

# Science + Technology

## IN CONGRESS

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### Bush to Fund Stem Cell Research, But Strict Limits Imposed

President Bush, in his first primetime address to the nation, announced August 9 that the federal government will fund research on human embryonic stem cells. The research, however, will be limited to cell lines already in existence.

The announcement followed months of speculation, forceful lobbying, and intense media attention. The resulting decision was a compromise between scientists' desire to move forward with potentially life-saving research and conservatives' objections to the research on the grounds that embryos are human beings.

Human embryonic stem cells, discovered in 1998, have created much excitement among scientists because of their great promise for finding new ways of treating disease. Derived from four-day-old embryos, they can theoretically differentiate into virtually any type of human cell, from blood cells to skin cells. Medical researchers hope to find ways of using these pluripotent cells to repair damaged tissue.

In August of 2000, President Bill Clinton announced that research on embryonic stem cells would be funded by the National Institutes of Health (NIH). However, when President Bush took office, he suspended this funding, and ordered Secretary of Health and Human Services Tommy Thompson to conduct a review of the issue.

For weeks, news reports had indicated that the president was looking for a compromise on the issue, but having difficulty forging one. Predictably, the resulting policy produced mixed reactions from both supporters and opponents of stem cell research. On the one hand, both sides have expressed relief: supporters that the research was not banned completely and opponents that strict limits have been imposed. But both sides have also expressed displeasure: many supporters have ques-

tioned whether the research that will be allowed to go forward will be enough to produce any progress, while many opponents believe that all research on stem cells derived from human embryos is immoral.

The president has announced that federally funded research can begin, but only on a limited group of cells. After a researcher isolates stem cells from an embryo, the cells, under certain conditions, will replicate indefinitely. Such a colony of cells

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### Federal R&D Rises as the Surplus Falls

Congress returned from a month-long August recess to confront a slow-moving fiscal year (FY) 2002 appropriations process that had become even thornier. The task of getting all 13 appropriations bills signed into law had become even more difficult due to revised projections that show the non-Social Security surpluses disappearing, and interest among members of Congress to boost national defense spending. It appeared that politicians would be forced to choose between dipping into the politically sacred Social Security surplus to fund domestic and defense programs, or paring back spending.

Now the recent terrorist attacks in Virginia and New York City will significantly shift the debate over these budgetary matters once Congress resumes discussions. The political pain involved in making these decisions now makes it certain that the appropriations process will not be done until later in the fall, and makes it impossible to predict final FY 2002 funding levels for federal research and development (R&D) programs.

Before the recess, Congress made some progress with both chambers having drafted separate versions of 9 out of the 13 appropriations bills. Following tradition, the House and the Senate left the largest and most difficult bills for the fall, namely the Department

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*"People complain about OPEC being a monopoly, but even they have 11 members."*

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## R&D

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of Defense (DOD) and the National Institutes of Health (NIH).

Both the House and the Senate would offer modest increases to the R&D agencies whose budgets they have considered so far. While the President's request would have cut R&D funding for nondefense, non-NIH agencies, both chambers would bring funding above the FY 2001 level. The House would appropriate \$28.0 billion for R&D in its versions of the nine appropriations bills acted upon, a modest 2.2 percent or \$594 million increase over the FY 2001 funding level, but \$1.2 billion above the overall cuts requested by the Bush Administration. The Senate would be even more generous than the House with \$28.6 billion for the same programs, 4.1 percent above FY 2001 and nearly \$1.8 billion above the request (see table below).

The House would offer a \$272 million or 8.3 percent increase for R&D in the National Science Foundation (NSF), a sharp contrast to the requested cut in the Bush budget. The House would also boost R&D funding for the National Aeronautics and Space

Administration (NASA) by 4.5 percent or \$446 million to \$10.4 billion, in contrast to flat funding in the request. With the notable exception of the Department of Commerce, most other R&D funding agencies would see flat funding or small increases and would receive far more than the cuts requested by the Administration. Commerce R&D would fall 9.4 percent in the House plan because the House would concur with the Administration plan to eliminate R&D in the Advanced Technology Program (ATP).

