



# SCIENCE & TECHNOLOGY IN CONGRESS

MEDICINE ■ TRANSPORTATION ■ BIOTECHNOLOGY ■ SCIENCE EDUCATION ■ NATIONAL SECURITY ■ COMMUNICATION

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## Clinton Proposes Big Boost for R&D

President Clinton proposed a major increase in funding for federal research and development (R&D) programs in his fiscal year (FY) 2001 budget rollout on February 7. Included in his proposal are several noteworthy initiatives which would boost investment in science and technology to promote continued economic growth and medical advances.

Previewed in a major speech at the California Institute of Technology and then echoed in his State of the Union Address, the President proposed a \$2.8 billion (7 percent) increase in the "21<sup>st</sup> Century Research Fund." The increase in this fund, which is a mechanism for highlighting Administration priorities in nondefense R&D programs, includes \$1 billion for biomedical research at the National Institutes of Health (NIH), the largest dollar increase for the National Science Foundation (NSF) in its history, and major interagency initiatives in information technology and nanotechnology. The total R&D budget request rises 3 percent to \$85.3 billion (see table on page 3).

"In the new century, innovations in science and technology will be the key not only to the health of the environment, but to miraculous improvements in the quality of our lives and advances in the economy," the President said in his State of the Union Address on January 27. "...we ought to keep in mind, government-funded research brought supercomputers, the Internet, and communications satellites into being."

As an example of successful federal funding of scientific research, the President highlighted the Human Genome Project in his speech to the nation. This project, a joint NIH/Department of Energy (DOE) effort to determine the sequencing of human DNA and identify the more than 100,000 human genes, is scheduled to be completed in 2003. The 13-year project offers potential for the treatment of many diseases, such as Parkinson's and diabetes. The head of human genome research at NIH, Dr. Francis S. Collins, sat with the First Lady during the address.

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## Future of Gene Therapy Examined

The death of a young man during a gene therapy experiment and the National Institutes of Health (NIH) admittance that it failed to properly track adverse events have drawn significant fire from congressional leaders and increased public scrutiny. As a result of these recent revelations, the NIH and the Food and Drug Administration (FDA) are reevaluating their oversight process, investigating institutions with active experiments to ensure safety compliance, and addressing ways to expand public disclosure of gene therapy clinical trials. In response to the safety lapses unveiled, the Senate Health, Education, Labor and Pensions subcommittee conducted a hearing to address this fast growing field of research.

In his opening remarks, Senator Bill Frist (R-TN), chairman of the subcommittee and a heart-transplant surgeon, stated, "[T]here is a need for vigilant oversight to ensure patient safety. If we expect patients to participate in moving science forward, then we must be assured that gene therapy clinical trials are safe." Much of the hearing fo-

cused on why researchers had failed to notify NIH of adverse events during trials as required by federal guidelines. More importantly, whether scientists are providing sufficient information of the potential risks involved when participating in an experiment before a patient can make an informed consent was discussed extensively. By the end of

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Along with a \$1 billion increase for NIH, the President has proposed a \$675 million (17 percent) increase for NSF in an effort to ensure an even distribution of federal funding among various disciplines, and between basic and applied research. NSF funds go almost exclusively to basic research and are distributed over the physical, biological, and social sciences. The agency represents less than 4 percent of the federal R&D budget, but it supports about half of the non-medical basic research conducted at colleges and universities. "This is an historic event for the National Science Foundation," said NSF Director Dr. Rita Colwell. "... [It's] the basic research that we do ... in physics, in mathematics, in chemistry and biology, that leads to ... medical advances. And so we'll be able to invest this new money in these areas to bring a better balance" to the federal R&D portfolio.

Once again, the Administration highlighted information technology (IT) as a priority. The FY 2001 budget request would provide \$2.3 billion in IT R&D, a \$605 million increase from last year and a billion dollars more than FY 1999. The IT initiative would focus on fundamental software research, ensuring the privacy and security of data, and continued advances in high-speed computing. Money would go to seven different agencies but primarily NSF, DOE, the Department of Defense (DOD), the National Aeronautics and Space Administration, and the Department of Health and Human Services, which houses NIH.

