

Science + Technology

IN CONGRESS

December
2000

R&D Headed for Record Increases

Although the federal government's fiscal year (FY) 2001 started on October 1, Congress and President Clinton have failed to complete action on FY 2001 appropriations, including federal support for research and development (R&D). But despite the remaining uncertainty, FY 2001 will prove to be a banner year for federal R&D programs.

At press time, only 9 of the 13 appropriations bills have been signed into law; two were vetoed over numerous disputes, one faces an expected veto, and one is not yet complete. Budget negotiations that have severely broken down and the aftermath of an uncertain presidential election forced Congress to return December 5th to a lame duck session in order to complete the FY 2001 budget.

Of the ten largest R&D funding agencies, two have not received their final appropriations. The Department of Commerce's budget is on the president's desk awaiting an expected veto. The remaining agency, the National Institutes of Health (NIH), is the largest nondefense R&D funding agency not to receive a final budget.

To date Congress and the President have agreed to provide substantial increases to nearly all categories of R&D spending and most R&D funding agencies. Fortunately, Commerce's funding levels are unlikely to change after the veto, and an informal con-

ference agreement would grant NIH a 15 percent increase in its budget, an increase that will almost certainly be signed into law. Thus, the substantial increases for federal R&D in appropriations action so far are likely to be very close to the final increases. Total federal R&D should, therefore, exceed \$90 billion for the first time. It would reach \$91.0 billion in FY 2001, an increase of \$7.6 billion (9.2 percent) over the FY 2000 funding (see table on page 3).¹

This total far exceeds the Clinton

Administration's request for \$85.4 billion, primarily because Congress plans to give far more for R&D in the Department of Defense (DOD) and NIH, the two largest R&D funding agencies, than requested. Nearly every major R&D funding agency, however, receives more than the budget request. Only the National Science Foundation (NSF) receives less for R&D than requested, but still receives 13.4 percent more for R&D than in FY 2000.

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Congress Expands DOE Polygraph Use

A provision has been inserted in the fiscal 2001 defense authorization act (H.R. 4205) that will impose new polygraph testing requirements at the Department of Energy (DOE) that could require tests for about 5,000 additional employees. The action, which comes in the wake of several high-profile security lapses at the national laboratories, has been portrayed as a way for Congress to send a message to lab employees about the importance of protecting nuclear secrets, but it has been strongly criticized as a burdensome requirement that will further diminish morale at the labs.

DOE has been plagued over the past year by two events: the controversial investigation of Wen Ho Lee, a Los Alamos National Laboratory physicist who pleaded guilty to a felony count of mishandling classified data, and the temporary disappearance of two hard drives containing sensitive weapons data in May. Congress expanded DOE's polygraph program last year in order to bolster counterintelligence efforts, but this year's changes would impose much stricter requirements.

According to a an October 17 Congressional Research Service report, last year's law would have required testing of about 15,000 DOE employees within five years, but DOE

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R&D Update

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Nondefense R&D increases by more than 11 percent to reach \$45.3 billion, a boost of \$4.6 billion and the fifth year in a row that nondefense R&D has increased in inflation-adjusted terms. Much of the recent increase, however, has been due to steady growth in the NIH budget, including increases of more than 15 percent for the last three years in a row.

In addition to the increase in the NIH budget (which is not yet final) there are substantial increases to other nondefense agencies. R&D in the Department of Energy (DOE) increases by 12.5 percent to reach \$8.0 billion, including a 14 percent boost to programs in the Office of Science; NSF R&D increases by 13.4 percent to \$3.2 billion, with substantial boosts to all the research directorates; and Science, Aeronautics, and Technology R&D in the National Aeronautics and Space Administration (NASA) increases by nearly 11 percent.

Defense R&D increases by a smaller but still substantial 7.2 percent to \$45.6 billion, bringing defense and nondefense R&D near parity for the first time in 20 years. Although defense R&D has exceeded non-defense R&D every year since the defense buildup of the early 1980s, the gap has narrowed in recent years, and nondefense R&D could narrowly exceed defense R&D when FY 2001 action is complete. DOD basic research ("6.1") increases by more than 13 percent, while applied research ("6.2") jumps by 8 percent. Although the Clinton

Administration requested a steep cut to DOD's "S&T" investments (6.1-6.3 accounts), Congress awarded an 8 percent increase. DOE's defense R&D continues the gains of recent years with a 12 percent gain in FY 2001, including expanded investments in defense computing and stockpile stewardship activities.

