



Science + Technology

IN CONGRESS

March
2003

Long-Delayed '03 Budget Provides Historic Increases for R&D

On February 13, the 108th Congress approved the 11 unfinished fiscal year (FY) 2003 appropriations bills in an omnibus package, completing a task that should have been finished by the 107th Congress. The budget provides a record-breaking increase for defense research and development (R&D), nearly completes the campaign to double the National Institutes of Health (NIH) budget over five years, and offers a substantial increase for the National Science Foundation (NSF).

The total federal investment in research and development hits a new record of \$117.3 billion in FY 2003, a \$14.2 billion or 13.8 percent increase over FY 2002 (see table on page 7). This represents the largest dollar increase in history coming after another record increase last year, and it is the largest percentage increase in 20 years.

In contrast to proposed cuts for most agencies in the original budget request, the FY 2003 budget provides at least modest increases for nearly all the major R&D funding agencies. The largest dollar and percentage increases go to the two principal R&D funding agencies, the Department of Defense (DOD) and NIH, reflecting the high priority placed on defense and health by the Bush Administration and Congress. DOD R&D increases by \$8.8 billion or 17.6 percent to reach \$58.6 billion following a simi-

lar increase last year. NIH R&D increases 15.5 percent to \$26.2 billion just slightly short of completing a five-year campaign to double the NIH budget. Among other agencies, NSF does well with an 11.4 percent boost in R&D funding to achieve an all-time high of \$3.9 billion, which could be the first installment of a five-year campaign to double its budget.

Basic and applied research in FY 2003 fares extremely well with a combined investment of \$52.9 billion, an increase of 9.7

percent or \$4.7 billion over FY 2002 that is well above the FY 2003 request. NIH remains the largest single sponsor of basic and applied research; in FY 2003, NIH alone will fund 47 percent of all federal support of research, its highest share in history. All other federal departments except the Departments of Transportation (DOT) and Commerce also receive increases for their basic and applied research portfolios, with especially large increases for research in NSF

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Congress Debates Hydrogen Initiative

President Bush's latest hydrogen initiative, which he announced in his January 28 State of the Union address, was met at a recent hearing of the House Science Committee with a mixture of excitement and skepticism.

The president's proposal would fund research and development (R&D) supporting the use of hydrogen fuel cells, which may eventually replace gasoline-powered engines in cars. The program is designed to complement last year's FreedomCAR initiative by supporting the development of infrastructure to produce, store, and distribute hydrogen for use as a fuel to power vehicles. The president has requested a total of \$1.5 billion over the next five years for the new initiative and FreedomCar, including \$272 million in R&D funding for fiscal 2004, \$68 million of which would be new funds.

"I ask you to take a crucial step and protect our environment in ways that generations before us could not have imagined," President Bush said in his State of the Union address. "In this century, the greatest environmental progress will come about not through endless lawsuits or command-and-control regulations, but through technology and innovation."

Hydrogen fuel cells can produce electricity by combining hydrogen and oxygen gases, a

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"Believe me, none of the questions you will ask can be any tougher than those we are asking ourselves. Our ethos is safety."

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Bi-Cameral Hearing on the Columbia Disaster

In the stately and historical Russell Senate Caucus Room, Sean O'Keefe, administrator of the National Aeronautics and Space Administration (NASA), testified at what will be the first of many hearings on the investigation of the *Columbia* disaster that claimed the lives of seven astronauts. Administrator O'Keefe was direct and unflinching during the four hour hearing organized by the Senate Commerce, Science, and Transportation and House Science Committees on February 12, just eleven days after the tragic accident. His reception by congressional leaders ran both hot

Rep. Bart Gordon sharply rebuked Administrator O'Keefe, stating that the so-called independence of the Board "did not pass the smell test." Sen. Byron Dorgan echoed his concerns by remarking that the agency cannot investigate itself.

and cold as he fielded questions regarding the austerity of the Space Shuttle budget, impact to the International Space Station, and the independence of the investigating commission.

