | 300 | 283 | 285 | NA | +1% |
| Facilities | 748 | 477 | 451 | 409 | –7% | –9% |
| Subtotal | 42,163 | 42,049 | 41,994 | 42,060 | ..... | ..... |
| **Funding by R&D Share:** | | | | | | |
| Civilian | 30,329 | 38,293 | 40,750 | 43,273 | +43% | +6% |
| Defense | 42,163 | 42,049 | 41,994 | 42,060 | ..... | ..... |
| Total | 72,492 | 80,342 | 82,744 | 85,333 | +18% | +3% |
| Civilian (percent) | 42% | 48% | 49% | 51% | ..... | ..... |
| **R&D Support to Universities** | 11,674 | 15,118 | 16,547 | 17,831 | +53% | +8% |
| **Merit (Peer) Reviewed R&D Programs** | NA | 23,812 | 26,021 | 28,157 | NA | +8% |

NA = Not Applicable

[1] Equipment and facilities data were not collected separately in 1993.

## Table 5–3. Science and Technology Initiative Highlights

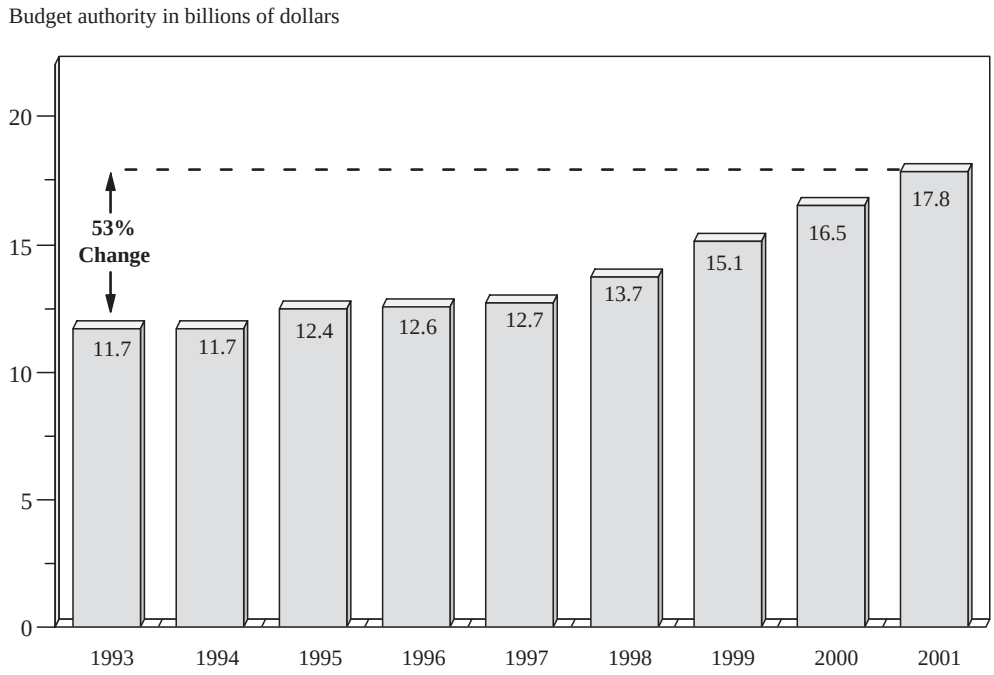
(Budget authority, dollar amounts in millions)