In his FY 2001 budget request, President Clinton placed a strong emphasis on achieving a better balance among science and engineering disciplines. A series of large increases for the National Institutes of Health (NIH) has resulted in an emphasis on biomedical and life sciences research in recent years within the federal research portfolio, hence the FY 2001 budget proposed large increases for R&D programs in non-life sciences disciplines. Though NIH is expected to receive a 15 percent-plus increase for the third year in a row, non-biomedical research also wins big this year.

NSF, the only R&D funding agency responsible for the entire range of science and engineering disciplines, with a particular emphasis on fundamental research and non-life sciences disciplines, receives the largest dollar increase in its history. DOE's Science programs, which support fundamental research in the physical sciences, receive a 14 percent boost to \$3.0 billion. As a result, nondefense R&D excluding NIH increases by 8.0 percent in FY 2001, a smaller increase than NIH's but a sharp contrast to stagnant or declining funding

in recent years. In addition, DOD support of basic (up 13 percent) and applied research (up 8 percent) in a range of physical sciences and engineering disciplines also increases substantially.

Although appropriations action is still incomplete, the Administration's multi-agency initiatives have fared well in the appropriations process, though funding levels fall short of the dramatic increases the Administration requested. Because the final allocation of funds within NIH, a major partner in these initiatives, has not been decided, final estimates on these initiatives' budgets are not yet available.

The Administration's Nanotechnology initiative proposed to double funding for existing nanotechnology programs from \$247 million in FY 2000 to \$495 million in new and continuing programs in FY 2001. NSF's leading role in the initiative was reduced from a proposed \$217 million down to \$150 million, but this still represents more than a 50 percent boost over the \$97 million FY 2000 funding level. DOE and DOD nanotechnology funding was also reduced from the request, but remains well above FY 2000 levels.

The Information Technology R&D initiative is also doing well. NSF's \$215 million for IT Research represents a dramatic jump from \$90 million in FY 2000, though it falls short of the \$280 million request. NSF also receives funding to construct a second terascale (trillions of operations per second) computing site for \$45 million, and receives a 25 percent increase for the Computer and Information Science and Engineering (CISE) directorate budget which includes IT research. DOE and DOD contributions to the initiative receive less than requested, but far more than FY 2000.

Basic and applied research truly benefit from the FY 2001 appropriations action so far. Federal support of basic research, the majority of which is performed in the nation's colleges and universities, increases by 12.5 percent or \$2.4 billion to \$21.3 billion, because of across-the-board increases to agencies' basic research-oriented programs. This includes increases of greater than 10 percent for basic research in NIH, NSF, and DOD. When taking into account applied research as well, total federal support of research (basic and applied) is \$41.2

AAAS NOTES

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Selected Memoranda of William T. Golden, October 1950 - April 1951
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billion in FY 2001, a jump of nearly \$5 billion or 12.9 percent over FY 2000. Again, there are across-the-board increases to agencies' research portfolios, with six agencies (NIH, NSF, DOE, DOD, NASA, and the Department of Transportation) slated to receive increases greater than 10 percent.

Much remains to be done on FY 2001 appropriations. The House and Senate must reach a conference agreement on the Labor-HHS bill (funding NIH and the Department of Education). Negotiations on the

final bill will be complicated because congressional leaders will seek to attach other legislative provisions to it, including possibly a large tax cut bill. President Clinton will also seek to add his own legislative priorities, including legislation on immigration.

The good news for R&D is that despite the delays, the increases for R&D are secure. The problems that remain on the appropriations bills have little to do with funding levels, and other than a little tinkering on the margins congressional appro-

priators are unlikely to do much to change the funding levels presented in this preliminary analysis. ●●●

Kei Koizumi

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¹ The figures presented in this analysis are preliminary and reflect appropriations action as of November 2. They will be revised in a later analysis to appear in a Special Update issue released after all appropriations action is complete.