Commerce Chairman John McCain (R-AZ)—a man best known for his caustic style—set a diplomatic tone at the onset of the hearing reflecting that the shuttle crew had "paid the ultimate price in pursuit of not only their dreams, but the dreams of nations." He further acknowledged that "[a] comprehensive examination necessitates a review of our own actions and those of the Administration to determine if the Shuttle program was underfunded or managed in a manner that compromised safety." Rep. Sherwood Boehlert (R-NY), chairman of the House Science Committee, quoted President Lyndon Johnson's address to Congress upon the death of President Kennedy: "All I have, I gladly would have given, not to be standing before you today."

Administrator O'Keefe provided a very sober and detailed minute-by-minute account of the shuttle's reentry sequence in

parallel with NASA's response to loss of communication to the final announcement that *Columbia* had been destroyed. He emphasized that having spent less than two weeks collecting shuttle debris and analyzing possible causes, much of the work still lies ahead. He stated that, "This morning you will be asking us challenging questions. That's as it should be. Believe me, none of the questions you will ask can be any tougher than those we are asking ourselves. Our *ethos* is safety."

He testified that by 10:30 of the morning of the accident—just one and a half hours after initial loss of communication—NASA began the process of initiating the Columbia Accident Investigation Board (CAIB) and officially activated the board under the chairmanship of retired U.S. Navy Admiral Hal Gehman by 5:00 pm the same day.

While many congressional leaders were quick to commend NASA for the speed and openness with which the agency has shared information with Congress, the media, and the public, concern was raised that CAIB was instituted as a non-independent board controlled by NASA. In a February 6th letter to President Bush, Democratic members of the House Science Committee requested that the charter be changed to require that the Board report directly to the White House and to Congress, rather than to the Administrator of NASA. At the hearing, Rep. Bart Gordon (D-TN), ranking member of the House Science Committee's Space and Aeronautics Subcommittee, sharply rebuked Administrator O'Keefe, stating that the so-called independence of the Board "did not pass the smell test." Sen. Byron Dorgan (D-ND) echoed his concerns, remarking that the agency cannot investigate itself and recommending that the White House form a separate investigative panel.

At the same time other members provided helpful criticism, suggesting that the investigative board would be greatly enhanced with the addition of more scientists and engineers to the existing mix of military and civilian government employees on the team.

In response to congressional criticism over the composition of CAIB, commonly referred to as the Gehman Commission, Administrator O'Keefe added Dr. Sheila

Widnall, an engineering professor at the Massachusetts Institute of Technology (MIT) and a former Secretary of the Air Force, as well as Roger Tetrault, a retired CEO of McDermott International, Inc., an energy services firm.

Those appointments apparently did not

With the three remaining shuttles grounded for the foreseeable future, NASA and its international partners must face the prospect of utilizing contingency plans to provide for the three astronauts onboard.

suffice, as Admiral Gehman announced, the day before the first public meeting of CAIB, the addition of three experts on space science and space policy, including a Nobel Prize laureate.

The new commission members included Dr. Sally Ride, a former astronaut and a physics professor at the University of California at San Diego; Dr. John Logsdon, a space policy professor at George Washington University, and Dr. Douglas Osheroff, a 1966 Noble Prize winner in physics and a professor at Stanford University. The appointments, especially of Dr. Osheroff, responded to the critique that the investigative team lacked the scientific caliber given by Dr. Richard Feynman, the Nobel Prize theoretical physicist on the *Challenger* investigative team, who cut to the heart of the *Challenger* accident and shuttle safety.

Aside from the investigation of what led to the demise of the space shuttle *Columbia*, another pressing issue is how to continue to support and maintain the safety and operations of the International Space Station. With the three remaining shuttles grounded for the foreseeable future, NASA and its international partners must face the prospect of utilizing contingency plans to provide for the three astronauts onboard. To date, the station has had supplies transported via the unmanned Russian Progress

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Hatch Claims Close to Sixty Votes for Cloning Bill

As two Senate committees hold competing hearings on the issue of human cloning, Sen. Orrin Hatch (R-UT) has said that he and Sen. Dianne Feinstein (D-CA) are close to achieving the 60 votes they need to pass their proposed ban on human reproductive cloning (S. 303).

