

Science + Technology

IN CONGRESS

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Senate Passes S&T Doubling Bill

On September 22, the Federal Research Investment Act (S. 2046) passed the Senate by unanimous consent, marking the third year in a row that the Senate has passed the bipartisan bill. The act was originally designed to authorize a doubling of federal funding for nondefense science and technology programs. As passed by the Senate, S. 2046 now encompasses three bills, including legislation passed separately by the House of Representatives to increase federal funding for information technology (IT) research. The prospects for passage of S. 2046 in the House are grim as the respective chairmen of the oversight committees exchanged a volley of verbal fire over the packaging of the new legislation.

The Federal Research Investment Act was created by a bipartisan group of Senators, including Sens. Bill Frist (R-TN), John D. Rockefeller, IV (D-WV), and Joseph I. Lieberman (D-CT). The legislation aims to support fundamental research to drive the innovation process by authorizing increased funding for the next five years for sixteen federal agencies and departments. S. 2046 now includes as part of its portfolio S. 296, the Federal Research Investment Act; S. 2046, the Next Generation Internet 2000 Act; and H.R. 2086, the Networking Information Technology Research and Development Act (NITRD).

NITRD was originally drafted by the House Science Committee and championed by Chairman F. James Sensenbrenner, Jr. (R-WI) as a congressional solution for addressing deficiencies in IT research and development (R&D) as outlined by the President's Information Technology Advisory Committee. Sensenbrenner's bill, which would increase funding for networking and IT R&D over five years, was passed by voice vote in the House of Representatives this past February and referred to the

Senate Commerce, Science, and Transportation Committee. Sen. Frist is chairman of the committee's Science, Technology, and Space Subcommittee.

The Federal Research Investment Act has received little play in the House. After three years of negotiating with science authorization counterparts in the House, Senate sponsors coupled the stand-alone doubling bill with NITRD to facilitate passage in the House. "I support the increases for net-

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Glenn Commission Tackles Education

A landmark report from a commission chaired by former senator and astronaut John Glenn (D-OH) has called for a major national effort to improve math and science education. Declaring the current state "unacceptable," the report sets out a detailed plan for reinvigorating math and science teaching that includes checklists for key members of the educational system and a list of estimated costs totaling \$5 billion.

With the Wright Brothers' first airplane overhead and the Mercury "Friendship 7" spacecraft, in which he became the first American to orbit the Earth, beside him, Sen. Glenn announced the release of the report before a large crowd at the National Air and Space Museum on September 27. The 25-member National Commission on Mathematics and Science Teaching for the 21st Century, which included two senators, two House members, and two governors, was appointed in 1999 by Secretary of Education Richard W. Riley.

The colorful 48-page report, entitled *Before It's Too Late*, describes an urgent need. "From mathematics and the sciences will come the products, services, standard of living, and economic and military security that will sustain us at home and around the world," Sen. Glenn writes in a foreword to the report. But "it is abundantly clear ... that we are not

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"[A]dvances in IT do not occur in isolation; they are strongly rooted in advances in engineering, physics, mathematics, and even biology and nanotechnology." TURN TO PAGE 6

With Boost from Greenspan, Education Bills Progress

Federal Reserve Chairman Alan Greenspan has given a strong boost to Rep. Vernon J. Ehlers' (R-MI) efforts to improve science and math education. Appearing at a September 21 Education and the Workforce Committee hearing on H.R. 4272, one of Rep. Ehlers' three bills addressing education, Dr. Greenspan heralded the importance of science and math education to the nation's continued economic prosperity.

On the same day, the Education and the Workforce Committee discharged another of Rep. Ehlers' bills (H.R. 4271), which was approved unanimously by the Science Committee on July 26, clearing the way for

"I am a firm believer in local control and implementation of education, but we are in a war on ignorance and in a war, we need a guiding strategy, ... a general staff that recognizes the national peril of a failed educational system."

passage through the House. Both bills are designed to address the growing shortage of good science and math teachers, with H.R. 4272 addressing programs at the Department of Education and H.R. 4271 focusing on programs at the National Science Foundation.