R&D in FY 2001 Appropriations (budget authority in millions of dollars)

	FY 2000 Estimate	FY 2001 Request	FY 2001 Conf.	House-Senate Conference		Chg. from FY 2000 Amount	Chg. from FY 2000 Percent
				Chg. from Request Amount	Chg. from Request Percent		
Defense (military)	39,282	38,576	41,936	3,360	8.7%	2,654	6.8%
("S&T" 6.1,6.2,6.3 + Medical)	8,667	7,609	9,383	1,774	23.3%	716	8.3%
(All Other DOD R&D)	30,615	30,967	32,553	1,586	5.1%	1,938	6.3%
National Aeronautics & Space Admin.	9,777	10,040	10,320	280	2.8%	544	5.6%
Energy	7,117	7,639	8,010	371	4.9%	893	12.5%
Health and Human Services *	18,082	19,168	20,793	1,625	8.5%	2,711	15.0%
(National Institutes of Health) **	17,102	18,094	19,789	1,696	9.4%	2,688	15.7%
National Science Foundation	2,863	3,431	3,248	-183	-5.3%	384	13.4%
Agriculture	1,763	1,824	1,957	133	7.3%	194	11.0%
Interior	573	590	591	1	0.3%	18	3.2%
Transportation	606	778	702	-76	-9.8%	96	15.8%
Environmental Protection Agency	647	673	686	14	2.0%	40	6.1%
Commerce	1,073	1,148	1,108	-40	-3.5%	35	3.3%
(NOAA)	591	594	635	41	6.9%	44	7.4%
(NIST)	458	497	420	-77	-15.6%	-38	-8.3%
Education *	233	271	235	-36	-13.1%	2	1.1%
Agency for Int'l Development	122	98	124	26	26.8%	2	1.9%
Department of Veterans Affairs	655	655	685	30	4.6%	30	4.6%
Nuclear Regulatory Commission	53	53	53	0	0.0%	0	0.0%
Smithsonian	113	122	119	-3	-2.1%	6	5.7%
All Other	376	362	394	32	8.7%	18	4.7%
Total R&D	83,334	85,427	90,962	5,535	6.5%	7,628	9.2%
Defense R&D	42,583	41,981	45,642	3,661	8.7%	3,059	7.2%
Nondefense R&D	40,751	43,446	45,320	1,874	4.3%	4,569	11.2%
Nondefense R&D minus NIH	23,650	25,353	25,531	178	0.7%	1,881	8.0%
Basic Research	18,965	20,259	21,333	1,074	5.3%	2,368	12.5%
Applied Research	17,577	18,355	19,909	1,554	8.5%	2,331	13.3%
Total Research	36,542	38,613	41,242	2,628	6.8%	4,699	12.9%

AAAS estimates of R&D in FY 2001 appropriations bills as of November 2, 2000. Includes conduct of R&D and R&D facilities. All figures are rounded to the nearest million. (Changes calculated from unrounded figures.)

* HHS and Education FY 2001 Conf. Figures are based on House-approved appropriations.

** NIH FY 2001 Conf. Figures are based on Senate-approved appropriations.

All other FY 2001 Conf. agency figures represent conference report appropriations and are final.

Ehlers Education Bill Fails on House Floor

The National Science Education Act (H.R. 4271), a bipartisan package of reforms designed to improve science and math education, failed to pass the House on October 24 after a flurry of last-minute lobbying by the major teachers' unions. The National Education Association and American Federation of Teachers came out against the bill after voicing opposition to a program that would have supported the hiring of "master teachers" at private schools, claiming it to be unconstitutional.

The master teacher proposal, considered a key element of the legislation, would have

However, two days before the bill was scheduled to come up on the floor, the teachers' unions weighed in against it, and 140 of 184 Democrats voted "no", enough to sink the bill.

authorized the National Science Foundation (NSF) to spend \$50 million each year for the next three years to help elementary and middle schools—public and private—to hire experienced teachers who would offer support and mentoring to other teachers in the areas of curriculum development, use of lab equipment, and professional development.

H.R. 4271 was the centerpiece of a trio of bills (known collectively as the National Science Education Acts) introduced and enthusiastically promoted by Rep. Vernon J. Ehlers (R-MI), the vice chairman of the Science Committee. While the other two bills (H.R. 4272 and 4273) remain in committee, it appeared that H.R. 4271 would pass the House as the session wound down. After passing the Science Committee 36-0 on July 26, it was discharged by the Education and the Workforce Committee on September 21, and it collected 110 cosponsors, approximately half from each party.