The bill, a similar version of which was introduced in the 107th Congress by Sen. Arlen Specter (R-PA), would outlaw attempts to initiate a pregnancy using cloning techniques, but would allow research to go forward using cloned embryos, which is often referred to as "research cloning." Sens. Sam Brownback (R-KS) and Mary Landrieu (D-LA) have authored competing

Sen. Hatch criticized the importation provision, saying it might prevent U.S. citizens from gaining access to medical treatments developed abroad using cloned embryos.

legislation which would outlaw both reproductive and research cloning by banning the creation of a cloned embryo for any purpose (S. 245).

At the end of the 107th Congress, the Senate was deadlocked on the issue, with neither the Brownback-Landrieu nor the Hatch-Feinstein legislation having the 60 votes required to defeat a filibuster, and the Senate leadership unable to reach an agreement with the sponsors on the procedure to bring either bill to the floor.

Meanwhile, the House has passed legislation similar to the Brownback-Landrieu bill, just as it did in 2001. H.R. 534, offered by Reps. Dave Weldon (R-FL) and Bart Stupak (D-MI), passed the House on February 27, after its supporters fought off a less restrictive substitute (H.R. 801) offered by Reps. James C. Greenwood (R-PA) and Peter Deutsch (D-FL) by a vote of 231-174.

Sen. Hatch, who is chairman of the Senate Judiciary Committee, said at a March 20 hearing that his bill has "close to 60 votes," implying that passage of the Brownback-Landrieu bill would be impos-

sible. The hearing featured several witnesses who have played prominent roles in the cloning debate, including Sen. Brownback, Dr. Leon Kass, the chairman of the President's Council on Bioethics, and Dr. Paul Berg, a Stanford University nobel laureate who was active in the 1970s in developing regulations governing controversial research on recombinant DNA technology.

Among the issues discussed was a provision included in the Weldon-Stupak bill banning the importation of "any product derived from" a cloned human embryo. Sen. Hatch criticized this provision, saying it might prevent U.S. citizens from gaining access to medical treatments developed abroad. It was also criticized by Dr. Kass, who supports a ban on research cloning but described the provision as "problematic." Apparently responding to similar critiques last year, Sen. Brownback removed the importation provision from the latest version of his bill, which he introduced in January. Rep. Weldon had dropped it from the initial version of his bill (H.R. 234) as well, but reinserted it into the new version intro-

duced just before it was considered by the House Judiciary Committee.

Sen. Brownback also changed his bill to add the cloning ban to the Public Health Service Act rather than the U.S. Penal Code. This allowed the bill to be referred to the Senate Health, Education, Labor and Pensions Committee, which is chaired by Sen. Judd Gregg (R-NH), who supports the bill and has indicated an intention to mark it up this summer. Previous versions had been referred to Sen. Hatch's Judiciary Committee, which plans to mark up S. 303 in the coming months.

A third committee, the Senate Commerce, Science and Transportation Committee, has also gotten in on the act, as its Science, Technology and Space Subcommittee, chaired by Sen. Brownback, has held two hearings on the cloning issue, on January 30 and March 27. ●●●

FOR MORE INFORMATION:

AAAS Policy Brief on Human Cloning:
www.aaas.org/spp/cstc/issues/cloning.htm

AAAS NOTES

- **REGULATING HUMAN CLONING**
www.aaas.org/spp/cstc/issues/cloningreport.pdf
An AAAS report which outlines concerns related to the regulation of human cloning.
- **AAAS REPORT XXVIII: RESEARCH AND DEVELOPMENT FY 2004**
www.aaas.org/spp/rd/rd04main.htm
A detailed analysis of the R&D budget for all federal agencies.
- **HOW DOES YOUR STATE RANK? CHECK THE AAAS STATE R&D PROFILES**
www.aaas.org/spp/rd/states.htm
A series of profiles on the impact of federal R&D on each of the 50 states; includes tables and charts for fiscal year 2000.
- **CAN WE TALK? A PUBLIC CONVERSATION ABOUT BEHAVIORAL GENETICS & SOCIETY**
www.aaas.org/spp/bgenes/cwt
AAAS Auditorium, 1200 New York Ave., NW, Washington, DC, May 2-3, 2003. A public conference focusing on new developments in genetics related to behavioral diseases, and the broader social issues associated with potential uses of this new knowledge.
- **AAAS ATLAS OF POPULATION AND ENVIRONMENT**
atlas.aaas.org
Provides maps and graphics that illustrate the broader links between population dynamics and the environment and places them within their historical perspective.