| | 1999 Actual | 2000 Estimate | 2001 Proposed | Dollar Change: 2000 to 2001 | Percent Change: 2000 to 2001 |
|---|---|---|---|---|---|
| **National Science and Technology Council Initiatives:** | | | | | |
| National Nanotechnology Initiative | 247 | 270 | 495 | +225 | +83% |
| Information Technology R&D | 1,301 | 1,721 | 2,315 | +594 | +35% |
| Information Technology Initiative ($IT^2$) | ..... | 309 | 823 | +514 | +166% |
| Next Generation Internet | 105 | 86 | 89 | +3 | +3% |
| Clean Energy: Biobased Products and Bioenergy | 195 | 196 | 289 | +93 | +47% |
| Climate Change Technology Initiative | 1,021 | 1,099 | 1,432 | +333 | +30% |
| Partnership for a New Generation of Vehicles | 235 | 226 | 255 | +29 | +13% |
| Integrated Science for Ecosystem Challenges | 630 | 657 | 747 | +90 | +14% |
| U.S. Global Change Research Program | 1,657 | 1,701 | 1,740 | +39 | +2% |
| Interagency Education Research Initiative | 30 | 38 | 50 | +12 | +32% |
| Critical Infrastructure Protection R&D | 450 | 461 | 606 | +145 | +31% |
| Weapons of Mass Destruction Preparedness R&D | 320 | 473 | 501 | +28 | +6% |
| **National Science Foundation:** | | | | | |
| Biocomplexity in the Environment | 12 | 50 | 136 | +86 | +173% |
| Work Force in the 21st Century | ..... | 72 | 155 | +83 | +115% |
| **National Aeronautics and Space Administration:**. | | | | | |
| Space Launch Initiative | 392 | 231 | 290 | +59 | +26% |
| Solar System Exploration | 683 | 801 | 940 | +139 | +17% |
| **Department of Energy:** | | | | | |
| Spallation Neutron Source (SNS) | 130 | 118 | 281 | +163 | +138% |
| National Scientific User Facilities (excluding SNS) | 1,124 | 1,124 | 1,191 | +67 | +6% |
| **Department of Commerce:** | | | | | |
| Advanced Technology Program (New Awards) | 40 | 51 | 65 | +14 | +27% |
| E-Commerce Research | 7 | 7 | 11 | +4 | +57% |
| **Department of Agriculture:** | | | | | |
| Climate Change Programs | 52 | 53 | 109 | +56 | +107% |
| National Research Initiative | 119 | 119 | 150 | +31 | +26% |
| **Department of Transportation:** | | | | | |
| Intelligent Transportation System Initiative | 177 | 184 | 338 | +154 | +84% |
| Highway Vehicle Crashworthiness | 27 | 22 | 43 | +21 | +95% |
| **R&D Support to Universities** | 15,118 | 16,547 | 17,831 | +1,284 | +8% |

***Promoting Major Multiagency Research Initiatives:*** The Science and Technology Initiative also supports multiagency investments, including two critical new activities: the National Nanotechnology Initiative and Biobased Products and Bioenergy, while significantly increasing funding for Information Technology and continuing support for other key areas.

*Nanotechnology Research:* The budget proposes a new multiagency National Nanotechnology Initiative at $495 million—nearly doubling the level of effort in 2000. The initiative focuses on the manipulation of matter at the atomic and molecular level, allowing us an unprecedented chance to study new properties, processes, and phenomena that matter exhibits at a scale between atoms and molecules and giving us an unprecedented ability to create new classes of devices as small as or smaller than a human cell. This research could lead to continued improvement in electronics/electro-optics for information technology; higher-performance, lower-maintenance materials for manufacturing, defense, space, and environmental applications; and, accelerated biotechnical applications in medicine, health care, and agriculture. Its application in medical science could lead to radical new surgical techniques that are far less invasive, and the detection of cancerous tumors when they are only a few cells in size.

**Chart 5-2. Federal Research and Development Funding to Universities**




*Clean Energy—Biobased products and bioenergy:* The budget proposes $289 million—a $93 million increase—for a new initiative established to meet the goal of tripling U.S. use of biobased products and bioenergy as stated by the President in Executive Order 13134 and Memorandum on Promoting Biobased Products and Bioenergy. The program provides funds for the research and development of technology that can produce feedstocks for chemical manufacturing, transportation fuels, and electricity that would compete with equivalent products made from fossil energy resources. It also funds advanced technology development for improving crop productivity and harvesting technologies to produce these raw plant materials from farm and forestry operations at an acceptably low cost. These new cash crops can boost farm incomes and add good jobs to rural economies while offsetting oil imports and reducing pollution and greenhouse gas emissions.