However, two days before the bill was scheduled to come up on the floor, the teachers' unions weighed in against the master teacher program, and 140 of 184 Democrats voted against it, including 28

cosponsors. This was enough to sink the bill because it was brought up under suspension of the rules and needed a two-thirds majority to pass. The total vote was 215 in favor, 156 against. Four members, three of whom were cosponsors, voted present.

In addition to the master teacher program, H.R. 4271 would set up programs within NSF to train teachers in the use of technology in the classroom, award scholarships to teachers who pursue scientific research, create a working group to identify and publicize strong curricula nationwide, and commission a National Academy of Sciences study on the use of technology in the classroom. The bill received strong support from the scientific and business communities.

Democrats made two arguments in objecting to the language allowing master teacher grants to go to private schools. They held that the program raises constitutional questions regarding the separation of church and state, and that providing aid to private schools would not be the best use of federal funds. Rep. Lynn Woolsey (D-CA), whose "Go Girl" program designed to encourage girls to study math and science was added to the bill as an amendment, is among those who voted against the legislation. She argued on the House floor that the master teacher program is "a poison pill that no Member who cares about public education in America wants to vote

for. ... [It] appears to violate our Constitution, and it absolutely takes precious dollars away from public schools."

Rep. Eddie Bernice Johnson (D-TX), who authored two sections of H.R. 4271 and appeared alongside Rep. Ehlers at an April news conference introducing the bill, made a similar argument and voted "present." "I support the provisions of 4271," she said, "but I have a concern about the constitutionality of this provision. ... [W]hat we have today is simply an effort to get public dollars funneled into private schools. We simply must not do that in this body."

Rep. Ehlers, however, counters that no one raised these concerns in the six months between the bill's introduction and the floor vote. Indeed, the issue did not come up at either a May 17 legislative hearing or a July 26 markup hearing, both of which focused on H.R. 4271. The master teacher program, he argued on the House floor, is the "most widely applauded portion of the bill."

Rep. Ehlers disputed the constitutional question as being based on an outdated Supreme Court decision, and he defended his decision to include private schools in the grant program. "[P]rivate schools does not mean rich preparatory schools, as many people think, and does not necessarily mean religious schools. In my city in Grand Rapids, we have a private school that serves students in the inner city.... It operates on a poverty shoestring." Moreover, one broad

>>> *Continued on page 6*

Holt Proposes New Education Bill

Reps. Rush Holt (D-NJ) and Connie Morella (R-MD) introduced a major science education bill on October 19. Entitled the National Improvement in Mathematics and Science Teaching Act of 2000 (H.R. 5504), the bill authorizes grant programs totaling \$5 billion for states to improve the recruitment and retention of math and science teachers.

"Success in this information age depends not just on how well we educate our children generally, but on how well we can educate them in math and science specifically," said Rep. Holt. "My bill identifies teaching as the most powerful instrument for reform, and thus the place to begin."

The bill focuses particular attention on professional development programs and the narrowing of the achievement gap that exists among girls and minority students in math and science. Much of the legislation is based on the recommendations made in September by the National Commission on Mathematics and Science Teaching for the 21st Century, a major national commission chaired by former senator and astronaut John Glenn (D-OH). ●●●

FOR MORE INFORMATION:

Glenn Commission Report:

www.ed.gov/americanaccounts/glenn

Rep. Rush Holt: www.house.gov/rholt

CONGRESSIONAL RESEARCH SERVICE

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

- **Department of Energy: Status of Legislated Security and Counterintelligence Measures (RL30569)**
In 1999, in the wake of concerns over espionage, Congress imposed new security measures on DOE and its nuclear weapons labs in the FY 2000 defense authorization act. This report looks at the status of a dozen such measures, including those relating to polygraph testing and foreign visitors.
- **DNA Identification: Applications and Issues (RL30717)**
This report provides an overview of how the genetic information contained in DNA is used for identification, and a discussion of issues associated with those uses. It addresses the unique properties of genetic information that make it a powerful tool for identification and what is involved in making identifications from DNA. The report also highlights current federal programs and activities regarding this topic and addresses issues such as use in the criminal justice system, impacts of technological innovation, and privacy.
- **Internet Access, Broadband and the Digital Divide: Federal Assistance Programs (RL 30719)**
This report addresses high speed Internet access, also known as "broadband," and its potential disparities across the United States that could have adverse economic and social consequences in creating a "Digital Divide." The report provides background on access to broadband technologies across the nation, federal telecommunications development programs, legislation introduced to address this topic, and policy implications of deployment of broadband technologies.
- **South Florida Ecosystem Restoration and the Comprehensive Everglades Restoration Plan (RS 20702)**
This report addresses the Comprehensive Everglades Restoration Program (CERP) and issues associated with the program. It discusses its effectiveness as a restoration effort, uncertainties in technologies used and their costs, coordination of restoration efforts, specifics of programmatic authorization, sufficiency of reporting requirements, and its effect on the U.S. Army Corps of Engineers budget.