Hydrogen Initiative

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process whose only waste product is water. A hydrogen-powered car would thus be very clean and produce no smog-causing pollutants or greenhouse gases. Since they would not use gasoline, such cars could help reduce the nation's oil consumption and dependence on foreign sources of oil.

A shift to a so-called "hydrogen economy" would not automatically reduce the nation's total energy use or greenhouse emissions because the production of hydrogen fuel would require the use of other fuels, most likely including fossil fuels such

"The magic of the marketplace alone is not going to create a hydrogen economy."

as natural gas. However, because hydrogen can be produced from many different sources, fuel cell vehicles could rely at least to some extent on environmentally friendly energy technologies such as wind or solar power and carbon sequestration.

Hydrogen, produced mostly from natural gas, is widely used in the chemical and oil industries. Demonstration vehicles that run on hydrogen fuel cells have also been produced, and General Motors announced that it will put several fuel cell vehicles in use in the Washington, DC, area in May. By October, Shell has committed to equipping one of its Washington-area gas stations with a hydrogen pump to support these vehicles. GM has said that it expects to offer a hydrogen-powered car for commercial sale by 2010.

Technology is also available for storage of hydrogen either as a compressed gas or as a very cold (-253° Celsius) liquid, and high-pressure hydrogen pipelines are in use as well. However, the challenges of implementing these infrastructure technologies on the scale necessary for wide use in automobiles are daunting, as some members of the Science Committee pointed out at the March 5 hearing.

"The magic of the marketplace alone is not going to create a hydrogen economy, at least not anytime soon," said Rep. Sherwood L. Boehlert (R-NY), the Science Committee chairman. "In addition to the

huge technical hurdles, switching to hydrogen may entail enormous costs. ... Hydrogen will be a cost-competitive fuel in the coming decades only if one takes into account the social costs of current fuels, such as the pollution they generate and the dependence on foreign oil they promote."

Moreover, many members of the committee questioned the administration's decision to request cuts in other energy R&D programs. "Much of next year's proposed [hydrogen initiative] funding comes from cutting other renewable energy R&D programs," Rep. Boehlert said. "That's not acceptable."

But David K. Garman, the Department of Energy's assistant secretary for energy efficiency and renewable energy, disputed this charge, describing the department's other programs as "reasonably flat."

In response to a question from Rep. Nick Smith (R-MI), Larry Burns, GM's vice president for R&D and planning, said that focusing on hydrogen would not sacrifice other efforts, such as higher-efficiency hybrid and gasoline-powered vehicles. He said that GM has near-term fuel-efficiency initiatives, as well as its long-term hydrogen initiative. Hybrids, he said, are an impor-

tant "intermediate" technology.

While many environmentalists welcome the advent of fuel cell technology, and the potential to produce hydrogen using renewable energy sources, others see the Bush proposal as an attempt to reduce pressure on the automotive industry to embrace the use of hybrid electric technology. Hybrid cars are already on the market and offer substantial fuel-efficiency improvements. While the administration hopes that automakers will produce cost-competitive hydrogen-powered cars by 2010, critics argue that they are not likely to come to market for a decade or more.