With time running short, passage this session of either of the bills appears somewhat unlikely, but Rep. Ehlers has succeeded in building a large, bipartisan base of support for the legislation. H.R. 4272 has gained 15 co-sponsors from the Education and the Workforce Committee, and although the committee does not plan to hold any more markups this session, Rep. Ehlers believes it would have enough support to pass. Each measure has gained over 100 co-sponsors, divided fairly evenly between Republicans and Democrats, indicating they may indeed have enough support to pass the full House if brought to a vote.

A third bill, H.R. 4273, which would offer math and science teachers a 10-year,

\$1,000-a-year tax credit, has been referred to the Ways and Means Committee and is not expected to move forward this session. Senate action on any of the companion bills (S. 2624, 2623, and 2622) is also unlikely, meaning Rep. Ehlers will have to reintroduce them in the next Congress.

The trio of bills known as the National Science Education Acts of 2000 was introduced by Rep. Ehlers in April. The Science Committee, of which Rep. Ehlers serves as vice chairman, has since held three hearings on the bills featuring an array of educators and industry representatives. The growing need for high-skilled workers and the difficulty of attracting and retaining good teachers were common themes at these hearings. The bills are designed as a first step in the process of addressing these issues.

The legislation has faced some opposition from Republicans who object to any federal involvement in education policy and from Democrats who would prefer to direct federal funding toward impoverished schools. Rep. Ehlers, however, has worked hard to build a bipartisan coalition of supporters. "As far as math and science goes," he says, "every school in this country is a

school in need."

At the September 21 hearing, Dr. Greenspan argued that better K-12 education in science, math, engineering, and technology is necessary for the healthy functioning of our economy. "[I]nnovations are markedly elevating the skill levels that will be needed ... in the years ahead," he testified. These needs demand "a significant upgrading or activation of underutilized intellectual skills," which requires good foundations in math and science. "[C]ompetency in mathematics—both in numerical manipulation and in understanding its conceptual foundations—enhances a person's ability to handle the more ambiguous and qualitative relationships that dominate our day-to-day decisionmaking," he said.

The hearing developed into an enthusiastic discussion of education in general, and math and science in particular. Rep. Ehlers discussed the value of a liberal arts education at the college level and emphasized that math and science are integral to the liberal arts. This sentiment was echoed by a chorus of committee members, including Rep. Rush Holt (D-NJ), who said

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Glenn Commission

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doing the job that we should do—or can do—in teaching our children to understand and use ideas from these fields. Our children are falling behind; they are simply not 'world-class learners' when it comes to mathematics and science."

The report sets out three goals: a systematic improvement in the quality of math and science teaching, an increase in the number of teachers, and a better working environment to make the teaching profession more attractive. It follows each with a list of "action strategies," including new summer institutes, teaching academies, "induction" programs, and school/business partnerships.

These proposals are summarized in seven checklists aimed at important sectors of the education community: school boards, principals, teachers, parents, states, universities and colleges, and businesses. Cost estimates are given for each new program at the end of the report, totaling \$5 billion. Of this, \$3.1 billion would come from the federal government, \$1.4 billion from state and local governments, and \$0.5 billion from the private sector.

While this is by no means the first attempt to address science and math education issues, the Glenn Commission's high-profile membership and specific recommendations that include cost estimates make the report unique. "This document is a turning point ... because it not only sets forth specific goals and recommendations, but it also clearly articulates how the initiatives should be carried out and who should be involved in implementing them," said Gerry Wheeler, executive director of the National Science Teachers Association. •••

FOR MORE INFORMATION:

Glenn Commission Report:

www.ed.gov/americaaccounts/glenn

Congress Funds Troubled Laser Facility

Despite a host of management problems and a critical report from the General Accounting Office (GAO), Congress is poised to fund the National Ignition Facility (NIF) at a level close to the Department of Energy's (DOE) request. The fiscal year (FY) 2001 Energy and Water appropriations bill, which passed the House and Senate and has been sent to President Clinton (who has threatened a veto for unrelated reasons), would designate \$199 million for construction of the troubled project, \$10 million less than asked for. The status of the facility, which is a key part of DOE's nuclear stockpile stewardship program, was in doubt even as conferees hammered out the final details of their conference report.