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- **Chemical and Biological Defense: Units Better Equipped, but Training and Readiness Reporting Problems Remain (GAO-01-27)**
This report is an update to an analysis conducted in 1996 to assess military readiness for chemical and biological defense. The report analyzes various service units and determines if they (1) have their required personnel protection, detection, and decontamination equipment and medical supplies and (2)

have incorporated chemical and biological defense training into readiness exercises and have authorized personnel to provide this training.

- **Federally Funded Math and Science Materials (GAO-01-81R)**
This report provides an overview of 61 math and science education materials created by individual federal agencies. It outlines each set of materials by agency sponsor, describes the topic and/or scope of the materials, the targeted grade level, and whether the materials are designed to be used over the course of a partial academic school year, a single academic school year, or multiple academic school years.
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This report provides information on which federal agencies sponsor biomedical research using human fetal tissue. It provides data on the number of human fetal tissue samples acquired annually, as well as the number of tissue supply organizations receiving federal funds, and the costs associated with acquiring human fetal tissue. The report discusses how researchers select and monitor suppliers, the extent to which federal human fetal tissue acquisition policies adhere to federal law, and how agencies ensure that federally funded researchers comply with existing law.

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).

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This report examines the basic strategies that finance the national immunization system in the current health care climate. It is a comprehensive volume, with data and highlighted examples, that explores the following: the evolution of the system in light of changing U.S. demographics, development of new vaccines, and other factors; the effectiveness of public health and health insurance strategies; and the condition of the infrastructure for control and prevention of infectious disease.
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scientific definitions

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

RESEARCH Systematic study directed toward more complete scientific knowledge or understanding of the subject studied.

BASIC RESEARCH To gain knowledge or understanding of phenomena without specific applications in mind.

APPLIED RESEARCH To gain knowledge or understanding necessary for meeting a specific need.

DEVELOPMENT The systematic use of knowledge or understanding gained from research directed toward the production of materials; devices; systems; or methods, including design, development, and improvement of prototypes and new processes.

BUDGET AUTHORITY The legal authorization to expend funds, it is the initial budget parameter for congressional action on the president's proposed budget.

BUDGET OBLIGATIONS Represents orders placed, contracts awarded, services received, and similar transactions during a given period, regardless of when the funds were appropriated and when the future payment of money is required.

BUDGET OUTLAYS Represents checks issued and cash payments made during a given period, regardless of when the funds were appropriated or obligated.

LIFE SCIENCES RESEARCH Consists of five detailed fields: biological (excluding environmental), environmental biology, agricultural, medical, and life sciences.

PHYSICAL SCIENCES RESEARCH Concerns the understanding of the material universe and its phenomena. It comprises the fields of astronomy, chemistry, and physics.

ENVIRONMENTAL SCIENCES RESEARCH Comprises the fields of atmospheric sciences; geological sciences; oceanography; and environmental sciences.

MATHEMATICS AND COMPUTER SCIENCES RESEARCH Employs logical reasoning with the aid of symbols and is concerned with the development of methods of operation employing such symbols and, in the case of computer sciences, with the application of such methods to automated information systems.

ENGINEERING RESEARCH Concerns studies directed toward developing engineering principles or toward making specific principles usable in engineering practice. It is divided into the following fields: aeronautical, astronautical, chemical, civil, electrical, mechanical, metallurgy, and materials.

SOCIAL SCIENCES RESEARCH Concerns the understanding of the behavior of social institutions and groups, and of individuals as members of a group. Social sciences include anthropology, economics, political science, and sociology.