Although overall the Senate would offer larger increases than the House, it would provide smaller increases than the House for NSF R&D (up 4.0 percent) and NASA R&D (up 0.4 percent), but larger increases than the House for most other agencies. The Senate would boost Department of Energy (DOE) R&D by 8.3 percent to \$8.4 billion, with increases for all three of DOE's missions in defense, energy, and science. In contrast to a requested cut of nearly 10 percent, the Senate would boost R&D in the Department of the Interior by 4.3 percent. And in contrast to the House and the

Administration's proposal to zero out ATP, the Senate would give substantial increases not only to the program but to other Commerce R&D programs for a total of \$1.4 billion, a 13.5 percent increase.

The future of the R&D budget, however, is overshadowed by the larger discretionary budget. In April, President Bush requested a total of \$661 billion for discretionary programs in FY 2002, a 4.0 percent increase over FY 2001, but with only placeholder numbers for the DOD budget pending completion of a strategic review. In late June, the Bush Administration finally released its FY 2002 DOD budget request for \$329 billion, a \$27 billion increase over FY 2001 that pushed the total FY 2002 discretionary request up to \$680 billion. The entire increase would go to defense, education, and the NIH, leaving all other domestic discretionary programs with less money in FY 2002 than in FY 2001.

In the April budget, the budget projections showed that the President's discretionary proposals, the tax cut, and other

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### Congressional Action on R&D in the FY 2002 Budget: Total R&D by Agency

(As of August 29, 2001; Budget authority in millions of dollars)

			Action by House			Action by Senate		
	FY 2001 Estimate	FY 2002 Request	FY 2002 House	Chg. from FY 2001 Amount	Percent	FY 2002 Senate	Chg. from FY 2001 Amount	Percent
National Aeronautics & Space Admin.	9,925	9,967	<b>10,371</b>	446	4.5%	<b>9,967</b>	41	0.4%
Energy	7,744	7,399	<b>7,720</b>	-25	-0.3%	<b>8,386</b>	641	8.3%
National Science Foundation	3,279	3,226	<b>3,551</b>	272	8.3%	<b>3,410</b>	131	4.0%
Agriculture	1,959	1,801	<b>1,942</b>	-18	-0.9%	<b>2,026</b>	66	3.4%
Interior	631	593	<b>653</b>	21	3.3%	<b>659</b>	27	4.3%
Transportation	747	798	<b>751</b>	4	0.5%	<b>774</b>	27	3.6%
Environmental Protection Agency	609	569	<b>609</b>	0	-0.1%	<b>600</b>	-9	-1.5%
Commerce	1,201	1,110	<b>1,088</b>	-113	-9.4%	<b>1,364</b>	162	13.5%
(NOAA)	726	772	<b>744</b>	18	2.5%	<b>835</b>	110	15.1%
(NIST)	421	313	<b>319</b>	-101	-24.1%	<b>504</b>	83	19.7%
Agency for Int'l Development	200	193	<b>193</b>	-7	-3.5%	<b>189</b>	-11	-5.7%
Department of Veterans Affairs	703	722	<b>733</b>	30	4.3%	<b>752</b>	49	7.0%
Nuclear Regulatory Commission	50	67	<b>68</b>	18	36.6%	<b>68</b>	18	36.6%
Smithsonian	118	118	<b>118</b>	0	0.0%	<b>118</b>	0	0.0%
All Other	272	230	<b>237</b>	-35	-12.8%	<b>243</b>	-29	-10.8%
<b>Total</b>	<b>27,439</b>	<b>26,793</b>	<b>28,034</b>	<b>594</b>	<b>2.2%</b>	<b>28,553</b>	<b>1,114</b>	<b>4.1%</b>

AAAS estimates of R&D in FY 2002 House and Senate appropriations bills. Includes conduct of R&D and R&D facilities. All figures are rounded to the nearest million. Changes calculated from unrounded figures. House/Senate Appropriations Committee-approved or House/Senate-approved figures as of August 29, 2001. Some of these appropriations may be amended or rejected on the House or Senate floor. Congress has not yet considered appropriations for the Departments of Defense, Education, and Health and Human Services (which includes the National Institutes of Health); **these agencies' R&D funds are not included in this table.**

# Embryonic Stem Cell Research: A History

The issue of stem cell research burst on the scientific scene in November of 1998 when researchers first reported the isolation of human embryonic stem (ES) cells. The discovery, made by Dr. James A. Thomson, a biologist at the University of Wisconsin, Madison, offered great promise for new ways of treating disease. ES cells, which are derived from four-day-old embryos, can theoretically differentiate into virtually any type of human cell, from blood cells to skin cells. Scientists hope to find ways of using these cells to repair damaged tissue.