If NIF works as planned, it will help scientists study the extraordinary conditions present during the detonation of a nuclear weapon. ... Unfortunately, however, there is no guarantee that the fusion reaction will take place.

Originally scheduled for completion in 2002 for a total cost of \$2.1 billion, NIF has encountered major technical and administrative problems which have ballooned the estimated cost to \$3.5 billion and pushed the completion date back to 2008. A DOE baseline report validating these new estimates called for \$209 million in FY 2001 construction funding, \$135 million more than the agency originally requested. This report, released September 15, followed an August GAO report (see title and URL at end of article) which details numerous management failures and pegs the cost at \$3.9 billion, a number it says could grow because "technical uncertainties persist."

The additional FY 2001 funding will keep the project afloat, but obstacles remain, and the money comes with strings attached. Of the \$199 million appropriated, \$69 million will be withheld until March 31, 2001, by which time the project must meet several

requirements: a new project plan and budget, certification of satisfactory construction progress, a review of scaled-back alternatives to the current plan, and a study of the importance of NIF to the stockpile stewardship program. Also included in the conference report is a punitive \$25 million reduction in the budget of Lawrence Livermore National Laboratory, the site of NIF. "The conferees remain concerned about the Department's proposed budget increase and schedule delay," the report says.

Supporters of NIF have touted the facility as a major part of the nuclear stockpile stewardship program, which has been charged with ensuring the reliability of the nation's nuclear weapons without using actual tests, which were halted in 1992. Data from experiments conducted at NIF, it is hoped, will be combined with data from previous nuclear tests and experiments using conventional explosives to allow computer simulations that can substitute for real tests.

The project has been plagued, however, by technical and managerial problems. The

GAO finds that the major cost overruns and delays were caused by "poor" Livermore management, "inadequate" oversight at DOE, and a lack of "effective independent reviews." The lab's former laser director, the report charges, assured managers, DOE, and Congress that the project was on cost and schedule "even while he was briefed on clear and growing evidence that NIF had serious problems." Furthermore, DOE did not uncover these problems until six months after they were documented at Livermore.

In a September 14 commentary in *Nature* entitled "When Peer Review Fails," Stephen Bodner, the former head of the Naval Research Laboratory's laser fusion program, and Christopher Paine, a researcher for the Natural Resources Defense Council, argue that inadequate independent reviews allowed problems to go unnoticed and warnings to go unheeded. Advocates of NIF "became captive to their own rhetoric, and dissenting voices were ignored," they write. They argue that scientists have raised legitimate questions

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AAAS NOTES

- **SCIENTIFIC FREEDOM, HUMAN RIGHTS, AND NATIONAL SECURITY**
October 19, 2000, 8:30 am - 1:30 pm, AAAS Auditorium, 1200 New York Ave., NW, Washington, DC. Topics include the impact on foreign students of the National Commission on Terrorism report, and security policies at the national labs. More information at www.aaas.org/spp/scifree, or call Victoria Baxter at 202/326-6797.
- **PRESIDENTIAL CAMPAIGN FORUM ON SCIENCE AND TECHNOLOGY POLICY**
Held at AAAS on October 5, this forum featured former Rep. Robert Walker (R-PA), an advisor to Governor George W. Bush, and David Beier, chief domestic policy advisor to Vice President Al Gore, discussing current science and technology issues. A webcast of the event may be found at www.aaas.org/news/forum.html.
- **HUMAN INHERITABLE GENETIC MODIFICATIONS: ASSESSING SCIENTIFIC, ETHICAL, RELIGIOUS, AND POLICY ISSUES**
Rapid breakthroughs in genetic research, advances in molecular biology, and new reproductive technologies are enhancing our understanding of and responses to genetically inherited diseases. Among these advances is the possibility of modifying human genes transmitted to future generations. This new AAAS report examines the feasibility of such modifications, the risks involved, the appropriate scope and limits of such research, consent issues, and the social, ethical, and theological implications of the technology. For a copy, go to www.aaas.org/spp/dssp/sfrrl/germline/main.htm or contact Rachel Gray at 202/326-7016.