*Information Technology (IT) R&D:* The IT R&D program funds long-term research in computing, information, and communication that will result in the development of increasingly powerful high performance computing systems, global-scale networking technologies with advanced capabilities, advances in software development technologies and applications software, advances in managing and accessing vast distributed knowledge repositories, and advances in human interface technologies. Federal investments for these programs are critical to ensuring America's leadership in an industry that accounts for one third of our economic growth, creates high-tech, high-wage jobs, and improves our quality of life. The budget proposes $2.3 billion for this program, which now formally merges the former High Performance Computing and Communications (HPCC) program (including the Next Generation Internet) with the Information Technology initiative ($IT^2$). HPCC is a 10-year old program to research better

supercomputers and networks. IT², introduced in 2000, builds on the recommendations of the President's Information Technology Advisory Committee to significantly increase investments in long-term, fundamental research and advanced computing applications. The merged IT R&D program provides a $594 million increase above 2000, to build on the fundamental research proposed in IT².

*Climate Change Technology Initiative (CCTI):* The budget proposes $1.6 billion for the third year of this effort to promote energy efficiency, develop low-carbon energy sources, and demonstrate technologies to reduce greenhouse gas emissions. Of the amount proposed, $1.4 billion is for R&D on energy efficiency and renewable energy technologies, carbon sequestration, extension of the useful life of existing nuclear plants, and development of highly efficient fossil fuel technologies. The remainder, $0.2 billion, funds tax credits to stimulate the adoption of energy-efficient technologies in buildings, homes, industrial processes, vehicles, and power generation.

*Partnership for a New Generation of Vehicles (PNGV):* The budget proposes $255 million—$29 million more than in 2000. This cost-sharing partnership with industry aims to produce attractive, affordable vehicles capable of meeting all applicable emission and safety requirements while achieving a fuel economy up to three times higher than today's cars. Current priorities include development of highly efficient fuel cells and direct injection engines that meet stringent new air quality standards, efficient energy storage systems, power electronics, batteries, and lightweight materials.

*Integrated Science for Ecosystem Challenges (ISEC):* The budget proposes $747 million—$90 million more than in 2000—to support environmental research to improve our understanding of factors that result in ecosystem decline and biodiversity loss and to design more effective options to prevent further decline. In 2001, ISEC will address four priority areas: invasive species, biodiversity and species decline; harmful algal blooms, hypoxia and eutrophication; habitat conservation and ecosystem productivity; and information management, monitoring, and integrated assessments.

*Fundamental Health Research:* The budget reflects the Administration's continued focus on R&D to protect human health. (See Chapter 3 "Strengthening Health Care" for more detail.) It funds research programs at NIH that have made the United States the world's leader in medical research. It also supports the development of vaccines for diseases like AIDS, malaria, and tuberculosis, which kill more than seven million people each year, research on cancer and diabetes, efforts to reduce the demand for illicit drugs, a food safety initiative, and the fight against emerging infectious diseases. To implement the President's Directive on emerging infectious diseases, we have stepped up research, surveillance, and response by calling for a nearly 15-percent increase for the Centers for Disease Control and Prevention's emerging infections programs.

*Weapons of Mass Destruction (WMD) Preparedness and Critical Infrastructure Protection R&D:* The budget provides $501 million, a $28 million increase, for WMD preparedness R&D to enhance our efforts in preventing, detecting, and responding to the release of weapons of mass destruction, and to more effectively manage the health, environmental, and law enforcement consequences should such an incident ever occur. The budget also includes $606 million, a $145 million increase, for Critical Infrastructure Protection R&D to improve the safety and security of the Nation's Critical Infrastructure—the power, communications, information, transportation, and other systems on which our economy and quality of life depend. These funds will both increase Federal research and also establish the Institute for Information Infrastructure Protection to work collaboratively with industry, non-profit research institutions and academia on key information infrastructure protection technologies that private corporations would not otherwise address.