## Ban on Embryo Research

Dr. Thomson's breakthrough work was not eligible for funding from the National Institutes of Health (NIH), the federal government's primary sponsor of biomedical research, and the sponsor of some of his other research projects. Instead, he set up a separate lab to work on human ES cells supported by private funding from the Geron Corp. of Menlo Park, Calif., and the Wisconsin Alumni Research Foundation.

The work was ineligible for public funding because of a 1995 ban placed on NIH-funded human embryo research by Congress in the Labor-HHS appropriations bill, which funds NIH. The ban has been retained in each successive appropriations bill, and no public funding has ever been provided for human ES cell research in the United States. Originally authored in 1995 by then-Rep. Jay Dickey (R-AR), the ban appeared most recently in NIH's fiscal 2001 appropriations bill (H.R. 3424, Sec. 510).

Because of the great potential promised by Dr. Thomson's discovery, NIH sought legal counsel from the Department of Health and Human Services (HHS) on the question of whether or not the ban applies to ES cell research. In January 1999, HHS concluded that public funds could be used for research on ES cells as long as they were not used for the derivation of the cells, the process that results in the destruction of an embryo. NIH thus began drafting guidelines governing funding for ES cell studies.

## Ethical Dispute

Opponents of ES cell research hold that human life begins as soon as an egg is fer-

tilized, and they consider a human embryo to be a human being. They therefore consider any research that necessitates the destruction of a human embryo to be morally abhorrent.

Proponents of ES cell research, meanwhile, point out that in the natural reproductive process, human eggs are often fertilized but fail to implant in the uterus. A fertilized egg, they argue, while it may have the potential for human life, cannot

be considered equivalent to a human being until it has at least been successfully implanted in a woman's uterus.

*In vitro* fertilization clinics routinely create more human embryos than are needed over the course of a fertility treatment, and are therefore left with excess embryos which are often simply discarded. Proponents of research hold that it is morally permissible to use such embryos for potentially life-saving biomedical research. Opponents object to this argument, however, saying that such research would still condone the destruction of embryos.

Some opponents of ES cell research also argue that research on stem cells obtained from adults is just as promising and renders ES cell research unnecessary. Most scientists, however, dispute this claim, citing great potential in the field of adult stem cells but several drawbacks as compared with ES cells. Proponents of ES cell research advocate funding for both fields.

## NBAC Report

Shortly after Dr. Thomson's announcement, President Bill Clinton requested a review of the issues surrounding stem cell research by the National Bioethics Advisory Commission (NBAC), a presidentially appointed committee established to advise the federal government on bioethics issues. In September 1999, NBAC released its report, entitled *Ethical Issues in Human Stem Cell Research*. The report concluded that the federal government should fund research on, and the derivation of, human ES cells,

provided that only embryos leftover from fertility treatments were used. It proposed that Congress carve out an exception to its embryo research ban for the derivation of ES cells.

## NIH Guidelines

Following HHS's determination that NIH could legally fund certain ES cell research, NIH began drafting guidelines to govern such research. Opponents of ES cell research objected to HHS's legal interpretation as sanctioning the destruction of human life, while proponents applauded it and encouraged NIH to move forward with funding for research.

In December of 1999, NIH released draft guidelines allowing federally funded research on ES cells derived in the private sector, and providing for stringent oversight of such research. The guidelines allow research on cells derived only from embryos leftover from fertility treatments and donated with the consent of the progenitors. In addition, if a fertility clinic were to profit from the sale of embryos used for stem cell derivation, research on those cells would not be allowed. After reviewing a flood of comments, NIH released final guidelines on August 25, 2000, and with the backing of President Bill Clinton, solicited applications for its first ES cell research grants.