NIH Issues Stem Cell Guidelines

On August 25, after nine months of sorting through approximately 50,000 comments, the National Institutes of Health (NIH) issued final guidelines for federally funded research utilizing human pluripotent stem cells derived from human embryos and fetal tissue. The NIH *Health Guidelines for Research Using Human Pluripotent Stem Cells* lay out a set of procedures to ensure that any research funded by NIH is conducted in an ethical and legal manner. The rules drew praise from the scientific community, which has thus far relied strictly on the private sector for

"We are simply not ready for a moon shot-like strategy in which we place all our bets on adult stem cells."

funds, and condemnation from policymakers and anti-abortion activists that view the ruling as a flagrant circumvention of the 1996 ban on human embryo research.

Pluripotent stem cells have the ability to grow into nearly any element of the human body and scientists see this field of research as an opportunity to discover treatments for Alzheimer's, Parkinson's, diabetes, and spinal cord injuries. However, critics say this area of research pits two moral issues against one another, the desire to treat and cure human disease against protecting the sanctity of life.

Shortly after the guidelines were issued a coalition of over 65 patient, health and scientific advocacy groups and universities issued a statement showing strong support for the NIH ruling. "Stem cell research offers one of the most promising avenues to finding a cure for my daughter and for all children with life-threatening disease," said Lyn Langbein, mother of a five-year old with diabetes, in the statement, which was issued by the American Society for Cell Biology.

Congressional lawmakers such as Sen. Sam Brownback (R-KS) and Rep. Jay Dickey (R-AK), who oppose the NIH guidelines, view the research as unethical, unnecessary, and immoral and take the position that

the derivation of embryonic stem cells is the same as the dismembering of a human being.

Though NIH may fund research utilizing stem cells, it stops short of allowing federal dollars to derive the stem cells, a process which involves the destruction of a human embryo — illegal by the 1996 ban. Hence, derivation of embryonic stem cells must remain strictly in the private sector. In addition, NIH narrows the pool of embryos that the private sector may use to obtain stem cells by restricting the sources to embryos created for the purpose of fertility treatment. The embryos must be frozen, in excess of clinical need, and no financial inducement may be offered for donating them to research. Couples seeking fertility treatment are also to be given informed consent agreements to donate their excess embryos only after they have decided to discontinue fertility treatments.

These conditions were set by NIH to separate the decisionmaking process of providing embryos for fertility treatment from the donating of embryos for research. In addition, they are to protect against creating a commercial market in the private sector for harvesting more embryos. As an added precaution, NIH will establish the NIH Human Pluripotent Stem Cell Review Group (HPSCRG) to review research proposals and compliance with the guidelines, and to hold public meetings to review proposals. HPSCRG also will be given the authority to recommend revisions to the NIH guidelines.

Other areas not eligible for NIH funding include research utilizing stem cells to create a human embryo; research where stem cells were derived using somatic cell nuclear transfer (the technique used to clone Dolly the sheep); research that would combine a human stem cell with an animal embryo (creating a chimera); and combining stem cells with somatic cell nuclear transfer for the purpose of reproductive cloning of a human being.

The only legislative interest in the topic of stem cell research continues to remain within the Senate Labor, Health and Human Services appropriations subcommittee, chaired by Sen. Arlen Specter (R-PA) and ranking member Sen. Tom Harkin (D-IA). The committee conducted two hearings to dis-

cuss the final NIH guidelines, but even with a star-studded witness list, the discussion focused on ethical issues and alternative methods such as adult stem cells that do not pose the same moral dilemma.

At the second hearing on September 14, Mary Tyler Moore, Michael J. Fox, and Gina Gershon testified on behalf of disease patient groups (diabetes, Parkinson's, and ALS, respectively). Each spoke of the hope that embryonic stem cells holds and acknowledged that while some may hold concerns about the research, the NIH guidelines adequately provide the necessary safeguards.