*Education Technology and the Interagency Education Research Initiative:* As part of the Administration's commitment to bridge the digital divide, the budget proposes $903 million—$137 million more than in 2000—for education technology, to ensure that America's classrooms are equipped with modern computers and connected to the Internet, that educational software is effectively inte-

grated in the curriculum, and that teachers are ready to use and teach with technology (see Chapter 9, "Strengthening the American Community"). This includes Next Generation Technology grants to develop education technology for the next century such as computer use of speech understanding to help every student learn to read, or interactive simulations that allow students to "learn by doing." Federal R&D investments such as the Interagency Education Research Initiative (IERI)—a Department of Education, NSF, and NIH's National Institute of Child Health and Human Development effort to support research to improve student learning and the development and promotion of the use of best practices in our schools. IERI is funded at $50 million, a $12 million increase above 2000.

*U.S. Global Change Research Program (USGCRP):* The budget proposes $1.7 billion for the USGCRP in 2001. This program will expand our understanding of changes in the Earth's environment, humanity's influence upon global change, and the impact of change upon society and the environment. USGCRP provides useful information for making decisions on environmental issues such as climate and ecosystem change, ozone depletion, and land use planning. In 1999, the program increased attention on the role of vegetation in the processes by which carbon moves between the atmosphere, the oceans, and the land.

### Investments at Federal Agencies

***National Institutes of Health (NIH):*** The budget continues its commitment to biomedical research by providing an increase of $1 billion over the 2000 level for NIH. This funding level will support research on diabetes, brain disorders, cancer, genetic medicine, disease prevention strategies, biomedical information and technology—including nanotechnology—and development of an AIDS vaccine. NIH's highest priority continues to be investigator-initiated, peer-reviewed research project grants. In the last year, NIH-supported researchers, who are leading the international effort to sequence the human genome, achieved a scientific milestone by unraveling for the first time the genetic code of an entire human chromosome. This achievement is the first step in the genetic revolution which could profoundly alter our approaches to preventing, treating, and curing disease.

***National Science Foundation (NSF):*** The budget provides $4.57 billion—17 percent more than in 2000—for NSF, whose broad mission is to promote science and engineering research and education across all fields and disciplines. In 1999, NSF-funded scientists reported the first complete DNA sequence of a plant chromosome, which will provide new information about chromosome structure, evolution, intracellular signaling and disease resistance in plants. The budget provides $740 million for NSF's lead role in IT R&D, focusing on long-term computer science research and providing scientists access to world-class supercomputers. The budget also provides $217 million for the National Nanotechnology Initiative. The budget increases funding for biocomplexity research by $86 million, or 173 percent, over 2000 to promote understanding of the complex biological, physical, chemical, and social interactions within and among the Earth's ecosystems. The budget also increases funding for the agency's 21st Century Work Force initiative by $83 million or 115 percent over 2000, focusing on the science of learning and enhancing educational performance and broadening participation in the science, mathematics, engineering, and technology enterprise.

***Department of Energy (DOE):*** The budget provides $3.15 billion, a 13-percent increase over 2000, for DOE's research programs in physics, chemistry, biology, materials, environmental, and computer sciences. The budget provides for the construction of new scientific facilities, including the Spallation Neutron Source and the Large Hadron Collider (in partnership with other countries), and an additional $30 million to increase support for DOE's National User Facilities. During this Administration, DOE-funded research has produced more than 5,000 new Ph.D. scientists. In 1995, researchers at Fermilab announced their discovery of the top quark, the last fundamental particle to be discovered. In the last seven years, 10 scientists have won Nobel Prizes in Chemistry or Physics for their DOE-supported research. In 2001, the budget will further strengthen the DOE research community by increasing support for research in materials science, the life sciences, and computational sciences, along with increased support

for the scientific user facilities that serve the entire community supported by the 21st Century Research Fund.