The guidelines were greeted with mixed reviews: praise from many supporters of ES cell research, and criticism from opponents. NIH received several grant applications for work to be conducted on ES cells under the new guidelines, and a committee was appointed to review the proposals. However, a statement by President Bush during his 2000 campaign seemed to indicate opposition to ES cell research and discouraged many scientists from submitting proposals.

President Bush said during his campaign, "I oppose federal funding for stem cell research that involves destroying living human embryos." Because of this statement, some speculated that he would overturn the NIH guidelines as one of his first acts as president. The president stood by his statement, but he resisted calls to overturn the guidelines outright and instead ordered a

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**FOR MORE INFORMATION:**  
[www.aaas.org/spp/cstc/issues/stemcells.htm](http://www.aaas.org/spp/cstc/issues/stemcells.htm)

## Bush to Fund Stem Cell Research, But Strict Limits Imposed

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is referred to as a "cell line." President Bush has decided that for a cell line already in existence, research is permissible because destruction of an embryo has already taken place. However, he will not allow research on any cell line created after August 9, so as to prevent the federal government from acting in a way that encourages the destruction of a human embryo.

Initially, NIH identified 64 existing cell lines at ten different labs which it approved for use by federally funded researchers. Previously, most scientists had thought the number to be much lower, and many have expressed doubts about how many of the 64 cell lines will be truly useful to researchers and meet the stringent ethical requirements set out by President Bush and imposed by many universities.

Concerns about the cell lines center on five questions: whether the cell lines are indeed robust stem cell colonies; whether the procedures used to create the cells are consistent with high ethical standards; whether the different cell lines have sufficient genetic diversity; whether cells produced from the cell lines would be safe for implantation in humans; and whether the owners of the cell lines will make them available to researchers in a timely fashion and at a reasonable cost.

Isolating and maintaining embryonic stem cell lines is a delicate process which scientists are still learning about. Much observation and testing is required to show that a cell colony is in fact composed of stem cells, and there is some doubt about whether the 64 cell lines have met the necessary criteria.

An August 27 NIH statement listing the owners of the 64 cell lines claimed that 19 stem cell lines have been created at Göteborg University in Sweden. However, the *New York Times* reported on August 29 that of these 19 lines, 12 are "still in early stages," four are "being studied and described," and just three are "established." Referring to the cells in early stages, Professor Lars Hamberger, a scientist at the Göteborg lab, told the *Times* that "[t]hose 12 perhaps ought to be called potential cell lines. If we get three good lines out of them

we'll be satisfied."

In a dramatic appearance before the Senate's Health, Education, Labor and Pensions (HELP) Committee on September 5, Secretary of Health and Human Services Tommy Thompson acknowledged that just 24-25 of the 64 cell lines President Bush referred to in his address are in fact established embryonic stem cell lines. He referred to the 64 lines as "derivations" and emphasized that although some are in early stages

### FOR MORE INFORMATION:

[www.aaas.org/spp/cstc/issues/stemcells.htm](http://www.aaas.org/spp/cstc/issues/stemcells.htm)

of development, all were derived before August 9 from surplus embryos created by fertility clinics and are therefore eligible for use by federally-funded researchers.

Regarding ethical requirements, the August 27 NIH statement says that all of the 64 cell lines "meet the President's criteria." In other words, they "must have been derived from an embryo that was created for reproductive purposes and was no longer needed," and "informed consent must have been obtained for the donation of the embryo and that donation must not have involved financial inducements." The statement did not indicate, however, whether the more detailed guidelines NIH developed under President Bill Clinton would be followed, or whether the cells are likely to meet the strict ethical standards enforced by many universities.

Also in doubt is the genetic diversity of the cells. In order to account for genetic differences in studying stem cells, researchers will need to carry out experiments on cells derived from a group of embryos that is genetically variable. However, while NIH has revealed the locations of the existing cell lines, their origins remain uncertain.