Ron Heagey, a paraplegic who founded an organization to help troubled youth called Life is an Attitude, testified against the final rulings. He stated that this area of research is more than just about a specific disease or handicap; it is about who determines the quality of life. He noted that if therapeutic treatments using embryonic stem cells are found, it could place pressure on patients to accept a treatment even if they do not condone the means by which it was created.

Dr. Darwin J. Prockop, director of the Center for Gene Therapy at Tulane University, provided a summary of his research utilizing adult stem cells and the promise they hold for treating diseases such as cystic fibrosis. Dr. Prockop tempered his statement, however, by emphasizing that his field has a long way to go and that they cannot be certain which therapies will work. "In my opinion, it would be a serious mistake to stop all research on human embryonic cells and tissues because of the exciting discoveries my laboratory and others have recently made about adult stem cells," said Prockop. "We are simply not ready for a moon shot-like strategy in which we place all our bets on adult stem cells."

The controversial guidelines became official the day they were published in the *Federal Register* (Vol. 65, No. 166) and allow NIH to begin accepting research proposals for funding as part of its fiscal year 2001 budget.

FOR MORE INFORMATION:
[www.nih.gov/news/stemcell/
stemcellguidelines.htm](http://www.nih.gov/news/stemcell/stemcellguidelines.htm)

CONGRESSIONAL RESEARCH SERVICE

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

- **Digital Surveillance: The Communications Assistance for Law Enforcement Act and FBI Internet Monitoring (RL30677)**
This report discusses electronic surveillance and parallels between the existing Communications Assistance for Law Enforcement Act (CALEA), and implementation of digital surveillance programs such as the FBI's Carnivore System. The report addresses funding issues, technical standards, impact on the telecommunications industry, system effectiveness, and privacy issues.
- **DNA Evidence: Legislative Initiatives in the 106th Congress (RL30694)**
This report discusses several issues related to DNA evidence and legislation proposed during the 106th Congress. The issues addressed include the nationwide backlog of unanalyzed DNA samples from convicted offenders and unsolved cases; kinds of DNA profiles that might be included in the Combined DNA Index System (CODIS), a set of law enforcement databases; and postconviction testing of DNA evidence.

GENERAL ACCOUNTING OFFICE

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

- **Arms Control: Experience of U.S. Industry With Chemical Weapons Convention Inspections (T-NSIAD-00-249)**
This testimony addresses the impact of proposed compliance regimes for the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons, and for the Biological Weapons Convention. It notes that these regimes would affect U.S. companies in the pharmaceutical, chemical, agricultural, and brewing industries.
- **Environmental Research: STAR Grants Focus on Agency Priorities, but Management Enhancements Are Possible (RCED-00-170)**
This report addresses the status of EPA's STAR grants program. It examines whether funding amounts align with EPA's strategic goals, ORD's research priorities, and program office priorities; the extent to which completed grants have provided research being used by EPA's program offices; and ways in which ORD could enhance its management of the program.
- **National Ignition Facility: Management and Oversight Failures Caused Major Cost Overruns and Schedule Delays (RCED-00-271)**
This report analyzes the extent and causes of cost overruns and delays at the Department of Energy's National Ignition Facility. It concludes that the total cost will be nearly twice the original estimate and blames problems on poor management, inadequate oversight, and a lack of independent reviews.

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).