The Science Committee plans to address these issues as part of a comprehensive energy reform package that the House will likely take up in April. The Committee expects to mark up its portion of the bill, H.R. 238, later this month. ●●●

FOR MORE INFORMATION:

White House Fact Sheet:

www.whitehouse.gov/news/releases/2003/02/20030206-2.html

Argonne National Laboratory's Hydrogen

Page: <http://hydrogen.anl.gov>

Columbia Hearing *Continued from page 2*

launch vehicle and existing stores should maintain the crew through June 2003. A second Progress flight is scheduled for June 8, but a critical issue that arises that month is insufficient water for the astronauts. Due to weight restrictions, NASA has relied on the space shuttle to transport water to the station.

NASA is discussing with its partners the notion of utilizing a Russian Soyuz vehicle as a taxi mission to transport astronauts back to Earth. In addition, it is analyzing whether additional Progress resupply flights may be able to solve the near-term problem, possibly in conjunction with an astronaut exchange mission via Soyuz that reduces the number of astronauts on board. A problem, however, is that previous reports have stated that a minimum of 2.5 astronauts are required simply to maintain operations. NASA now states that 2 astronauts are sufficient, a delicate balance given heightened scrutiny into safety issues.

NASA has emphasized that the station could remain uninhabited, if need be, with non-essential infrastructure components shut down and the unmanned Progress launch vehicle used to boost the station back into orbit.

Subsequent hearings are planned to analyze the role of manned and unmanned space exploration, the costs and benefits of continuing the shuttle program, the future of the International Space Station, and the effectiveness of NASA management. A second hearing is scheduled in the Senate on April 2. ●●●

FOR MORE INFORMATION:

Columbia Accident Investigation Board:

www.caib.us

NASA Columbia Home Page:

www.nasa.gov/columbia

CONGRESSIONAL RESEARCH SERVICE

Copies of CRS reports for congressional use are available by calling 202/707-7132.

- **Balancing Scientific Publication and National Security Concerns: Issues for Congress (RL31695)**
This report discusses issues surrounding the publication of information resulting from federally funded scientific research and national security concerns that arise with the sharing of information that could be used in a terrorist attack. It outlines current federal policies, methods for classifying and restricting the flow of scientific and technological information, and potential mechanisms that could be used to monitor and assess the risk of such information being misused.
- **Privacy: Total Information Awareness Programs and Related Information Access, Collection, and Protection Laws (RL31730)**
This report describes the Total Information Awareness (TIA) programs within DOD, and related information access, collection, and protection laws. This new program plans to sift through personal transactions in electronic data to find patterns connected to terrorist activities. The report outlines current laws and safeguards that protect the privacy of personal information, the legal process for officials who seek access to information, and dissemination of information for law enforcement, intelligence, and terrorism purposes.
- **Regulation of Plant-Based Pharmaceuticals (RS21418)**
Some genetically engineered crops are being developed to produce proteins within the plant itself that are pharmaceutical compounds that could be used to ease treatment of and vaccination against a number of diseases. While farmers may benefit economically from an increased demand for these new crops, a host of risks may also arise, such as potential environmental, food safety, and trade problems. This report outlines the topic of plant-based pharmaceuticals and addresses whether the current system for regulating biotechnology among the various federal agencies is adequate.

GENERAL ACCOUNTING OFFICE

Copies of GAO Publications are available online at www.gao.gov or by calling 202/512-6000.

- **Border Security: Challenges in Implementing Border Technology (GAO-03-546T)**
In the past, identifying travelers at the ports of entry was performed primarily by inspecting travel documents, such as passports and visas, and asking questions. Biometrics, a technology that identifies an individual by one or more distinct physiological characteristics, has been suggested as a way of improving the nation's ability to determine whether travelers are admissible to the United States. This GAO testimony addresses the issues and challenges associated with using biometrics in border control systems.