A new research priority highlighted by the White House is the interagency National Nanotechnology Initiative, designed to promote basic research in the emerging fields of nanoscience and nanoengineering. These areas of research, which are named for the word nanometer, or one billionth of a meter, deal with matter at the level of individual atoms. According to Presidential Science Advisor Dr. Neal Lane, nanotechnology promises to produce remarkable breakthroughs. "[It] may not be something that everybody talks about every day, but they will, because it's really the whole next generation in manufacturing and in applications [to fill] the whole variety of societal needs," he said. The initiative involves six different agencies at a total cost of \$497 million, \$227 million of which is new spending. The bulk of this money would go to NSF (\$217 million), DOD (\$110 million), and DOE (\$96 million).

President Clinton's proposals drew generally positive reactions from Capitol Hill. In response to the Cal Tech speech, Rep. F. James Sensenbrenner, Jr., (R-WI), chairman of the House Science Committee, welcomed the President's emphasis on science, but expressed some doubt about his commitment to fiscal discipline. "I'm hopeful these encouraging

words represent the Administration's actual priorities and are not merely promises within the context of an across-the-board government spending spree.... A strong science program and a responsible overall budget would be very good news for the science community."

Addressing the President's full budget request, Sen. Pete V. Domenici (R-NM), chairman of the Senate Budget Committee, was also critical of the Administration's spending philosophy. "The President is proposing the era of big government come back with a vengeance," he said.

But Rep. Ralph Hall (D-TX), ranking Democrat on the Science Committee, was uniformly positive. He praised the President's proposals, saying, "If we want to live longer, healthier lives and if we want to create new industries driven by emerging technologies, it is important to make wise investments in the future."

Lane and Colwell are optimistic about the prospects for new R&D funding in Congress. Said Lane, "Science and technology has been an area that garnered strong bipartisan support and it should, because it's so clear from every study, every kind of data, economic analysis, that the federal investment in science and technology is about as good an investment as you can possibly make with the American taxpayer's money." Colwell concurs. "When Alan Greenspan continually says that at least 70 percent of our economic boom is due to technological advances, I think everyone across the country gets it," she said. ■

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**R&D in the FY 2001 Budget (budget authority in millions of dollars)**

Agency	FY 1999	FY 2000	FY 2001	Change FY 00-01	
	Actual	Estimate	Budget	Amount	Percent
Defense (military)	38,850	38,719	<b>38,640</b>	-79	-0.2%
<i>S&amp;T (6.1-6.3)</i>	7,574	8,397	<b>7,543</b>	-854	-10.2%
<i>All Other DOD R&amp;D</i>	31,276	30,322	<b>31,097</b>	775	2.6%
Health and Human Services	15,797	18,063	<b>18,998</b>	935	5.2%
<i>Nat'l Institutes of Health</i>	15,008	17,141	<b>18,133</b>	992	5.8%
NASA	9,715	9,753	<b>10,035</b>	282	2.9%
Energy	6,992	7,091	<b>7,655</b>	564	8.0%
Nat'l Science Foundation	2,702	2,903	<b>3,464</b>	561	19.3%
Agriculture	1,645	1,773	<b>1,828</b>	55	3.1%
Commerce	1,084	1,073	<b>1,152</b>	79	7.4%
<i>NOAA</i>	593	591	<b>594</b>	3	0.5%
<i>NIST</i>	465	458	<b>501</b>	43	9.4%
Interior	500	584	<b>590</b>	6	1.0%
Transportation	786	585	<b>733</b>	148	25.3%
Environ. Protection Agency	670	648	<b>679</b>	31	4.8%
All Other	1,601	1,552	<b>1,561</b>	9	0.6%

<b>Total R&amp;D</b>	<b>80,342</b>	<b>82,744</b>	<b>85,335</b>	<b>2,591</b>	<b>3.1%</b>
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Defense	42,049	41,994	<b>42,060</b>	66	0.2%
Nondefense	38,293	40,750	<b>43,275</b>	2,525	6.2%

Basic Research	17,468	19,027	<b>20,328</b>	1,301	6.8%
Applied Research	15,915	17,193	<b>18,026</b>	833	4.8%
Development	44,302	44,071	<b>44,323</b>	252	0.6%
R&D Facilities and Equipment	2,657	2,453	<b>2,658</b>	205	8.4%

21st Century Research Fund	37,032	40,038	<b>42,895</b>	2,857	7.1%
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Source: AAAS, based on OMB data for R&D for FY 2001, agency budget justifications, and information from agency budget offices.

For timely and detailed analyses of the President's Budget Request for R&D by individual agency, visit the AAAS R&D Budget and Policy Program website at [www.aaas.org/spp/R&D](http://www.aaas.org/spp/R&D). The site includes data by R&D source and performer, including industry trends.