- **The Internet's Coming of Age (ISBN: 0-309-06992-0)**
This report presents a detailed analysis of the Internet's infrastructure and provides a set of guiding principles for those who build and operate its components and for policy-makers who attempt to regulate it.
- **From Neurons to Neighborhoods: The Science of Early Childhood Development (ISBN: 0-309-06988-2)**
This book presents findings on nature-versus-nurture, the impact of being born into a working family, the effect of politics on programs for children, and the costs and benefits of intervention. It issues a series of challenges to decision makers regarding child care, ethnic diversity, the integration of cognitive and emotional development, and more.
- **Making IT Better: Expanding Information Technology Research to Meet Society's Needs (ISBN: 0-309-06991-2)**
This book highlights the fundamental importance of research to ensure that information technology (IT) meets society's expanding needs. It examines the scope and diversity of IT research, the structures and mechanisms for funding and conducting research, and whether sufficient funding is being provided.
- **Science and Technology in the National Interest: The Presidential Appointment Process**
This report concludes that there are too many obstacles to government service today, and that these obstacles have reduced the pool of talented people who are willing to serve in science and technology (S&T) presidential appointments. It identifies ways in which the new U.S. president can reduce the barriers to recruiting the nation's best scientists and engineers for senior policy-making positions.
- **Educating Teachers of Science, Mathematics, and Technology: New Practices for the New Millennium (ISBN: 0-309-07033-3)**
This study addresses current teacher-preparation and professional-development efforts in K-12 science, mathematics, and technology. It finds that they are often disjointed and inadequate, even though higher standards are raising the bar for teachers' performance. The study recommends that school districts and colleges join forces to establish a system that offers teachers a rigorous and comprehensive education.
- **Attracting Science and Mathematics Ph.D.s to Secondary School Education (ISBN: 0-309-07176-3)**
This report examines whether recent Ph.D.s in science and mathematics might provide an additional resource for helping to meet the nation's need for qualified secondary school science and mathematics teachers in the coming years.

scientific definitions

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

MASTER TEACHER A teacher with responsibility for (1) development or implementation of curricula; (2) in-classroom assistance; (3) hands-on inquiry materials; (4) mentoring of other teachers; and/or (5) professional development. (As defined in H.R. 4271.)

FISSION Process of splitting the nucleus of a heavy atom into two or more lighter atoms when the heavy atom absorbs a neutron. Fission also releases a large amount of energy and two or more neutrons. When the heavy atoms are numerous and close enough, the new neutrons split more atoms and sustain a chain reaction. Fission has been used in nuclear reactors and atomic bombs.

FUSION Combining (fusing) the nuclei of two light atoms, such as helium or hydrogen, into one heavier nucleus (a process that releases an enormous amount of energy; more energy than from fission). This requires a very high temperature, as in our sun. So far, fusion has been produced on earth only in the hydrogen bomb.

JOULE The standard international unit of energy. It is the energy expended when a 1-Newton (0.2-pound) force moves an object 1 meter (about 3 feet) in the direction of application. 1 kilojoule = 1,000 joules.

EMBRYO Organism in the early stages of growth and development. In animals, embryos are characterized by the cleavage of the fertilized eggs to many cells, the laying down of the three germ layers, and formative steps in organ development.

STEM CELL In general, a cell with the capacity to reproduce itself, and to produce distinct differentiated tissue.

PLURIPOTENT Referring to cells able to give rise to virtually any tissue type, but not to a functioning organism.

TOTIPOTENT Refers to cells able to give rise to virtually any tissue type and, in some cases, as shown experimentally in mice, to a functioning organism.

ADULT STEM CELL Any stem cell taken from mature tissue, regardless of the age of the donor.

CELL LINES Cultures of disaggregated tissue that can be maintained and propagated for use in research. The length of time cells will survive in culture varies. Some cell lines are *immortalized*; that is, they can be maintained essentially indefinitely. Embryonic stem cells and embryonic germ cells are immortal.

EMBRYONIC GERM CELLS These cells are found in a specific part of the embryo/fetus called the gonadal ridge, and normally develop into mature gametes (sperm or eggs).

SOURCES: American Nuclear Society (www.ans.org/pi/glossary); *Stem Cell Research and Applications: Monitoring the Frontiers of Biomedical Research* (www.aaas.org/spp/dspp/sfrl/projects/stem/main.htm)

S&T Doubling Bill Continued from page 1

working IT R&D contained in H.R. 2086," stated Frist in a letter to Sensenbrenner. "However, I believe that doubling the federal investment solely in networking R&D is only part of the equation. ...[A]dvances in IT do not occur in isolation; they are strongly rooted in advances in engineering, physics, mathematics, and even biology and nanotechnology."