The safety of the existing cell lines for implantation is also emerging as a major concern. Most of the 64 cell lines have been grown in culture with the help of mouse stem cells which could potentially introduce animal viruses dangerous to humans. Although scientists say that human clinical trials are years away, if stem cells are to produce the type of revolutionary medical

benefits many hope for, they will need to be transplanted into humans, and this may be impossible or impractical with the currently available cells. Under Food and Drug Administration rules, such transplants with existing cells would be classified as "xenotransplants," or transplants of animal tissue, and would be subject to strict requirements on both researchers and patients.

In order to address concerns about the access researchers will have to existing cell lines, Secretary Thompson announced at the HELP Committee hearing that NIH had signed a memorandum of understanding with WiCell

Research Institute, which according to NIH, is the owner of five cell lines. The agreement allows NIH scientists to access these cells for their research and to freely publish their results, while guaranteeing that WiCell will retain commercial rights to its materials and receive a fee to cover handling and distribution expenses. In addition, WiCell has agreed to make its cells available for use by non-profit institutions that receive NIH grants under the same terms as those available to NIH scientists.

This step, however, has not silenced the concerns of some critics about access to the stem cells. Several Democratic members of the HELP Committee, for example, questioned the wisdom in limiting research to cell lines that are controlled by just ten different entities. "People complain about OPEC being a monopoly, but even they have 11 members," said Sen. Edward M. Kennedy (D-MA), the HELP Committee chairman. Sen. John R. Edwards (D-NC), another committee member echoed these concerns and argued that the restrictions effectively cede control over embryonic stem cell research to the ten entities that have already produced cells.

Likewise, Sen. Arlen Specter (R-PA), who appeared prior to Secretary Thompson as a witness before the committee, testified that "[w]e are just beginning to learn which researchers and companies throughout the world have ownership of existing stem cell lines, but we have little knowledge of their property rights, [and] their willingness to

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## CONGRESSIONAL RESEARCH SERVICE

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

- **The Changing Composition of the Federal Research and Development Portfolio (RL31031)**  
This report analyzes federal research and development (R&D) funding trends between fiscal year (FY) 1962 to 2001. It examines whether funding growth is distributed most effectively among the various fields of science and engineering. It outlines concerns that growth in federal funding for physical science and engineering research has not kept pace with that for the life sciences.
- **High-Speed Rail: Development and Investment Issues in the 107th Congress (RL31027)**  
This report analyzes whether the United States needs a high-speed rail system. It addresses how a high-speed system would improve the existing passenger rail infrastructure, how different investment mechanisms could be utilized to fund such a project, and legislation that has been introduced to address the issue.
- **Arctic Petroleum Development: Implications of Advances in Technology (RL31022)**  
This report addresses the issue of drilling in the Arctic National Wildlife Refuge (ANWR). It discusses the status of exploration, drilling, and production options, and the history of North Slope petroleum activities. It also outlines different technologies that could be used for lower-impact approaches, and production methods for reducing physical presence.

## GENERAL ACCOUNTING OFFICE

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- **Technology Transfer: DOE has Fewer Partnerships, and they Rely More on Private Funding (GAO-01-56)**  
This report reviews the National Nuclear Security Administration's (NNSA) use of cooperative research and development agreements (CRADAs). It finds that DOE reduced its use of CRADAs while entering into more agreements fully funded by private partners. Though CRADAs have enabled laboratories to recruit and retain experienced staff, they also compete for limited funding and generally take longer to execute.
- **Space Station: Inadequate Planning Design Led to Propulsion Module Project Failure (GAO-01-633)**  
This report examines NASA's contract with Boeing Reusable Space Systems to build the now-canceled follow-on propulsion module for the International Space Station. GAO found that the initial propulsion module project did not meet performance, cost, and schedule goals largely because NASA proceeded with Boeing's proposal without following fundamental processes involving project planning and execution.

- **Nuclear Security: DOE Needs to Improve Control Over Classified Information (GAO-01-806)**  
DOE has increased protection and control of classified matter. This report reviews the extent to which DOE's laboratories have implemented established access controls and need-to-know requirements for vaults and computer systems containing the most sensitive classified information as well as the adequacy of these requirements.