Be sure to check out the Center for Science, Technology, and Congress website at [www.aaas.org/spp/cstc](http://www.aaas.org/spp/cstc).



# DOE Looks to Bolster Security, Improve Morale

In two separate steps, Secretary of Energy Bill Richardson has continued his quest to bolster security at the national labs while simultaneously attempting to improve morale among the labs' scientists. On January 7, Richardson released his implementation plan for the creation of a new semi-autonomous agency that will be responsible for weapons-related programs within the Department of Energy (DOE). On January 19, he adopted the recommendations of the DOE Task Force Against Racial Profiling designed to reach out to Asian and Asian-American employees at the national labs.

The new agency, called the National Nuclear Security Administration (NNSA), was mandated by Congress last fall and is designed to tighten security at DOE's nuclear weapons programs. DOE must complete the formation of NNSA by March 1, and the first step in the plan is the appointment of a search committee for an NNSA Administrator.

In a move that has drawn fire from Capitol Hill, the plan also requires DOE's top counterintelligence and security officials to serve concurrently as NNSA's Chief of Defense Nuclear Counterintelligence and Chief of Defense Nuclear Security. "[The plan] falls short by attempting to shoehorn the DOE bureaucracy into the NNSA management structure by 'dual-hatting' Department employees," said Rep. Mac Thornberry (R-TX), who chairs a panel charged by the House Armed Services Committee with overseeing the DOE reorganization. "While the report is better than I had hoped, it is far less than what's needed and what's required."

At the January 19 news conference, Richardson appeared with several members of a task force created last June in the aftermath of the dismissal of Wen Ho Lee, a former physicist at Los Alamos National Laboratory. Secretary Richardson acknowledged serious distrust of DOE officials among many Asian-American employees, who feel they have been singled out for scrutiny because of their ethnicity. DOE is taking several actions recommended by the task force, including the appointment of Dr. Jeremy S. Wu as a national DOE ombudsman.

Both steps make up the latest round in Richardson's long-running effort to balance the needs of security and open scientific exchange at DOE. The NNSA was the result of considerable debate about how to reorganize the department in the wake of the investigation of Wen Ho Lee, who has been accused of mishandling classified data, and reports by Rep. Christopher Cox (R-CA) and the President's Foreign Intelligence Advisory Board on DOE's security problems. Both reports heavily criticized the department and recommended changes to its structure, increasing pressure on both Richardson and Congress to take action.

The Task Force Against Racial Profiling, meanwhile, was created by Secretary Richardson last June in response to growing distrust among Asians at the national labs in the aftermath of the Lee investigation. While Richardson has denied that race played any role in the Lee case, he admits to the existence of a serious problem of perception, which has deterred many Asian-Americans and foreign scientists from working at the labs.

The ebbing morale has hindered recruitment and concern has grown over a potential "brain drain" at the labs. Scientists have expressed reservations that heightened security will interfere with the open scientific exchange crucial to the labs' continued productivity. For example, Congress placed a moratorium on the department's Foreign Visitors Program, viewed as an important element of scientific exchange. At the January 19 press conference Richardson stated that Congress "overreacted" when it restricted visits and vowed that he would press for changes. "Scientific exchange," he said, "is the lifeblood of the labs."

As controversy over lax security has grown, consternation over the future of non-weapons-related science at the labs has also grown. The NNSA implementation plan attempts to strengthen security at the national laboratories while ensuring that they continue to perform scientific research for non-defense DOE programs, other federal agencies, and outside organizations. The plan states: "It is critically important for programmatic and financial reasons that all of the missions of the Department have access to the technical expertise and specialized facilities at all of the laboratories and facilities, regardless of which element of the Department they are assigned to." An activity performed at an NNSA facility by NNSA employees, but funded by a non-NNSA office, will not be considered "a function of the NNSA." In such cases, non-NNSA offices will retain the authority to direct NNSA employees.

Richardson's implementation plan has met with mixed reviews on Capitol Hill. Sen. Pete Domenici (R-NM) expressed reservations about the plan, stating, "It will have to be carefully looked at, and it is obvious that some of the concepts and approaches are not consistent with what I believe is congressional intent." He later warned in a speech at Sandia National Laboratory that "if the department fails to implement the semi-autonomous agency carefully, they will leave Congress with no alternative other than to create an independent agency."