Although Sensenbrenner has pressed for Senate passage of NITRD, he has criticized Frist's approach and claims that passing agency authorization bills over multiple years would shirk the committee's legislative authority. In a letter to the senator, Sensenbrenner stated, "I cannot support a long-term authorization bill that includes a single annual blanket authorization for all civilian R&D agencies. In my opinion, such an authorization would provide little support for scientific research funding while undermining the Science Committee's ability to operate as an effective legislative entity." Sensenbrenner added, "Also of concern is the fact that a blanket authorization transfers the authority for science policy to the appropriations committees since anything they choose to fund would be authorized." He recommended to Sen. Frist that H.R. 2086 be removed to "at least pass that on which we can all agree."

Sen. Frist countered, "I do not support this legislation to avoid my authorizing responsibility..., but rather because the 40 plus Senate co-sponsors of this bill believe as I do that long-term funding of multidisciplinary R&D at our nation's universities and laboratories will raise our standard of living and help us maintain our thriving economy." He went on to note that, "You have articulated your objection to long-term authorization bills despite the fact that H.R. 2086 contains funding for five years. ...You simply are holding the Federal Research Investment Act up to a different standard than you do your own Committee bills."

With Congress under pressure to pass the remaining appropriations bills and adjourn with sufficient time to devote to campaigning, it is unlikely that any compromise will be found between the two chambers during the remaining session. •••

National Ignition Facility

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about both the chances of NIF's success and the relevance of NIF, if it is successful, to stockpile stewardship.

If NIF works as planned, it will help scientists study the extraordinary conditions present during the detonation of a nuclear weapon. Such explosions have two stages: a "primary," in which conventional explosives trigger fission in a material such as plutonium, and a "secondary," in which a fusion reaction between different forms of hydrogen boosts the primary reaction. NIF will create a fusion reaction similar, though much less powerful, to the secondary of a nuclear weapon.

To do this, the facility will train 192 laser beams on a hollow gold cylinder smaller than a pen cap. The gold will then radiate x-rays on a pellet of hydrogen placed inside the cylinder, and this radiation, coming from all directions, will crush the hydrogen so densely that it will ignite.

Unfortunately, however, there is no guarantee that the fusion reaction will take place as planned. Even the project's supporters give only about a 50-50 chance of ignition, while some physicists are skeptical that there is any chance at all. While the facility will still be useful if ignition is not achieved, it would be a major disappointment.

Several factors make the goal difficult to achieve. For one thing, scientists have little knowledge of the extreme conditions that the laser will create. In fact, the amount of energy thought to be necessary for ignition has increased over the years. In the 1970s, DOE scientists thought that 1 kilojoule would be sufficient; then the estimate grew to 5, then to 200, and now NIF is designed to deliver 1,800 kilojoules of laser energy.

One major technical challenge is to ensure that the x-rays produced by the gold cylinder bombard the hydrogen pellet uniformly. Compressing the hydrogen enough

to cause ignition is an extraordinary task that has been compared to shrinking a basketball down to the size of a pea. If any asymmetry is present in the radiation, the hydrogen would squirt out in all directions instead of being compressed.

Other difficulties arise in manufacturing of the laser glass. At the extreme temperatures at which the laser will operate, the smallest piece of dust could burn the optical surfaces, so the glass must be assembled in clean rooms and transported by ultraclean machinery. Moreover, the high-powered ultraviolet rays that the laser will produce will cause defects to form in the glass, and it will be necessary to periodically replace certain parts of the laser

assembly.

While President Clinton has promised to veto the Energy and Water bill, his reasons are unrelated to NIF, and the new funding language is expected to remain. While the FY 2001 funding will keep construction of NIF moving, the facility faces plenty of challenges in the years ahead. •••

FOR MORE INFORMATION:

NIF baseline report:

www.dp.doe.gov/dp_web/news_f.htm

GAO report: "National Ignition Facility: Management and Oversight Failures Caused Major Cost Overruns and Schedule Delays,"

www.gao.gov/new.items/rc00271.pdf

Education Bills

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that "mathematics and science bring order, harmony, and balance to our lives." Dr. Greenspan was repeatedly pressed for specific ideas about how to improve education, but refused to go into much detail and never directly addressed H.R. 4272, the topic of the hearing. When Rep. Chaka Fattah (D-PA) asked him to compare the federal role in education with federal management of the economy, he again was noncommittal, saying that monetary policy must be centralized, but that education is not quite analogous to banking.