***National Aeronautics and Space Administration (NASA):*** The budget provides $14.0 billion for new and ongoing NASA activities, a three-percent increase over 2000. NASA's budget includes a 48-percent increase for space transportation, including $290 million for a five-year, $4.5 billion Space Launch Initiative to support a competition in 2005 that will enable NASA to more safely meet its human space flight needs at lower cost on commercial launch vehicles. This initiative fulfills a 1994 National Space Transportation Policy guideline calling for government and private sector decisions by the end of this decade on development of an operational, next-generation reusable launch system. The budget provides $2.4 billion, a nine-percent increase over 2000, for Space Science. This includes $940 million, a 17-percent increase, for enhanced solar system exploration, which supports revolutionary technologies and systems for a sustained presence at key research sites in our solar system that will greatly enhance the science return and resiliency of future missions. The budget also includes $256 million for investments to help ensure continued safe Space Shuttle operations, a 37-percent increase over 2000. Finally, the budget supports a wide range of other investments, including: continued deployment of the International Space Station within cost guidelines, ongoing development of the first series of Earth Observing System satellites for Earth Science, and key Aero-Space Technology goals to improve aviation safety, air traffic congestion, and aircraft noise and emissions.

***Department of Defense (DOD):*** The budget funds $1.2 billion in basic research, $3.1 billion in applied research, and $3.2 billion in advanced technology development, providing options for new defense strategies and laying the groundwork for procuring next-generation defense systems. With its emphasis on the physical sciences, DOD's research and development investments are vital to the Nation's engineering, mathematics, and computer science efforts. The budget proposes $116 million to conduct Advanced Concept Technology Demonstrations, which bring technology experts and military operators together early in technology system development to eliminate communication barriers, improve management of development programs, and address key warfighter challenges. The budget also supports a major role in Information Technology R&D, the Nanotechnology Initiative, counterproliferation R&D and protecting against 21st Century threats. Recent DOD technological accomplishments include two developments with life-saving potential: a hemostatic dressing developed for containing previously uncontrollable hemorrhages and a method to extend the shelf life of stored blood to 10 weeks.

***Department of Agriculture (USDA):*** The budget provides $894 million for the operating programs of the Agricultural Research Service, $64 million more than in 2000, and $55 million for the Economic Research Service, which together conduct a broad range of food, farm, and environmental research programs. The budget also provides $469 million for grants for the research and education programs of the Cooperative State Research, Education, and Extension Service (CSREES), including $150 million for the National Research Initiative (NRI), a 26-percent increase over the 2000 level. CSREES provides grants for agricultural, food, and environmental research, and for higher education. NRI competitive research grants improve the quality and increase the quantity of USDA's farm, food, and environmental research. The USDA budget includes increases for high-priority research in areas such as bioenergy and bioproduct human nutrition, food safety, climate change, air and water quality, food quality protection, agricultural genomes and genetics, sustainable ecosystems, carbon sequestration, and ISEC activities, including invasive species, emerging and exotic diseases, and the Forest Service's Forest and Rangeland Research program. Under the Agricultural Research Extension and Education Reform Act of 1998, $120 million in mandatory funding also will be available in 2001.

***Department of Commerce:*** In the National Institute of Standards and Technology (NIST), the budget provides $176 million—a 23-percent increase over 2000—for NIST's Advanced Technology Program to promote rigorously competitive, cost-shared R&D partnerships that develop high-risk technologies promising

widespread economic benefits. The budget provides $331—a 17-percent increase over 2000—for research at NIST's Measurement and Standards Laboratories. The NIST labs work with industry to develop and apply technology, measurements and standards. In 1999, NIST built upon its previous breakthroughs in quantum physics and discovered a new type of matter by chilling atoms and manipulating them into a novel formation. This eventually may lead to a better understanding of superconductivity, resulting in new electronic devices and enormous reductions in the cost of producing and transmitting electricity. In 2001, NIST will conduct additional research on nanotechnology and information technology, and will support a new institute to develop technologies to protect our national information infrastructure protection. For the National Oceanic and Atmospheric Administration, the budget provides $303 million for research to improve understanding of climate change, air quality, and stratospheric ozone depletion, as well as research to promote economic growth through efforts in marine biotechnology and environmental technologies.