Sen. Jeff Bingaman (D-NM), however, was far more positive. "Secretary Richardson has taken an ambiguous and problematic law, which could have

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# OSTP Releases Policy on Research Misconduct



The Office of Science and Technology Policy (OSTP) released a new government-wide federal policy on research misconduct on October 14 (*Federal Register* Vol. 64, No. 198) in order to protect the integrity of the research record. The policy proposes a uniform definition of research misconduct and establishes guidelines and procedural safeguards for responding to allegations of research misconduct. The policy applies to all federally funded research, including intramural research, research conducted or managed by contractors, universities, or research institutes.

Since the 1980's the disclosure of various cases of research misconduct at major research institutions has drawn significant interest in addressing methods of preventing it. To regain public trust in science, the government took various actions over the years to pursue allegations of research misconduct and promote research integrity.

In April 1996, OSTP, through the Committee on Fundamental Science and the National Science and Technology Council, established the Research Integrity Panel (RIP), consisting of representatives from the major research agencies. This panel was charged with developing a definition of research misconduct, as well as establishing procedural guidelines for handling allegations. The RIP's initial recommendations have been under review since 1997, culminating in the October *Federal Register* proposal.

One of the most discussed and acclaimed parts of the new policy is its unifying definition of research misconduct. Previously, federal agencies that sponsor research all used slightly different definitions of scientific misconduct. Now, the OSTP policy replaces this variation with a uniform definition to be used by all federal agencies.

Research misconduct is defined as, "fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results." Fabrication is "making up results and recording or reporting them." Falsification is defined as "manipulating research materials, equipment, or processes, or changing or omitting data or research results such that the research is not accurately represented in the research record." Plagiarism, an issue that had not been addressed before, is defined as the "appropriation of another person's ideas, processes, results, or words without giving appropriate credit, including those obtained through confidential review of others' research proposals and manuscripts."

The policy encompasses "all basic, applied, and demonstration research in all fields of science, engineering, and mathematics." The research record

is defined as, "the record of data or results that embody the facts resulting from scientific inquiry, and includes, for example, laboratory records, both physical and electronic, research proposals, progress reports, abstracts, theses, oral presentation, internal reports, and journal articles."

To promote an atmosphere of honest reporting, OSTP proposes guidelines for protecting both whistle blowers and the accused. It encourages universities and other recipients of federal grants to protect the confidentiality of whistle blowers and to promptly inform those accused about the charges and give them a chance to respond. While independent researchers and small research institutions are also subject to the new policy, "it is understood that they may not have the institutional structures in place to meet the full range of responsibilities outlined in this policy."

The new policy, however, does not supersede existing government policies, criminal or civil laws, or procedures for addressing other misconduct that might occur during the course of research. For example, it would exclude misconduct in the treatment of human research subjects or laboratory animals in research. In addition, the policy does not limit agency or institutional policies and prerogatives in addressing other forms of misconduct, such as the misuse of public funds. The policy directs agencies to address these other issues as authorized by law and as appropriate to their mission and objectives. Also not covered are authorship disputes, unless they involve plagiarism, and honest error or honest differences of opinion.

OSTP opened the proposal to a 60-day public comment period that ended December 13, after which a final policy will be released that federal agencies will be required to implement. Many federal agencies already have established guidelines for addressing misconduct allegations so implementation may be a minor process for some. While some questions remain, and it is hoped that the final OSTP policy will answer them, the proposed changes mark the beginning of a new era of partnership between the government and academe and, so far at least, are being well received in the research community. ■

*Rachel J. Gray, Program Associate for the AAAS Scientific Freedom, Responsibility, and Law Project, contributed to this article. The article first appeared in their newsletter, "Professional Ethics Report." The entire article may be viewed at <http://www.aaas.org/spp/dspp/sfrr/per/per.htm>.*



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caused long-term damage to Sandia and Los Alamos, and developed a workable solution,” he said. “The plan complies with the letter and spirit of the law, ... and protects the important national programs and resources at the laboratories.”

The search committee for an NNSA Administrator, who will also serve as Under Secretary for

National Security, is headed by former DOE Deputy Secretary Charles B. Curtis. The committee hopes to complete its work in time for President Clinton to submit a nomination to the Senate by March 1. ■

#### GENE THERAPY, from page 1

the lengthy and sobering hearing, it was apparent that institutions conducting gene therapy research will be scrutinized even further.