SOURCE: National Science Foundation, *Federal Funds for Research and Development: Fiscal Years 1998, 1999, and 2000*, Volume 48, Arlington, VA 2000.

Ehlers Education Bill Continued from page 4

purpose of hiring master teachers is to provide young science teachers with mentors in order to increase the chances of keeping them in the teaching profession. Young teachers trained in private schools may move on to teach in public schools. "[Y]ou have to recognize teachers move from one school to another," Rep. Ehlers said. "If you educate or train a teacher, are you going to say once we have trained them with Federal money, they cannot teach in a private school anymore...?"

The constitutional question focused on several Supreme Court decisions interpreting the establishment clause of the First Amendment. Some Democrats argued that the case of *Lemon v. Kurtzman* (1971) prohibits federal aid to private schools. "It should be noted that private religious schools would be able to discriminate on the basis of religion when they hire teachers with Federal funds," said Rep. Robert C. Scott (D-VA), "and that is particularly absurd on a science bill, to think that a private school could fire a master teacher, hired with Federal funds, because that master teacher it was found believed in evolution, if teaching evolution is inconsistent with the teaching [of that school]."

Reps. Ehlers and F. James Sensenbrenner, Jr. (R-WI), the chairman of the Science Committee, contended that *Lemon* has been largely superseded by more recent, less restrictive decisions. They also pointed to an existing NSF program that honors outstanding teachers by granting their schools—both public and private—a \$7,500 award. "[T]his is typical language that we have incorporated in this bill," Rep. Ehlers holds. "We are not breaking new ground."

However, replied Rep. Johnson, "There is a real difference between a \$7,500 award and paying the full salary of a teacher for a private school."

A hastily prepared Congressional Research Service analysis placed into the congressional record by Rep. Scott addressed the issue, but did not fully resolve it. The analysis agrees with Republicans "that the Court's church-state jurisprudence is evolving," and that it has abandoned some of its earlier findings, but it also found that *Lemon* "appears still to be good law." Thus, it concluded, the master teacher program "appears to raise a constitutional question." ●●●

Polygraphs

Continued from page 1

recommended that it be scaled back to between 2,600 and 3,100 individuals in sensitive positions. Estimates of the impact of the new language vary, with some saying it will affect about 5,000 employees and others arguing that it will be limited to a smaller number.

Morale at the national labs has been sagging in the wake of congressional criticism, and some argue that increasing morale is as important to national security as protecting nuclear secrets. A September 25 DOE report by former Sen. Howard Baker (R-TN) and former Rep. Lee Hamilton (D-IN) analyzed the effect on Los Alamos of the disappearance of the hard drives and the investigation that ensued. "It is not sufficient ... simply to guard against the loss of nuclear secrets," the report found. "We must also promote a strong and vibrant scientific culture at our national laboratories to continue developing the technological advances that secrecy is designed to protect."

However, additional polygraph testing is viewed by many lab employees as a form of punishment, and is expected to decrease morale even further. Sen. Pete V. Domenici (R-NM), the chairman of the Budget Committee, was among those who criticized the new rules. "The Baker-Hamilton Report clearly indicated that we should avoid further 'Made in Washington' rules that frustrate scientific pursuits and only serve to further demoralize laboratory personnel," he said.

President Clinton also attacked the provision in a statement released at the bill's October 30 signing. He described the requirements as "unrealistic in scope, impractical in execution, and ... strongly counterproductive in their impact on our national security."

The law gives the Secretary of Energy the authority to waive the polygraph requirement, but it specifies that the criteria for a

waiver "shall not include the need to maintain the scientific vitality of the laboratory." The president singled out this clause for particular criticism, saying that it "directs the Secretary not to do his job, since maintaining the scientific vitality of DOE national laboratories is essential to our national security and is one of the Secretary's most important responsibilities."

A new blue-ribbon commission ap-

pointed by DOE will follow up on the Baker-Hamilton report and help DOE develop a coherent security policy that fosters scientific research. ●●●

FOR MORE INFORMATION:

AAAS Scientific Freedom & National Security Project: www.aaas.org/spp/scifree

Baker-Hamilton Report: www.lanl.gov/orgs/gro/bakerham.html

Do Polygraphs Work?

A major problem with polygraph testing of particular importance to scientists is the questionable effectiveness of the technique.