- **Critical Infrastructure Protection: Efforts of the Financial Services Sector to Address Cyber Threats (GAO-03-173)**
Since 1998, the federal government has taken steps to protect the nation's critical infrastructures, including developing partnerships between the public and private sectors, notably the financial services sector. This report reviews (1) the general nature of the cyber threats faced by the financial services industry; (2) steps the industry has taken to share information on, vulnerabilities, and incidents; (3) the relationship between government and private sector efforts to protect the industry's critical infrastructures; and (4) actions financial regulators have taken to address these cyber threats.
- **Weapons of Mass Destruction: Additional Russian Cooperation Needed to Facilitate U.S. Efforts to Improve Security at Russian Sites (GAO-03-482)**
This report analyzes DOD and DOE programs to help improve security at sites where Russia stores (1) weapons-usable nuclear material, (2) nuclear warheads, (3) dangerous biological pathogens, and (4) chemical weapons. GAO recommends that DOE re-evaluate its plans for securing Russia's nuclear material, and that DOD develop criteria to guide efforts to secure biological pathogens and revisit its decision not to secure additional chemical weapons sites.

THE NATIONAL ACADEMIES

Government offices may obtain single complimentary copies by calling the Office of Congressional and Government Affairs at 202/334-1513. Others may order copies from the National Academy Press (800/624-6242, www.nap.edu).

- **Satellite Observations of the Earth's Environment: Accelerating the Transition of Research to Operations (Prepublication: 0-309-08749-X)**
This report discusses the partnerships between government agencies that have led to major improvements in weather forecasting and climate monitoring. It notes, however, that new technologies are often slow to be adopted by, or may never reach, those who could use them. The report recommends that NASA and the National Oceanic and Atmospheric Administration establish a joint office to plan, coordinate and support the application of new meteorological research to standard practices.
- **Who Goes There?: Authentication Through the Lens of Privacy (Prepublication: 0-309-08896-8)**
This report provides an in-depth examination of the technical, legal, and policy issues surrounding the use of authentication systems. It offers a comprehensive set of guidelines to ensure that an individual's privacy is not unnecessarily compromised, whether by commercial or government organizations. The report stresses that appropriately designed authentication systems require the minimum information necessary to achieve a specific security goal.

scientific definitions

1. The act of making clear and distinct.
2. the act of stating a precise meaning or significance.

AEROSPACE TERMS

AERODYNAMICS The science that deals with the motion of air and other gaseous fluids, and of the forces acting on bodies when the bodies move through such fluids, or when such fluids move against or around the bodies.

AERODYNAMIC FORCE The force exerted by a moving gaseous fluid upon a body completely immersed in it.

AERODYNAMIC HEATING The heating of a body produced by passage of air or other gases over the body; caused by friction and by compression processes and significant chiefly at high speeds.

BERNOULLI LAW (or Bernoulli Theorem) In a flow of incompressible fluid the sum of the static pressure and the dynamic pressure along a streamline is constant if gravity and frictional effects are disregarded. (After Daniel Bernoulli, 1700-1782, Swiss scientist).

DRAG A retarding force acting upon a body in motion through a fluid, parallel to the direction of motion of the body. It is a component of the total fluid forces acting on the body. See aerodynamic force.

GEOSTATIONARY ORBIT A circular orbit in the equatorial plane, any point on which revolves about the Earth in the same direction and with the same period as the Earth's rotation. An object in a geostationary orbit will remain directly above a fixed point on the equator at a distance of approximately 42,164 km from the center of the Earth

PERTURBATION 1) Any departure introduced into an assumed steady state of a system, or a small departure from a nominal path such as a desired trajectory. 2) Specifically, a disturbance in the regular motion of a celestial body, the result of a force additional to that which causes the regular motion, specifically, a gravitational force.

PLASMA An electrical conductive gas comprised of neutral particles, ionized particles, and free electrons but which, taken as a whole, is electrically neutral. A plasma is further characterized by relatively large intermolecular distances, large amounts of energy stored in the internal energy levels of the particles, and the presence of a plasma sheath at all boundaries of the plasma.

REENTRY The event occurring when a spacecraft or other object comes back into the sensible atmosphere after being rocketed to higher altitudes; the action involved in this event.

SENSIBLE ATMOSPHERE That part of the atmosphere that offers resistance to a body passing through it.

SOURCE: www.nasa.gov

FY 2003 R&D

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and the National Aeronautics and Space Administration (NASA).