The most riveting testimony came from the father of Jesse Gelsinger, the young man who died as the result of a gene therapy treatment at the University of Pennsylvania. Mr. Gelsinger testified that he wasn't given information regarding adverse events in prior experiments conducted by the university and in the private sector; information that would likely have influenced the final decision to participate. He lamented, “Looking back, I can see that I was fairly naïve to have been as trusting as I was.” He expressed serious concerns about the influence of the private-sector, its ability to hide behind a proprietary curtain, and a “race to be first” in the field that have all contributed to unnecessary risk to patients. Mr. Gelsinger recommended that an independent patient advocate be present at informed consent sessions when risks are explained to ensure that patients are protected.

The use of gene therapy as a potential treatment for disease has been experimented with since the 1980's. It involves the introduction of recombinant DNA into the system either by directly injecting DNA or through viral vectors which involve manipulating a virus to carry a therapeutic gene that can eliminate or weaken the disease that is being treated. These experimental studies are approved and monitored by oversight procedures established by NIH and FDA. While FDA has oversight over all gene therapy trials, public and private, NIH monitors only those experiments that receive funding from the institute.

Following Jesse Gelsinger's death, the first that can be directly attributed to a genetic vector, NIH canvassed all investigators involved in gene therapy treatment that they have oversight of to report any adverse event. An adverse event is considered to be an expected or unexpected event (not necessarily a death) that can be related to the treatment, to the disease itself, or an outside factor. Subsequently, NIH received 652 reports of serious events that previously had gone unreported. Only 39 adverse events had been reported as required by the agency, bringing the total number to 691. According to

NIH, 372 clinical trials are currently registered and more than 4,000 patients have participated in gene therapy experiments. Senator Frist called the negligence “inexcusable.”

Dr. Amy Patterson, Director of the Office Biotechnology Activities at NIH, testified that with the advent of this new treatment the *NIH Guidelines* – a set of policies and procedures designed to ensure safety of research utilizing recombinant DNA – were updated to include gene therapy studies. The *NIH Guidelines* specify that it is the responsibility of individual investigators to report adverse events. In addition, once a new research protocol is approved the research investigator and institution receive a letter reminding them of the requirement.

The tragic case of Jesse Gelsinger, however, is not one of negligent reporting. In fact, the University of Pennsylvania did report his death within an appropriate timeframe. The FDA, subsequent to an investigation into his death, discovered potential safety violations and shut down all gene therapy studies at the university.

His case, however, does highlight the potential problem of insufficient disclosure. According to NIH, 89 percent of the gene therapy studies funded by them are considered “Phase 1” which are designed to assess safety and toxicity, and not for efficacy or therapeutic benefit. Hence, many informed consent forms generally include language that essentially states that the researchers do not fully know what the risks are to humans. If researchers are not reporting adverse events, it becomes more problematic for other scientists to adequately prepare for a new study and to properly inform potential volunteers. The concept of a single public database listing all reported adverse events in gene therapy studies was mentioned at the hearing. Concern, however, was raised over maintaining patient confidentiality and elevating public fear before the medical community had sufficient time to evaluate the scientific results.

The future of gene therapy experiments relies on volunteers. Whether the future will be hindered by a volunteer's fear of not knowing enough or knowing too much still needs to be addressed. ■

# Reports and Publications

## CONGRESSIONAL RESEARCH SERVICE

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

*Challenges in Collecting and Reporting Federal Research and Development Data* (RL30413). This report examines the collection and reporting of federal R&D funding data to the National Science Foundation. It contains potential options for improving collection and reporting and possibilities for future congressional action.

*Electronic Commerce: An Introduction* (RS20426). E-commerce, whether retail business-to-customer or business-to-business transactions, has grown at an extraordinary rate over the last five years. Policymakers in the U.S. and abroad are likely to face increasingly complex issues of security, privacy, taxation, and infrastructure development in 2000 and beyond.

*Intelligent Transportation Systems: Overview of the Federally Supported Research and Deployment Program* (RL30403). Intelligent Transportation Systems (ITS) use information technologies to improve the safety, management, efficiency, and/or control of roadways and vehicles. This report provides information and analysis on the federal role in ITS research and deployment, with particular attention given to the Department of Transportation's ITS expenditures.

*Public Access to Data From Federally Funded Research: OMB Circular A-110 and Issues for Congress* (RL30376). This report examines issues associated with the Shelby amendment to make data from federally funded research available to the public through the procedures established under the Freedom of Information Act.