A polygraph test measures the subject's blood pressure, pulse, respiration, and skin conductivity as the individual is asked a series of questions. Changes in these measures from an established baseline are thought to indicate an emotional reaction when lying in response to a question. This emotional reaction is presumed to be fear of detection, but it may be caused by any number of feelings, including fear of registering as a liar even when you're telling the truth. Even the U.S. Supreme Court has concluded that uncertainties exist in polygraph exams, and that there is no way to know how accurate and reliable they are. [*United States v. Scheffer*, 523 U.S. 303 (1998)]

Law enforcement and intelligence agencies, however, have long maintained that the polygraph is a useful tool. This is especially true when the machine is used on a subject who believes in it. A subject who believes that his lies would be detected may be more likely to register an emotional reaction during the test. Moreover, the threat of a "lie detector" can be used to intimidate a subject into confessing, even without valid results. In terms of employee screening, the threat of a polygraph test may also deter employees from engaging in illicit activities.

It is difficult, however, to say whether or not a polygraph test can actually detect lies. There are many variables involved, and the outcome depends on the judgment of the person conducting the examination. Even if the data collected in a polygraph are accurate, interpretations may vary. In the case of Dr. Wen Ho Lee, a polygraph examination administered in 1998 initially indicated that he did not commit espionage against the United States. Two additional polygraph examiners studied the same data, with the same conclusion. However, the FBI drew the opposite conclusion in a later examination.

In the face of such uncertainty, employees at the national labs are reluctant to submit to the tests. According to Sen. Pete V. Domenici (R-NM), scientists have already begun to quit in frustration. "Security will be a moot point if our national laboratories fail to achieve scientific advances worth protecting," he said.

Congress has pushed for more widespread polygraph testing as a swift way to assuage security concerns. However, whether or not the technique is actually effective in protecting national security and promoting the nation's science enterprise is an open question. ●●●

Matthew Zimmerman, AAAS Science and Human Rights Program

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.

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Heard off the Hill

Are you Listening? • A study conducted by researchers at the Indiana University School of Medicine may add fuel to women's arguments that

men just don't listen. Scientists utilizing functional magnetic resonance imaging (fMRI) found that men listen with only one side of their brains, while women use both. The researchers emphasized that this doesn't mean that women are better listeners than men are—just that they listen differently. They hope to utilize the results of the study to improve understanding of how men and women recover from strokes and brain tumors.

---> *EurekAlert!*, November 28, 2000.

Monkey Think, Robot Do • Scientists have moved a step closer to merging minds and machines. Neuroscientists at Duke University were able to identify the brain signals in owl monkeys that are generated when they prepare to move their arms to grasp something. The researchers were able to utilize those same signals in real time to make a robotic arm "read" the monkeys' intentions and carry out the movement before the monkeys did. Making a robot move in real time based on brain signals is a major step. Previous experiments had only been able to make them move using brain signals that had been downloaded after the fact. Scientists hope to further develop these experiments to help create machines and prosthetic tools for paralyzed patients.

---> *The New York Times*, November 16, 2000.

Eye Off the Ball • From little league to the major leagues the rule of thumb has been that better batters keep their eye on the ball. Researchers at the University of Sussex in the United Kingdom may have found otherwise. Scientists utilized head-mounted cameras on cricket batters of varying levels of skill to monitor their eye movements as they prepared to hit the ball. The study found that all the batters made rapid eye movements to where they anticipated the ball to be after it was pitched to them from a machine. The scientists discovered that the more rapid the eye movements or the faster the batters took their eyes off the ball, the more likely they were to hit the ball well.

---> *Science*, December 1, 2000.

Underwater Museum • Archaeologists discovered what appears to be the intact wreck of a ship estimated to have sunk 1,500 years ago in the Black Sea. The discovery provides further evidence of the theory that the Black Sea used to be a freshwater lake that was separated from the Mediterranean Sea by a natural dam. When the dam was breached thousands of years ago, the denser seawater plunged to the bottom of the lake, creating a layer of oxygen-starved waters. This allows for a sterile environment that has prevented wood-boring mollusks or other creatures from disturbing the ship's remains. Previous expeditions have found man-made mud and wood structures. "The Black Sea probably has more preserved history lying in its depths than anywhere else in the world," remarked marine archaeologist Robert Ballard.

---> *Washington Post*, November 3, 2000.