***Department of the Interior's U.S. Geological Survey (USGS):*** The budget provides $895 million—a 10-percent increase over 2000—for science that supports natural resource management and environmental decision-making. In 1999, USGS scientists developed effective techniques to control certain invasive species while reducing impacts to native species. The 2001 budget supports research and technical assistance on the needs of land managers and local land-use planners. USGS will use its mapping, remote sensing, and natural resources monitoring capabilities to develop new ways to analyze and improve the availability of natural hazard, earth science, and biological information. This information will promote local planning and conservation efforts to protect the most valuable open spaces and critical habitats. The USGS will also begin to operate the seventh Landsat Earth observing satellite launched in April 1999. The budget also continues to support research to enhance understanding of ecosystems, invasive species, and coral reefs. Work in 2001 contributes to the multi-agency ISEC initiative.

***Environmental Protection Agency (EPA):*** The budget provides $531 million, a five-percent decrease from 2000, which contained numerous one-time congressional earmarks, for EPA's Office of Research and Development (ORD). ORD performs the majority of EPA's research and provides a sound scientific and technical foundation for environmental policy and regulatory decision-making. The budget funds research in all environmental media, and includes funding for EPA's participation (either by ORD or the Office of Air and Radiation) in crosscutting initiatives such as USGCRP, CCTI, PNGV, and ISEC, as well as funding for valuable research projects such as Environmental Technology Verification (ETV) and the Environmental Monitoring and Assessment Program (EMAP). Established by the Administration in 1995, the ETV program has verified 55 environmental technologies and 105 are currently in testing. In the last year, EMAP has verified annual declines in sulfate levels in the 1990s of up to six percent in the Nation's streams and lakes as a result of environmental regulations to curb emissions that cause acid rain.

***Department of Transportation:*** The budget proposes a total of $715 million for the Highway Research and Deployment Initiative—a $225 million increase over the 2000 level. These increases will address activities such as improving the technology for traffic operations and design, the durability of pavement and bridges, and reducing transportation crashes and incidents. The budget includes $338 million for the Intelligent Transportation System (ITS) initiative—a package of technologies to enhance the safety and efficiency of surface transportation infrastructure. This ITS total includes an additional $120 million for continued deployment of integrated "intelligent infrastructure," such as interactive traffic signals, traveler information systems, and advanced electronic motor carrier toll clearance systems in urban and rural areas and the commercial vehicle industry. The budget also provides $184 million for aviation research and development, a $28 million increase over the 2000 level. These increases will address key aviation safety, air traffic congestion, aircraft noise, and emissions goals in the National R&D Plan for Aviation.

***Department of Veterans Affairs' Medical Research:*** The budget provides $321 million—about a third of the Department's overall $1 billion research program—for clinical, epidemiological, and behavioral studies across a broad spectrum of medical research disciplines. Among the agency's top research priorities are improving the translation of research results into patient care, geriatrics (including end-of-life care and Alzheimer's disease), and treatment of Parkinson's disease and Persian Gulf Veterans' illnesses.

***Department of Education:*** The budget proposes a $60 million increase above 2000 for Department of Education reserach programs, including a $30 million increase for research, development, and dissemination activities under the proposed National Institute for Education Research. This includes a $10 million increase, for a total of $20 million, for the agency's contribution to the third year of the IERI, a collaborative effort with NSF and the NIH's National Institute of Child Health and Human Development. This innovative initiative will continue to support large-scale research focused on identifying the best approaches to raising pre-K–12 student achievement and effectively applying the latest educational technologies. The proposed increase for education research will also support national research and development centers, field-initiated studies, ongoing research on comprehensive school reform models, and new research on the education of language–minority children.