## THE NATIONAL ACADEMIES

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*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](http://www.nap.edu)).*

- **Stem Cells and the Future of Regenerative Medicine (ISBN: 0-309-07630-7)**  
This report clarifies what is known about the scientific potential of stem cells and how it can best be realized. It finds that existing stem cell lines must be monitored closely for genetic mutations and other limitations, and that new stem cell lines will be needed in the future. Preventing the human body from rejecting transplanted stem cells also is critical, it says, and research in this area should be pursued aggressively, including research on somatic cell nuclear transfer.
- **Readiness Issues Related to Research in the Biological and Physical Sciences on the International Space Station (ISBN: 0-309-07631-5)**  
This report finds that construction delays and funding cuts are jeopardizing plans for microgravity research slated to begin aboard the International Space Station after 2006. It says that NASA should stand ready to launch annual space shuttle missions dedicated to microgravity research if the station isn't ready in time.
- **Clearing the Smoke: The Science Base for Tobacco Harm Reduction (ISBN: 0309-07282-4)**  
This study examines the types of products that could reduce the health risks of tobacco use. It reviews the available evidence for their impact on various forms of cancer and other major ailments, and it recommends approaches to governing these products and tracking their public health effects.
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This book reviews what our nation does and does not know about illegal drugs, and how data are assembled and used by federal agencies. It explores the data and research needed to support strong drug policy analysis, describes the best methods to use, explains how to avoid misleading conclusions, and outlines strategies for increasing access to data. The book discusses how researchers can incorporate randomization into studies of drug treatment and how state and local agencies can compare alternative approaches to drug enforcement.

# scientific definitions

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

**EMBRYO** In humans, the developing organism from the time of fertilization until the end of the eighth week of gestation, when it becomes known as a fetus.

**DIFFERENTIATION** The process whereby an unspecialized early embryonic cell acquires the features of a specialized cell such as a heart, liver, or muscle cell.

**BLASTOCYST** A preimplantation embryo of 30–150 cells. The blastocyst consists of a sphere made up of an outer layer of cells (the trophoctoderm), a fluid-filled cavity (the blastocoel), and a cluster of cells on the interior (the inner cell mass).

**TROPHECTODERM** The outer layer of the developing blastocyst that will ultimately form the embryonic side of the placenta.

**INNER CELL MASS** The cluster of cells inside the blastocyst. These cells give rise to the embryonic disk of the later embryo and, ultimately, the fetus.

**STEM CELL** A cell that has the ability to divide for indefinite periods in culture and to give rise to specialized cells.

**EMBRYONIC STEM (ES) CELLS** Primitive (undifferentiated) cells from the embryo that have the potential to become a wide variety of specialized cell types.

**ADULT STEM CELL** An undifferentiated cell found in a differentiated tissue that can renew itself and (with certain limitations) differentiate to yield all the specialized cell types of the tissue from which it originated.

**TOTIPOTENT** Having unlimited capability. The totipotent cells of the very early embryo have the capacity to differentiate into extra embryonic membranes and tissues, the embryo, all postembryonic tissues and organs, and in some cases, an entire organism.

**PLURIPOTENT STEM CELL** A single stem cell that has the capability of developing cells of all germ layers (endoderm, ectoderm, and mesoderm).

**MULTIPOTENT STEM CELLS** Stem cells that have the capability of developing cells of multiple germ layers.

**PRIMARY GERM LAYERS** The three initial embryonic germ layers—endoderm, mesoderm, and ectoderm—from which all other somatic tissue-types develop.

**GERM CELL** A sperm or egg, or a cell that can become a sperm or egg. All other body cells are called somatic cells.

**SOMATIC CELLS** Any cell of a plant or animal other than a germ cell or germ cell precursor.

SOURCE: *Stem Cells: Scientific Progress and Future Research Directions*, National Institutes of Health, 2001, [www.nih.gov/news/stemcell/scireport.htm](http://www.nih.gov/news/stemcell/scireport.htm)

## Stem Cell Research: A History

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review by Secretary of Health and Human Services Tommy Thompson. In April 2001, NIH canceled the first scheduled meeting of its committee set up to review grant applications for stem cell research. In a letter to the Culture of Life Foundation dated May 18, 2001, President Bush reiterated his campaign statement.