Dr. Greenspan's testimony was followed by an additional panel, which included Dr. Craig R. Barrett, the president of Intel Corporation, Dr. William Haseltine, CEO of Human Genome Sciences, Inc., and Dr. Leon Lederman, a Nobel Laureate in physics. The witnesses discussed the quickening pace of technological change, the difficulty in recruiting skilled workers, and the value of science literacy to our society as a whole. They also expressed support for a limited federal role in education policy, and Dr. Haseltine and Dr. Lederman specifically backed H.R. 4272. "I am a firm believer in local control and implementation of education, but we are in a war on ignorance and in a war, we need a guiding strategy, a kind of cerebral cortex, a general staff that recognizes the national peril of a failed educational system," Dr. Lederman testified.

Rep. Ehlers' legislative effort has coincided with the release of two major science education reports by the National Research Council (NRC) and the Glenn Commission, a high-profile national commission headed by former senator and astronaut John Glenn (see article on page 1). The NRC report calls for a "fundamental revamping of teaching as a profession," including new approaches to teacher education and recommendations for action at all levels of government. •••

FOR MORE INFORMATION

NRC report: "Educating Teachers of Science, Mathematics, and Technology,"

books.nap.edu/catalog/9832.html

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Heard off the Hill

replacing incandescent bulbs in traffic lights around the country. LEDs use much less electricity and last 10 years or longer, compared with the two-year life span of incandescent lights. The Office of Naval Research was a pioneering supporter of the materials technology in these bright green LEDs, which are manufactured from gallium nitride.

---> *Office of Naval Research, October 5, 2000*

Better Digs • Archaeologists soon may be using sound waves to survey potential building sites for significant cultural artifacts, say researchers at the University of Illinois. They recently demonstrated a high-resolution acoustic system capable of detecting and imaging small buried objects. The technique is similar to those used in seismic exploration, where a single element transmitter sends pulses of sound into the ground and the reflected sound waves are picked up by an array of receivers. The device can penetrate about a foot underground and resolve objects that are 2 inches in diameter. Future improvements are aimed at increasing both penetration depth and resolution, and with additional modifications, the system could be used to detect land mines.

---> *EurekAlert, October 5, 2000*

Green Light Special • If it seems to you that green traffic lights are getting a lot greener, you're not imagining it. Bright new green light emitting diodes, or LEDs, are

Quest for the Perfect Pizza • Cornell University researchers have discovered how to make fat-free or low-fat mozzarella cheese melt better. The secret: "You don't need a lot of fat inside the cheese, you just need a very small amount of fat on the surface," says Michael Rudan, a Cornell postdoctoral researcher. In their quest for perfection, the scientists applied a thin hydrophobic surface coating with an oil-spray product to the cheese before baking. The coating allows the no-fat and low-fat mozzarella to behave like its full-fat cousin.

---> *Cornell University, October 5, 2000*

Congressional Brains • Everyone knows what makes intelligence: more brains. But now, some scientists have asked whether Albert Einstein, perhaps the country's most famous genius, really did have *more* brains. Einstein's brain has been preserved since his death in 1955, and a recent study found that although his whole brain was no larger than average, his parietal lobes, which are important in spatial reasoning, were indeed wider than normal. It turns out, however, that measuring brain size is not a new phenomenon. At the December 1933 meeting of the AAAS, one scientist presented a study of brain size in members of Congress. The average weight of the brains of the 71 House members studied was 50 ounces, compared with 52 ounces for the 18 senators studied. This led one newspaper to declare, "More brains needed to get into U.S. Senate than into House, survey shows." How the data were obtained, however, was not reported.

---> *Science, September 1, 2000 and September 15, 2000*