Although it was officially created only at the end of January, the new Department of Homeland Security (DHS) is poised to become a major player in federal R&D funding. For FY 2003, R&D programs scheduled to transfer to the new department this year will receive \$669 million in R&D funding, nearly triple the \$266 million for comparable programs in FY 2002. Because there is no budget account yet for DHS, these programs are funded in FY 2003 in their current agencies (DOT, DOD, USDA, and DOE) and will be transferred to DHS in the coming months. In FY 2004, when the new DHS initiates its own R&D programs, DHS R&D would jump to \$1.0 billion in the president's request.

Nondefense R&D reaches another all-time high, for the seventh year in a row. A large part of this, however, is due strictly to the steady growth in the NIH budget, an agency that enjoyed increases of approximately 15 percent for five years in a row. As a result, NIH R&D has become nearly as large as all other nondefense agencies' R&D funding combined.

Funding for nondefense R&D—excluding NIH—has stagnated in recent years. After steady growth in the 1980s, funding peaked in FY 1994 and then declined sharply as a result of tight budget conditions in the mid-1990s. The FY 2003 increases for non-NIH agencies, while large, just barely bring these agencies back to the funding levels of the early 1990s. The FY 2004 budget request would provide increases smaller than the expected rate of inflation for nondefense R&D compared to FY 2003.

"The process was not the best, but we're finally here." Such was the assessment of Congressman C.W. Bill Young (R-FL), chairman of the House Appropriations Committee, upon completion of the massive omnibus appropriations bill. Though offered specifically in reference to concluding the omnibus bill, Chairman Young's observation could just as well have been said of the entire FY 2003 budget process. The session was marked by the failure of the House and Senate to arrive at a concurrent budget resolution, partisan squabbles over the wisdom of deficit spending in which Democrats and Republicans

continued to all but reverse their historical positions on the issue, and growing concern over the budgetary implications of a looming military confrontation with Iraq. When President Bush signed the bill into

law on February 20, 2003—some two weeks after he had submitted his FY 2004 request to Congress—all parties involved were left hoping that the FY 2003 process would soon be forgotten. ●●●

—Kei Koizumi, Director, AAAS R&D Budget and Policy Program

FOR MORE INFORMATION:

AAAS R&D Web Site: www.aaas.org/spp/rd

Congressional Action on R&D in the FY 2003 Budget (Budget authority in millions of dollars; March 7, 2003)

	FY 2002 Actual	FY 2003 Request	Action by Congress				
			FY 2003 Approved	Chg. from Request		Chg. from FY 2002	
				Amount	Percent	Amount	Percent
Defense (military)	49,877	54,460	58,646	4,187	7.7%	8,769	17.6%
("S&T" 6.1,6.2,6.3 + Medical)	10,337	9,706	11,232	1,525	15.7%	894	8.6%
(All Other DOD R&D)	39,539	44,753	47,415	2,662	5.9%	7,875	19.9%
National Aeronautics & Space Admin.	10,224	10,717	10,999	283	2.6%	775	7.6%
Energy	8,078	8,059	8,205	146	1.8%	127	1.6%
(Office of Science)	3,074	3,035	3,075	40	1.3%	1	0.0%
(Energy R&D)	1,244	1,211	1,281	70	5.8%	37	3.0%
(Atomic Energy Defense R&D)	3,761	3,812	3,849	37	1.0%	89	2.4%
Health and Human Services	24,016	27,624	27,550	-74	-0.3%	3,534	14.7%
(National Institutes of Health)	22,714	26,430	26,245	-184	-0.7%	3,531	15.5%
National Science Foundation	3,525	3,651	3,927	276	7.6%	401	11.4%
Agriculture	2,112	1,911	2,166	255	13.4%	54	2.6%
Interior	623	575	627	52	9.0%	4	0.6%
Transportation *	892	852	835	-17	-2.0%	-57	-6.4%
Environmental Protection Agency	592	627	643	16	2.6%	52	8.7%
Commerce	1,227	1,063	1,248	185	17.4%	21	1.8%
(NOAA)	677	575	684	109	19.0%	7	1.1%
(NIST)	503	466	527	61	13.0%	24	4.7%
Education	265	302	315	13	4.4%	50	18.9%
International Assistance Programs	279	297	301	4	1.3%	22	7.9%
Department of Veterans Affairs	756	794	800	6	0.8%	44	5.8%
Nuclear Regulatory Commission	62	59	59	0	0.0%	-3	-4.8%
Smithsonian	126	128	128	0	0.0%	2	1.6%
All Other **	445	826	846	20	2.4%	401	90.1%
Total R&D	103,100	111,944	117,297	5,352	4.8%	14,197	13.8%
Defense R&D	53,731	58,762	62,986	4,224	7.2%	9,254	17.2%
Nondefense R&D	49,368	53,182	54,311	1,129	2.1%	4,943	10.0%
Nondefense R&D minus NIH	26,654	26,753	28,066	1,313	4.9%	1,411	5.3%