### Anticipation Builds

During the president's first few months in office, he delayed his decision on the guidelines, and repeatedly rebuffed attempts by reporters to get him to talk about the issue. Meanwhile, media attention on the issue of stem cell research built gradually, until the topic reached the front pages in early summer. On July 9, stem cells graced the cover of *Newsweek* magazine. Reports surfaced of a divided White House (*Washington Post*, June 12) as President Bush sought a compromise (*New York Times*, July 4).

Intense lobbying campaigns were waged on each side of the issue. Patient groups, scientific organizations, and the biotechnology industry lobbied President Bush to go forward with federal funding for ES cell research, while conservative anti-abortion groups and the Catholic Church urged him not to.

In Congress, most Democrats and moderate Republicans have argued for ES cell research, while most conservatives have opposed it. However, there are also a few staunch conservatives who support stem cell research, such as Sen. Strom Thurmond (R-SC) and former Sen. Connie Mack (R-FL). On June 13, 2001, Sen. Orrin Hatch (R-UT), who led the fight in the early 1990s against fetal tissue research, came out strongly in support of stem cell research, setting out his views in a 10-page letter to Secretary Thompson. At a July 18 hearing, Sen. Bill Frist (R-TN), a surgeon who has often advised President Bush on health-related issues, announced his support for ES cell research that is confined to "a limited number of cell lines."

The president finally announced his decision in a primetime address to the nation on August 9. ●●●

## R&D

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budget proposals could all be paid for while still preserving Social Security surpluses for the next ten years, allowing all Social Security surpluses to be used for paying down the national debt. In the May congressional budget resolution, Congress' own budget plan, lawmakers factored in the cost of the tax cut and agreed with the President's original proposal for \$661 billion in discretionary spending.

By summer, however, it became increasingly clear that the April budget projections were far too optimistic. At the end of August, the Office of Management and Budget (OMB) released its revised budget projections reporting that the unified FY 2001 surplus projection had plunged from \$281 billion to \$158 billion. More importantly, the non-Social Security surplus in both FY 2001 and FY 2002 had narrowed to a projected \$1 billion, an amazingly small margin in a \$2 trillion budget, with surpluses of just \$2 billion in FY 2003 and \$6 billion in FY 2004. Shortly thereafter, the Congressional Budget Office (CBO) released its own revised budget projections, which showed that because of the tax cut and the slowing economy, the non-Social Security surplus in FY 2001 would completely disappear and go into deficit. CBO projects a \$9 billion on-budget (excluding Social Security and the U.S. Postal Service fund) deficit in FY 2001 and further on-budget deficits in FY 2003 and FY 2004. In FY 2002, however, the CBO analysis projects a tiny \$2 billion on-budget surplus because of projections that assume discretionary spending will grow at the level of inflation after FY 2001.

There is too little time to approve all the appropriations bills through the normal process, especially if there are vetoes. In the end, which may come in October, November, or even December, Congress will be forced to bundle several unfinished or ve-

toed bills together into an omnibus appropriations bill, negotiated in a frenzy behind closed doors by congressional leaders and Bush Administration officials. In the aftermath of the terrorist attacks, the goal of preserving the entire Social Security surplus for debt reduction has disappeared completely, so Congress and the president will have to find other spending targets to limit discretionary spending.

Left hanging in the balance is the fate of federal R&D. Although DOD will almost certainly receive large increases no matter what happens in the budgetary endgame, the appropriations outcomes for the non-defense agencies, including NIH, are still unclear. Although the House and Senate have so far offered modest increases for the

majority of these programs, setting final funding levels will be extremely difficult in this budget environment. It is uncertain whether the President will go along with the higher funding levels or whether he will insist on his requested levels in order to conserve funds for his priorities. For all the agencies, even DOD and NIH, it may be a long fall of waiting. ●●●

*Kei Koizumi, director of the AAAS R&D Budget and Policy Program, contributed to this article.*

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### FOR MORE INFORMATION:

*AAAS R&D Website:*

*[www.aaas.org/spp/R&D](http://www.aaas.org/spp/R&D)*

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## Bush to Fund Stem Cell Research, But Strict Limits Imposed

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share or license the use of those lines to other researchers."