*Satellite Television: Provisions of the Satellite Home Viewer Improvement Act (SHVIA) and Continuing Issues for Congress* (RS20425). This report examines issues surrounding SHVIA, which gives consumers greater access to network television by allowing satellite companies to retransmit a local network signal back into the same local market area.

## GENERAL ACCOUNTING OFFICE

Copies of GAO Publications are available by calling 202/512-6000 or via the Internet at <http://www.gao.gov>.

*Export Controls: International Space Station Technology Transfers* (NSIAD-00-14). This report provides information on licenses granted to NASA to export space station-related technology. It finds a need for greater management involvement in export-related decisions and additional training to educate employees about export regulations.

*Export Controls: Statutory Reporting Requirements for Computers Not Fully Addressed* (NSIAD-00-45). In July 1999, the executive branch released a congress-

ionally mandated report justifying proposed changes to export controls on high performance computers. The Administration's report is examined and found to be missing an assessment of the impact on national security of the use of high performance computers by foreign militaries. It focuses, instead, on the importance to national security of a strong U.S. computer industry.

*NIH Clinical Trials: Various Factors Affect Patient Participation* (NEHS-99-182). This report presents a review of patient access to clinical trials in response to concerns that access has become increasingly constrained by financial issues. The report, however, finds no quantitative evidence that enrollment has slowed or that trials are being hindered by enrollment problems.

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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 by calling 800/624-6242 or via the Internet at <http://www.nap.edu>.

*A Question of Balance: Private Rights and the Public Interest in Scientific and Technical Databases* (ISBN 0-309-06825-8). This report examines lawmakers' efforts to strike an appropriate balance between the rights of database holders and public-interest users of the data. It recommends against the creation of any strong new protective measures, but recognizes that some additional limits against wholesale misappropriation of databases may be necessary.

*Female Engineering Faculty at U.S. Institutions: A Databook* (ISBN 0-309-06092-3). This report documents the participation of women engineers in academic institutions within the U.S. It contains the results of a survey that gathered career information on 800 women engineering faculty.

*Genetics, Health, and Behavior: Science in Perspective* (ISBN 0-309-06373-6). This report brings a fresh perspective to the issue of genetic research by presenting several case studies that illustrate the state of the science of genetic research on behavior, the difficulty of understanding the complex ways that genetics and environmental influences interact, and the scientific and social opportunities that spring from this line of research.

*Reconciling Observations of Global Temperature Change* (ISBN 0-309-06891-6). This report examines the apparent conflict between surface temperature and upper-air temperature, which has led to the controversy over whether global warming is actually occurring. It concludes that the Earth is, in fact, warming.



## HEARD OFF THE HILL



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Ever wonder why the bubbles in a freshly poured pint of Guinness appear to go down? Scientists at the University of New South Wales in Australia applied an advanced computer modeling technique to get to the bottom of it. Armed with data on bubble sizes from the Guinness brewery in Ireland, they determined that initially all the bubbles in the glass rise, with the outside ones rising a little slower because of surface tension. The more quickly rising bubbles in the center drag along some liquid, which tends to get pushed outward when it gets to the top and then goes down the outside of the glass, taking outer bubbles with it. *Science* January 14, 2000.

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Scientists at the University of Washington have discovered a way to record the “conversations” taking place between thousands of molecules inside a single yeast cell. Using robots to monitor baker’s yeast as it grows, researchers have determined which molecules in a cell “talk” to one another. These discussions, which are carried out through physical contact, are important to the functioning of all cells, so this feat could have significant implications for the understanding of human health and disease. *National Institutes of Health* February 9, 2000.

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Falling snow on a winter landscape usually evokes tranquility. So snow falling on a body of water should be nice and quiet too, right? Not according to physicists at the University of Washington, who have found that snowflakes can make high-pitched screeching noises as they hit. A solid-liquid attraction between the snowflakes and the water causes tiny amounts of water to rush upwards and create air bubbles. These bubbles vibrate, producing short bursts of sound that last roughly a ten-thousandth of a second. The sounds are outside of the range of human hearing but can disrupt underwater sonar experiments. *American Institute of Physics*, January 27, 2000.

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When a bee finds a good source of food, it communicates the location to the rest of its hive through a remarkable series of movements called a “waggle dance.” Researchers have found that information is conveyed by individual movements in this dance, and now they have discovered that bees use visual cues to keep track of distance as they fly to and from the hive. By training bees to fly through a narrow tunnel to find food, the scientists found that changing the pattern on the inside of the tunnel walls skews the bees’ inner odometers. *Science* February 4, 2000.



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