AAAS estimates based on FY 2003 appropriations bills. Includes conduct of R&D and R&D facilities. FY 2002 and FY 2003 Request figures based on OMB R&D data and supplemental agency budget data. FY 2003 Approved figures include 0.65% across-the-board cut for domestic programs mandated in legislative language. Figures are rounded to the nearest million. Changes calculated from unrounded figures.

* Includes TSA and Coast Guard. These agencies transfer to the Department of Homeland Security in FY 2003.

** Includes programs that will transfer to the new Department of Homeland Security in FY 2003, except for TSA and Coast Guard.

Science and Technology in Congress (ISSN# 1096-0406) is published by the Center for Science, Technology, and Congress (CSTC) at the American Association for the Advancement of Science (AAAS). It is distributed 8 times per year: February through August and October. Issue Updates are published periodically to supplement the newsletter.

AAAS is a non-profit, non-partisan organization. Since it was founded in 1848, AAAS has been dedicated to the advancement of scientific knowledge for the good of society as a whole.

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Frontiers in Science

Toothy Scales • The skin of a shark is coated by sharp, tooth-like scales which protect the fish from predators and parasites and help prevent scrapes. Now researchers have discovered another use for this prickly covering: juvenile spotted dogfish use their skin to help tear apart prey. Scientists in the United Kingdom observed the fish curving their tails forward until their scales hooked onto large pieces of squid held in their jaws. They would then yank their heads backward to tear off smaller chunks. Dubbed "scale rasping," the technique could help baby sharks consume large prey such as crustaceans. Scale rasping was seen only rarely in adult dogfish, most likely because they have larger mouths, and simply do not need it.

---> *Proceedings of the Royal Society, March 20, 2003*

Marijuana in Prenatal Rats • Pharmacologists at the University La Sapienza in Rome have found that rats exposed to marijuana in the womb suffer damage to a part of the brain known as the hippocampus, making them hyperactive and forgetful. Past studies have suggested that women who smoke marijuana while pregnant run the risk of harming their unborn children, but there

has been no conclusive evidence that exposure to marijuana causes memory problems. The Italian researchers, however, found that when pregnant rats were injected with a synthetic form of the drug, their offspring were not only agitated and restless, but also performed worse on a memory test than a control group. Compared to untreated rats, they more quickly returned to a compartment where they had earlier received an electric shock.

---> *Proceedings of the National Academy of Sciences, April 4, 2003*

Adult Stem Cells • Transplanted adult stem cells have been shown to repair liver damage in mice, but two new studies suggest that the improvement may result from the stem cells fusing with host cells rather than producing new liver cells. The apparent ability of adult stem cells to produce a variety of different cell types has raised hopes that treatments may be found for many diseases without using ethically controversial embryonic stem cells. However, the two studies found that when bone-marrow stem cells were transplanted into mice with damaged livers, the livers became normal but their cells contained both donor and recipient genes, and some had double or triple the normal amount of DNA. The researchers suspect that this is caused by fusion of the transplanted stem cells with host liver cells. However, other research has found no evidence of fusion, so much work remains before scientists have definite answers about the potential of adult stem cells.

---> *Nature, March 30, 2003*