"Science should have the full range of opportunity," Sen. Specter said, referring to embryonic stem cell lines regardless of when they were derived and to adult stem cells.

On September 11, the National Academy of Sciences released a new report on stem cells which concluded that public funding should be made available for research on both embryonic and adult cells, and that in the long run, it will be necessary to derive new embryonic stem cell lines. The report also recommended that research on somatic cell nuclear transfer, or research cloning, be pursued.

Scientists are anxiously awaiting further information about the existing cell lines, and NIH has promised to facilitate the dissemination of this information by creating the Human Embryonic Stem Cell Registry. Secretary Thompson promised at the September 5 hearing that the registry would be launched in 10-14 days.

As more becomes known about the 64 cell lines, the future of federally funded stem cell research will become clearer. While some claim that a majority of Congress favors a policy less restrictive than the president's, it is unclear whether Congress will act. Even if it does, President Bush has vowed to veto any legislation that would loosen his restrictions. NIH, meanwhile, has encouraged researchers to submit grant applications for embryonic stem cell research and requests to use existing funds for such research.

The president also announced during his speech the formation of a new President's Council on Bioethics, to be chaired by Dr. Leon Kass, a bioethicist at the University of Chicago. In addition to studying a range of ethical issues raised in the biomedical and behavioral sciences, the council will oversee all federally funded ES cell research. ●●●

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## Heard off the Hill

**Dinosuits** • A physiologist studying dinosaur locomotion has taken a surprising new step: to test the mobility of theropods such as *Allosaurus*, he dressed up his

graduate students in dinosuits and put them through a series of running and jumping tests. The unusual outerwear consisted of a backpack with horizontal beams attached to it and weights distributed so as to give the wearer a mass distribution similar to a theropod. The results suggested that these dinosaurs had some agility problems. While not all experts are convinced, many were impressed by the experiment. "This is one of those bits of incredibly delightful goofiness that I wish I'd thought of," said one paleontologist.

---> *Science*, August 31, 2001

**Jump for Science** • On September 7, 2001, children all across Britain were asked to jump for science. The event, which was held to launch the country's Science Year, was a large seismology experiment. At a designated time, about a million schoolchildren from Glasgow to Cardiff jumped up and down for a minute. Scientists, meanwhile, monitored the event on seismometers, which are used to monitor earthquakes. As expected, the jump did not register on their instruments. It will, however, register in the *Guinness Book of Records* as the "greatest simultaneous jump in history."

---> *BBC News*, September 7, 2001

**Knotted Spaghetti** • Mathematical models have been made in the past to predict how strings break, but physicists have never formally tested the predictions in a macroscopic material. Now, a team of University of Lausanne researchers has done just that. The results were what the models predicted, but the material they used may be a bit of a surprise: cooked strands of spaghetti coated with olive oil, which, it turns out, break at just the right rate for high-speed filming. The experiments demonstrated that knotted strings break just before the knot, where the tension is greatest. No measurements were reported, though, of knotted spaghetti's gastro-nomic properties.

---> *Science*, August 17, 2001

**The Crack of the Bat** • The crack of a baseball bat provides not only a pleasing sound for fans, according to Yale University physicist Robert Adair, but also vital information on the flight of the ball for fielders. When a player hits the ball on the "sweet spot" of the bat, he says, a satisfying 500-Hertz crack is produced. However, when the ball is hit farther from the sweet spot and so will not travel as far, other vibrations are also produced, resulting in a lower-frequency, 170-Hertz sound that is more like a clunk. For an outfielder standing 300 feet from home plate, the difference between a crack and a clunk is important information. If the outfielder depended only on looking at the trajectory of the ball, Adair says, it could take about 2 seconds to figure out whether to run in or out. The sound of the bat, by contrast, arrives in a snappy 0.3 seconds.

---> *American Institute of Physics*, June 7, 2001